MORGAN CITY CORPORATION

PUBLIC WORKS STANDARDS

MORGAN CITY
EST. 1868
BUILDING ON PIONEER DREAMS

June 2023

JONES & ASSOCIATES
CONSULTING ENGINEERS

P U B L I C W O R K S S T A N D A R D S

A N D

T E C H N I C A L S P E C I F I C A T I O N S

MORGAN CITY CORPORATION

SUBMITTED AND RECOMMENDED:

Matthew E. Hartvigsen 08-24-2023

Matthew E. Hartvigsen, P.E. Date
Morgan City Engineer

APPROVAL:

DocuSigned by:
Ty Bailey 8/28/2023 | 11:34 AM PDT
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Ty Bailey Date
Morgan City Manager

REGISTERED PROFESSIONAL ENGINEER
08/24/2023
No. 323821
MATTHEW E. HARTVIGSEN
STATE OF UTAH

Prepared by:

JONES AND ASSOCIATES

Consulting Engineers

6080 Fashion Point Drive, South Ogden, Utah 84403

www.jonescivil.com, (801) 476-9767

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DIVISION 1

GENERAL REQUIREMENTS

Section 1.01 PURPOSE OF DOCUMENTS:

The purpose of these Standard Specifications and Standard Drawings is to govern any work done or improvements installed within Public right-of-ways or across easements. Construction work shall comply with Morgan City Code, Planning and Zoning. Developers/Contractors should thoroughly read and understand these specifications and standards before constructing public improvements.

The Developer/Contractor shall contact Public Works/Engineering for all matters dealing with construction work within a City right-of-way or with any work connecting onto a City utility. SPECIAL PERMITS AND BONDING ARE REQUIRED FOR ALL SUCH WORK.

Section 1.02 PERMIT, FEES AND BONDING REQUIRED:

It shall be unlawful to do any construction, excavation work on any street, curb, gutter, sidewalk, sewer line, water line, pressure irrigation line, storm drain or other infra-structure addition or improvement in the City of Morgan without a Public Works' permit from the City to do so. The City of Morgan and all utility companies are bound by these standard specifications. No work shall be started until a permit is secured. In order to obtain a Public Work's Permit, the Developer's/Contractor's authorized signature is required. If a contract to do such work for the City has been finalized, the contract fulfills the permit requirement.

Sub-section A. All Public Works' permit applications shall include:

1. Start and completion dates of the project.
2. The exact address or location of the work to be done.
3. The type of work to be done.
4. A request for all utility companies to be contacted through Blue Stakes 1-800-662-4111.

Sub-section B.

Before a permit is issued, a permit fee and an inspection fee shall be paid to the City. These fees will be set by Council resolution. Fees shall be assessed on the following items:

1. Sewer and Water Lateral Installation Inspection (Applies to those not covered by Building Permit)
2. Pressure irrigation service connection.
3. Re-inspection (When an inspection has been requested, the inspection is performed and the work is not complete, a re-Inspection fee shall be assessed.)
4. Bond
   All public improvement projects done for Public Works shall be bonded. Each contractor doing work in the City is required to maintain a $5000.00 bond with the City. Bond requirements are to guarantee the following:
   a. Construction work is completed.
   b. Final inspection is conducted.
   c. Repairs and/or replacement of required public improvements are finished and accepted.

   Cash bonds for a one-time permit will be calculated based on the estimated cost of street repairs plus 10%.

   The bonds shall be in the form of a bond from a surety company or a cash bond paid directly to the City. The City shall approve all bonds submitted. No bond shall be released until all improvements are completed and accepted by the City.

Section 1.03 CONTRACTOR AND CONSTRUCTION PLAN APPROVAL:

Before a Contractor performs any work within the City, the City shall approve the Contractor. Approval is granted for a period of one (1) year upon submission of the following:

A. A current Utah State Contractor's License. (Work will be restricted to that authorized by the license.)
B. Proof of comprehensive general liability insurance. Bodily injury insurance will be in an amount of not less than three hundred thousand dollars ($300,000.00) for any one occurrence. Property damage insurance will be in an amount of not less than two hundred thousand dollars ($200,000.00) for any one occurrence and shall include underground exposure. Combined liability insurance will be in an amount of not less than five hundred thousand dollars ($500,000.00) for any one occurrence.
C. A five thousand dollar ($5000.00) performance bond owing to the City, that will be in effect for a period of one (1) year or one (1) year after the completion of work performed by the contractor, whichever is greater.

The Public Works Representative/Engineer shall approve construction plans and cut sheets before any work begins. Developers/Contractors proceeding with work without such approvals shall have the project shut down until such approvals are obtained. Repeated offenses may result in the Contractor losing its pre-qualification to perform work in the City.

Section 1.04 PRE-CONSTRUCTION CONFERENCE:

A pre-construction meeting with the Developer and the Contractor(s) involved in the subdivision construction shall be held with the Public Works Representative/Engineer prior to commencement of any work. The location of the meeting shall be at the Morgan City Center, 90 West Young Street, Morgan, Utah 84050 or other location as determined. The following items shall be furnished at the meeting:

A. A detailed outline showing the sequences of construction of principle items of work. The outline shall show the beginning and ending dates of the major items of work on the Project.
B. A list of names, titles, addresses, and telephone numbers of the Developer/Contractor's responsible personnel, indicating those who may be reached outside normal working hours.
C. A list of Sub-Contractors and Materials Suppliers to be involved with the project and the items of work they are going to perform or furnish materials for. The City will notify the Developer/Contractor of any concerns or pre-qualification deficiencies of the companies they plan to use.

Other items may be discussed at this pre-construction conference as determined by the Public Works Representative/Engineer. Official minutes of this meeting as prepared by the Public Works Representative/Engineer shall become part of the project file for the project.

Section 1.05 TIMELY COMPLIANCE WITH THE ISSUED PERMIT:

The Developer/Contractor shall perform in accordance with the terms of the permit and the Standard Specifications and Standard Drawings in effect at the date of the permit. The work shall be done in a timely manner. Time limits may be a condition of the permit and may be shortened because of safety concerns. Permits may be suspended if compliance is not met.

Sub-section A. Inspections:

All work covered by a Public Works' permit shall be inspected by the Public Works Representative prior to the following:

1. Backfilling and compacting.
2. Placing concrete and asphalt
3. Placing any underground piping
4. Making any connection into a city utility line
5. Other work done in a public right of way.

Public Works shall also be notified prior to starting any Public Works project.

Sub-section B. Notification of Needed Inspections:

The Contractor shall request inspections forty-eight (48) hours in advance. Inspections are done on regular working days during the regular work hours of the City.

A charge shall be assessed for inspection call-backs.

Sub-section C. Responsibility of the Developer:

The developer is responsible for the complete development, including construction of the entire subdivision, until it is finalized and accepted by the City.

Sub-section D. Definition of "Public Works Representative/Engineer:"

The term "Public Works Representative/Engineer" as used in these specifications refers to the Public Works Director, Public Works Inspector, City Engineer, Public Works staff and others as designated by the Public Works Director.

Sub-section E. Conflict:

These Standard Specifications and Standard Drawings are the minimum requirements of the City of Morgan. In the event that any provisions herein conflict with general industrial standards, or with other requirements specified by the City, the more stringent of the standards will apply.

Section 1.06 ELECTRONIC AND RECORD DRAWINGS:

When the Developer's Engineer has the capability, plat and improvement drawings shall be furnished electronically in MicroStation Format (.dgn), AutoCAD format (.dwg) or Data Exchange Format (.dxf). These electronic files shall be provided to the City after final approval but before recording of the Plat.

After completion of all public works improvements the Developer shall provide the City with a set of sepia (reproducible) "record drawings" which have been corrected, stamped and certified by the Developer's Engineer, to show the constructed improvements. Final payment from the bond shall not be made until these records are received.

Section 1.07 TEMPORARY SERVICES:

Any temporary services and utilities such as telephone, electrical, water toilet facilities, etc., shall be the responsibility of the Developer/Contractor.

Section 1.08 CODES AND STANDARDS:

Where codes and standards are referred to they shall be current, approved copies. It shall be the duty of the supplier of any material on this work to submit evidence, if requested, that its material is in compliance with the applicable codes and standards.

Section 1.09 STATE AND LOCAL LAWS:

The Developer/Contractor shall conform to all applicable state and local laws in carrying out its obligations under the Contract.

This shall include, but is not limited to, compliance by the Developer/Contractor with the requirements of Chapter 30, of Title 34, of the Utah Code Annotated, 1953 as Amended. If the provisions of Section 34-30-1, of the Utah

Code Annotated, 1953 as amended, are not complied with, this Contract shall be void.

Section 1.10 COMPLIANCE WITH GOVERNMENTAL REGULATIONS:

The Developer/Contractor's personnel, equipment, and operations shall comply fully with all applicable standards, regulations, and requirements of existing Federal, Utah State, and Local governmental agencies. This shall include, but not necessarily be limited to, the following:

Sub-section A. United States Occupational Safety and Health Administration Regulations:

Title 29 of the Code of Federal Regulations, Part 1926 (29 CFR Part 1926), Safety and Health Regulations for Construction.

Sub-section B. Utah State Industrial Commission Regulations:

The Utah Occupational Safety and Health Act (1973) and Employer-Employee Safe Practices for Excavations and Trenching Operations (Jan. 1, 1974), as published by the Utah State Industrial Commission, including any and all amendments or revisions effective prior to performance of the work.

Sub-section C. City Ordinances:

The Developer/Contractor shall be required to comply with all Morgan City Ordinances.

Sub-section D. UDOT Requirements:

When crossing or working within Utah Department of Transportation rights-of-way the Developer/Contractor shall be responsible to obtain all necessary permits and comply with all appropriate UDOT regulations including applicable sections in "State of Utah Standard Specifications for Road and Bridge Construction," latest edition.

Sub-section E. Permits:

The Developer/Contractor is responsible to obtain all required business licenses and building permits applicable to this project. Developer/Contractor shall be subject to the conditions of all permits and agreements between the Owner and the permitting agencies.

Section 1.11 FEDERAL, STATE, AND LOCAL INSPECTING AGENCIES:

The site of construction is to be open at all reasonable times and places for periodic observation by accredited representatives of the Federal, State, and local agencies who have regulatory or supervisory authority over any part of the work proposed or regulated thereto.

Section 1.12 PUBLIC SAFETY AND CONVENIENCE:

The convenience of the general public and the protection of persons and property is of prime importance and shall be provided for by the Developer/Contractor during this project. The Developer/Contractor shall use every reasonable precaution to safeguard persons and property. Failure of the Owner or the Public Works Representative/Engineer to notify the Developer/Contractor of any deficiencies in providing for public safety and convenience shall not relieve the Developer/Contractor from its responsibility. The Developer/Contractor shall be required to comply with the requirements of the Manual on Uniform Traffic Control Devices (MUTCD).

Sub-section A. Compliance with Rules and Regulations:

The Developer/Contractor shall comply with all rules and regulations of the City, County, and State authorities regarding the closing of public streets, or highways, to the use of public traffic. If conditions

justify, the Public Works Representative/Engineer may authorize the Developer/Contractor to close general traffic to not more than one (1) city block at any given time. No such closure shall be made without authorization of the Public Works Representative/Engineer. Closure of streets or highways shall be in conformance with the (MUTCD).

Sub-section B. Road Closures and Obstructions:

No road shall be closed by the Developer/Contractor to the public except by express permission of the Public Works Representative/Engineer. The Developer/Contractor shall, at all times, conduct its work so as to ensure the least possible obstruction to traffic and normal commercial pursuits.

Sub-section C. Protection of the Traveling Public:

All obstructions within traveled roadways shall be protected by signs, barricades, and lights where necessary for the safety of the traveling public. All barricades and obstructions shall be protected at night by signal lights which shall be suitably distributed across the roadway and kept burning from sunset to sunrise. Barricades shall be of substantial construction. Failure of the Owner or the Public Works Representative/Engineer to notify the Developer/Contractor to maintain barricades, barriers, lights, flares, danger signals, or guards shall not relieve the Developer/Contractor from its responsibility.

Sub-section D. Hazardous Conditions:

Whenever the Developer/Contractor's operations create a hazardous condition, it shall furnish flaggers and guards to give adequate warning to the public of any dangerous conditions to be encountered. It shall furnish, erect, and maintain fences, barricades, signs, lights, and other devices that may be necessary to prevent injury and damage to persons and property. Flaggers and guards shall be UDOT trained and shall hold current certification and shall be equipped with signs, flags, etc. as required by the Utah State Department of Transportation (UDOT) regulations.

Sub-section E. Dust and Debris Control:

The Developer/Contractor shall control dust and debris that originates in the construction right-of-way or site. Dust, trash, and other debris shall be controlled on a daily basis by methods that shall include, but not be limited to, the use of a dust setting spray, a "pick-up broom or street sweeper and trash disposal. When conditions warrant and at the sole determination of the City, the Developer/Contractor shall maintain on the project site a water truck. The Developer/Contractor shall be responsible to secure a source of water and shall obtain the necessary permission for its use. Failure by the Developer/Contractor to adequately control dust and debris may result in the City initiating dust and debris control measures and deducting the cost from payment due to the Developer/Contractor.

Section 1.13 CONFINEMENT OF WORK AND ACCESS TO RIGHT-OF-WAY AND EASEMENTS:

The Developer/Contractor will be required to confine construction operations within the dedicated right-of-way for public thoroughfares or within areas for which construction easements have been obtained unless it has made special arrangements with the affected property owners in advance. The Developer/Contractor will be required to protect stored materials, lawn, trees, and other features located adjacent to the proposed construction site. During construction operations, the Developer/Contractor shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to their residences or places of business for a period exceeding eight (8) hours, unless the Developer/Contractor has made special arrangements with the affected persons prior to commencing work in the area.

Section 1.14 NOTIFICATION OF RESIDENTS:

All property owners and residents adjacent to the streets or easements affected by the construction shall be notified by the Developer/Contractor at least forty-eight (48) hours in advance of time construction begins. The

Developer/Contractor can satisfy this requirement by placing a written notice on the door of each residence or business.

Section 1.15 WEATHER CONDITIONS:

In the event of temporary suspension of work, or during inclement weather, the Developer/Contractor will, and will cause its SubDeveloper/Contractors to, protect any project work or materials against damage from the weather. If, in the opinion of the Public Works Representative/Engineer, any Project work or materials become damaged by reason of failure on the part of the Developer/Contractor or any of its SubDeveloper/Contractors to so protect its work, such work or materials shall be removed and replaced at the expense of the Developer/Contractor.

Section 1.16 LAND MONUMENTS:

The Developer/Contractor shall preserve existing City, County, State, and Federal land monuments whenever possible. When these monuments cannot be preserved, the Developer/Contractor shall notify the Public Works Representative/Engineer at least two (2) weeks in advance of the proposed construction in order that the Public Works Representative/Engineer will have ample opportunity to reference these monuments for later replacement.

Section 1.17 SOURCE OF MATERIALS:

All materials furnished or incorporated in this project shall conform to the requirements of these Specifications.

The Developer/Contractor shall acquire the necessary rights, at its own expense, to take material from aggregate sources and to use properties for plant site, hauling roads, and other purposes.

The Developer/Contractor may select areas for disposal of surplus materials; however, the Developer/Contractor will be responsible for acquiring the necessary right, at its own expense, to use the property for such purpose.

Section 1.18 OPERATION AND MAINTENANCE MANUALS:

The Developer/Contractor shall furnish the Public Works Representative/Engineer with two (2) sets of all operation and maintenance manuals, drawings, diagrams, etc., for all pumps, motors, control panels, valves, meters, etc., for use in the Operation and Maintenance Manual.

Section 1.19 INTERFERING STRUCTURES, UTILITIES AND FACILITIES:

The Developer/Contractor shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. While these structures and utilities may be shown on the improvements plans, the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed, and it is presented simply as a guide to possible difficulties. The Developer/Contractor shall notify all utility offices concerned at least forty-eight (48) hours in advance of construction operations in which a utility agency's facility may be involved. Notification to blue stakes does not necessarily cover all buried lines. This shall include, but not be limited to, irrigation, water, telephone, electric, sewer, storm drain, gas, and cable television. The Developer/Contractor shall be responsible for any and all changes to, relocation of, or re-connection to public utility facilities encountered or interrupted, which could have been reasonably foreseen, during the prosecution of the work. All costs relating thereto shall be at the Developer/Contractor's expense.

It shall be the responsibility of the Developer/Contractor to expose all existing underground structures and utilities in such a manner as to prevent damage to the same. Any structure or utilities damaged by the work shall be repaired or replaced at the Developer/Contractor's expense.

If the Developer/Contractor encounters existing structures that will prevent construction, it shall notify the Public Works Representative/Engineer before continuing with the construction in order that the Developer's Engineer or Public Works Representative/Engineer may make such field revisions as necessary to avoid conflict with the existing structures.

Section 1.20 MATERIAL AND COMPACTION TESTING:

During the course of the work, a Geotechnical Engineer/Testing Company may perform such tests as are required to identify materials, to determine gradation, to determine compaction characteristics, to determine moisture, to determine density of fills in place, to determine concrete strength, to determine density and mixture of asphalt. These tests will be used to verify that the construction conforms to the requirements of the specifications. Such tests are not intended to provide the Developer/Contractor with the information required by it for the proper execution of the work and their performance shall not relieve the Developer/Contractor of the necessity of completing the construction in accordance with these specifications and Standard Drawings.

DIVISION 2

TRENCH EXCAVATION AND BACKFILL

Section 2.01 GENERAL:

This section covers the requirements for trenching and backfilling for underground pipelines. Unless otherwise shown or ordered, pipe shall be laid in an open trench. All incidental clearing, preliminary grading, structure removal, and benching shall be considered a part of the trenching operation.

Section 2.02 BARRICADES:

Barriers shall be placed at each end of all excavations, and at such places as may be necessary along excavations, to warn all pedestrians and vehicular traffic of such excavations. Lights shall also be placed along excavations from one hour before sunset each day to one hour after sunrise of the next day, until such excavations are entirely refilled, compacted, and surfaced or final graded. All excavations shall be barricaded in such a manner as to prevent persons from walking into, falling into, or otherwise entering those excavations.

Signs, signals, pavement markings, channelizing devices and other traffic control devices on roadways in and around work zones shall meet the standards contained in the most recent publication of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).

Section 2.03 BLASTING:

Blasting will not be allowed except by permission from the Public Works Representative/Engineer. The Developer/Contractor shall comply with all laws, regulations, ordinances, and safety codes relative to the handling, storage, and use of explosives. The Developer/Contractor shall be fully responsible for all damage to life and property attributable to its blasting operations. Excessive blasting or overshooting will not be permitted. The Developer/Contractor shall remove any material outside the authorized cross section, which may be shattered or loosened by blasting.

Section 2.04 SHEETING, BRACING AND SHORING OF EXCAVATIONS:

Excavations shall be sheeted, braced, and shored as required to support the walls of the excavations. These measures shall be taken to protect the workers, the work in progress, existing utilities, structures, and improvements, from damage due to sliding and settling of trench walls. All such sheeting, bracing, and shoring shall comply with the regulations of the Utah State Industrial Commission, and accident prevention and safety provisions of the Contract.

The Developer/Contractor shall be fully responsible for the adequacy of methods and materials used in trench sheeting, bracing, shoring, and other systems provided to protect workers. Injury to or death of workers resulting from inadequate trench safety measures shall be the full and complete responsibility of the Developer/Contractor. All damages resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Developer/Contractor, and the Developer/Contractor shall affect all necessary repairs or reconstruction at its own expense resulting from such damage.

Sheeting or shoring that does not extend below the centerline of the pipe may be removed at the discretion and responsibility of the Developer/Contractor after the pipe embedment has been placed and compacted to a level twelve inches (12") above the top of the pipe. Following removal of the sheeting or bracing, the trench shall be immediately backfilled and compacted or consolidated.

Section 2.05 CONTROL OF GROUNDWATER:

All trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing, and pipe embedment operations. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in all cases where the static groundwater is above the bottom of any trench or bell hole excavation,

such groundwater shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress. Surface water shall be prevented from entering trenches. No sanitary sewer shall be used for disposal of trench water. Clean discharge from excavation dewatering shall be conducted to natural drainage channels, gutters, drain pipes, or storm drain lines. Discharge water that is visibly clouded with sediment or other contaminant must first be treated for removal by filtration or the use of settlement basins. The Developer/Contractor shall verify the capacity of receiving facilities to ensure that downstream flooding will not occur. Permission must be obtained before discharging into private ditches or canals.

Section 2.06 TRENCH EXCAVATION:

Excavation for pipelines shall be located as shown on the Drawings or as staked in the field. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

Sub-section A. Normal Excavation:

Except in ledge-rock, cobbles, stones, or water-saturated earth, mechanical excavation of trenches shall not extend below an elevation four inches (4") above the bottom of the pipe after placement in its final position. All additional excavation necessary for preparation of the trench bottom shall be made manually.

Sub-section B. Authorized Over-Excavation:

Where ledge-rock, cobble rock, stones or other material render the trench material unsuitable for pipe bedding, as determined by the Public Works Representative/Engineer, bedding material shall be imported and placed. The trench shall be excavated to a minimum of four-inches (4") below the bottom of the pipe after placement in its final position.

Where unstable material is encountered in the excavation, foundation material may be required, as determined by the Public Works Representative/Engineer. In such cases, a minimum of eight inches (8") below the bottom of the pipe after placement in its final position shall be removed. Over-excavation not ordered, specified, or shown shall be considered to be unauthorized excavation.

Sub-section C. Unauthorized Over-Excavation:

Any excavation carried below the elevation required to install the pipe as specified in these Specifications, or directed by the Public Works Representative/Engineer, shall be considered to be unauthorized. Such excavation shall be backfilled in accordance with Section 2.07, all at the Developer/Contractor's expense.

Sub-section D. Trench Width:

The trench shall be excavated such that the pipe is always centered in the trench. The minimum clear trench width at the horizontal diameter of the pipe must not be less than the outside diameter of the pipe plus twelve inches (12").

Trench width for pipeline structures, valves, or other accessories shall be sufficient to leave at least twelve inches (12") clear between their outer surfaces and the trench. Backfill with earth under structures or valves will not be permitted. Any unauthorized excess excavation below the elevation indicated for foundation of any structures shall be backfilled in accordance with Section 2.07, at the Developer/Contractor's expense.

Sub-section E. Trenches in Embankments:

Before laying pipes that are to be in fill or embankment areas, the embankment shall first be placed and compacted to the specified density to a depth of not less than two feet (2') above the top of the proposed pipe. After placing and compacting the embankment, the trench for the pipe or conduit shall be excavated through the fill and fine graded and the pipe installed as specified.

Sub-section F. Placement of Excavated Material:

All excess material shall be hauled away from the construction site and disposed of in an area obtained by the Developer/Contractor and approved by the Public Works Representative/Engineer. The Developer/Contractor shall be responsible for all rights-of-way, easements, and access associated with the disposal of excess excavated material. It shall further be responsible to obtain permission from the property owner or person controlling the property where the Developer/Contractor plans to dispose of excavated material. No compensation will be made to the Developer/Contractor for disposal of excess excavated material.

Non-excess excavated material shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters and irrigation ditches shall be kept clear or other satisfactory provisions shall be made for street drainage and continuity of irrigation.

Grading of the area surrounding the trenches, including excavated materials, shall be performed as necessary to prevent surface water from flowing into trenches, or other excavations. Control of groundwater shall be as specified in section 2.05, Control of Groundwater.

Sub-section G. Fine Grading the Trench Bottom:

The bottom of the trench shall be accurately graded and prepared to provide uniform bearing and support on undisturbed soil or compacted granular bedding at every point along the entire length of the pipe. Bell holes shall be hand excavated after the trench bottom has been fine graded. Bell holes shall be only large enough to permit making the joints and to assure that any portion of the joint or bell does not support the pipe.

Section 2.07 TRENCH BACKFILL

Trench backfill for piping consists of four zones: foundation, bedding, initial backfill, and final backfill. "Pipe embedment" is a commonly used term that refers to the region including the bedding and initial backfill zones, or any region within one foot (1') of any pipe, pipeline structure, or accessory. The foundation is defined as the region between ten inches (10") and six inches (6") below the bottom of the pipe. The bedding is defined as the region between six inches (6") below the bottom of the pipe and the bottom of the pipe. The initial backfill is defined as the region between the bottom of the pipe and twelve inches (12") above the top of the pipe. The final backfill is defined as the region above twelve inches (12") above the pipe.

All fill materials shall be compacted as specified in this section.

The Public Works Representative/Engineer shall determine the suitability of excavated materials for use as foundation, bedding, initial backfill, and final backfill. When the excavated materials are not satisfactory for foundation, bedding, or backfill, the Developer/Contractor shall provide imported granular material.

Sub-section A. Imported Granular Material:

Imported granular material for foundation, bedding, and backfill shall be cleaned crushed rock or gravel, free from sod, vegetation, and other organic or deleterious material. Slag will not be allowed in the pipe embedment. Imported granular material shall conform to the following gradation specifications:

1. Foundation Material. One hundred percent (100%) less than two-inch (2") and maximum of five percent (5%) less than one-half-inch (½").
2. Embedment Material (bedding and initial backfill):
   - Waterlines: Use sand backfill - one hundred percent (100%) less than three-eights inch (3/8") and maximum five percent (5%) passing a No. 200 sieve.
   - Sewer and Storm Drain: One hundred percent (100%) less than three-quarter inch (3/4") and maximum of five percent (5%) passing a No. 200 sieve.

3. Final Backfill Material. One hundred percent (100%) less than eight-inch (8") and maximum of fifteen percent (15%) passing a No. 200 sieve.

Sub-section B. Foundation Placement:

When over-excavation is authorized by the Public Works Representative/Engineer, foundation material shall be placed in the foundation zone and below. The foundation material shall be placed so that the trench can be properly fine graded as specified. The foundation material shall be deposited over the entire trench width and compacted in layers. The layers shall have a maximum uncompacted thickness of six-inches (6").

The material shall then be fine graded in accordance with the specification for Fine grading herein.

Sub-section C. Pipe Embedment:

Embedment material for other than PVC pipe may be excavated materials consisting of loose earth, sand, or gravel having no material larger than two-inches (2") in any dimension. For PVC pipe, embedment cannot have material greater than three-quarters of one inch (3/4") in any dimension. If the excavated materials are not satisfactory, the specified imported granular material shall be used for pipe embedment.

1. Bedding. The bedding material shall be deposited over the entire trench width to a compacted thickness of no less than six inches (6"). The material shall have a maximum uncompacted thickness of six inches (6").
2. Initial Backfill. After the pipe is in place, initial backfill material shall be placed at any point below the mid-point of the pipe simultaneously and uniformly on both sides of the pipe in un-compacted layers not to exceed ten-inches (10") or one-half the diameter of the pipe, whichever is less. Initial backfill material shall be placed with care to prevent displacement of or damage to the pipe during the embedment process. Initial backfill material shall be scattered alongside the pipe and not dropped into the trench in compact masses.
3. That section of the pipe zone from the mid-point of the pipe to twelve inches (12") above the top of the pipe shall then be filled with initial backfill materials and compacted.

Sub-section D. Final Backfill:

Final backfill shall be from twelve inches (12") above the top of the pipe to the level shown on the Drawings. Excavated materials consisting of fines, sand, and gravel shall be used for final backfill. No oil cake, bituminous pavement, concrete, rock, or other lumpy material shall be used in the final backfill unless these materials are scattered and do not exceed six inches (6") in any dimension. Perishable or spongy material shall not be used in final backfilling.

Sub-section E. Compaction:

Backfill shall be compacted by means of sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or mechanical tampers.

Under pavements or other surface improvements the in-place density shall be a minimum of ninety-six percent (96%) of laboratory standard the maximum dry density as determined by AASHTO T-99. In shoulders and other areas the in-place density shall be a minimum of ninety percent (90%) of the maximum dry density as determined by AASHTO T-99.

Fill material shall be placed at a moisture content and un-compacted lift thickness such that after compaction the required relative densities will be produced. In no event will the material be placed in lifts that, prior to compaction, exceed six inches (6") for foundation and embedment and twelve inches (12") for final backfill.

If the required relative density is not attained, test sections will be required to determine any adjustments in compaction equipment, thickness of layers, moisture content and compactive effort necessary to attain the specified minimum relative density.

Approval of equipment, thickness of layers, moisture content, and compactive effort shall not be deemed to relieve the Developer/Contractor of the responsibility for attaining the specified minimum relative densities. The Developer/Contractor, in planning its work, shall allow sufficient time to perform the work connected with test sections and to permit the Public Works Representative/Engineer to make tests for relative densities.

Sub-section F. Consolidation

Consolidation of backfill shall be accomplished by those methods in which water is used as the essential agent to produce the desired condition of density and stability. Water shall be applied by jetting unless flooding is specifically authorized by the Public Works Representative/Engineer. Authorization by the Public Works Representative/Engineer to use any consolidation method does not relieve the contractor of his responsibility to meet the specified density requirements. Water for consolidation shall be furnished by the contractor at his expense.

In the jetting procedure the jets shall be inserted at not more than four-foot intervals (staggered throughout the length of the back filled area) and shall be slowly forced down to the bottom of the trench or top of previously jetted lift and held until the trench back fill is completely saturated with water. Depth of jetted lift shall not exceed 5 feet unless otherwise approved by the Public Works Representative/Engineer.

The minimum size of hose equipment shall be as to provide a minimum pressure of 35 pounds per square inch at the discharge. The jet shall be a rigid iron pipe with a minimum diameter of one inch.

After the water-settled trench has set for several days, any depression in the trench shall be filled, mounded over, and wheel rolled to compact the material thus placed.

All precautions necessary shall be taken by the contractor to prevent damage and movement (including floating) of the pipeline, structures, and existing adjacent improvements and utilities. The use of consolidation methods will be allowed only when they not result in damage to adjacent ground. The contractor shall make his own determination in this regard, and shall assume all risks and liability for settlement or lateral movement of adjacent ground, improvements, or utilities, either on the surface of the ground or underground.

Section 2.08 TRENCH CROSSINGS AND EASEMENTS:

At road crossings or where existing driveways occur on a road, the Developer/Contractor shall make provisions for trench crossings either by means of backfill, tunnels, or temporary bridges.

Any disturbance to property caused by the Developer/Contractor's activity within easements shall be restored as near as possible to preexisting conditions and shall work with the owner of the property to resolve specific and reasonable concerns directly related to the work on private property. If necessary, shrubs, fences, or other objects shall be removed carefully. If work must occur on a lawn, the lawn shall be cut to a width of two feet (2') wider than the intended work area (one foot (1') on each side). The lawn sod shall be stacked separately from and shall not be mixed with other excavated material.

After the sod is removed, if excavation is necessary, the topsoil shall be removed to a depth of twelve inches (12"), or the actual depth of the topsoil, whichever is less. The topsoil shall be stored separately from and shall not be mixed with other excavated material.

Following completion of the backfilling and the compaction of the trench, the Developer/Contractor shall replace topsoil, lawn sod, shrubs, fences, and other items that may have been removed from within the easement area and

shall clean up and remove any rocks, dirt or any other debris that remain from the construction work.

Section 2.09 RESTORATION OF CONSTRUCTION SITE:

During the progress of the Work, the Developer/Contractor shall clean up all construction debris, excess excavation, and excess materials, and shall restore all fences, irrigation structures, ditches, culverts, and similar items. The Developer/Contractor shall stockpile the excavated trench material so as to do the least damage to adjacent grassed areas, or fences, regardless of whether these are on private property or public rights-of-way. All excavated materials shall be removed from grassed and planted areas and these surfaces shall be left in a conditions equivalent to their original surface and free from all rocks, gravel, boulders, or other foreign materials.

Section 2.10 DEVELOPER/CONTRACTOR'S RESPONSIBILITY:

The Developer/Contractor will be responsible to see that the backfilling and compaction are properly and adequately done. Settlement of trenches within a period of one- (1) year after final acceptance of the project shall be considered incontrovertible evidence of inadequate compaction, and the Developer/Contractor shall be responsible for correcting the condition in accordance with the provisions of these Specifications. This includes the replacement of sidewalk, curb and gutter, and other surface improvements.

DIVISION 3

PRESSURE PIPE
CULINARY WATER

Section 3.01 GENERAL:

This Division covers furnishing and installing pressure pipe to the lines and grades shown on the drawings and/or established in the field, and all flushing, testing, repairing, and required to ensure adequate and safe operation of the water system.

All materials in contact with drinking water shall conform to NSF Standard 61 and Standard 14, and applicable sections of the most recent publication for ANSI/AWWA Standards C104 through C550 and C900 through C950.

For water mains not connected to fire hydrants, the minimum line size shall be 4 inches in diameter, unless they serve picnic sites, parks, semi-developed camps, primitive camps, or roadway rest-stops. Minimum water main size, serving a fire hydrant lateral, shall be 8 inches in diameter unless a hydraulic analysis indicates that required flow and pressures can be maintained by 6-inch lines.

Section 3.02 DUCTILE IRON PIPE:

Sub-section A. Materials:

Ductile iro
n pipe shall conform to all requirements of ANSI/AWWA C151/A21.51, "American National Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined molds, for Water or Other Liquids." Minimum pressure Class will be 250 for pipes larger than 12-inch diameter. Pipes of 12-inch diameter and smaller shall be pressure Class 350. If thickness class pipe is used, pipes of diameters from 4-inches through 10-inches shall be minimum Class 51 and pipe from 12-inch diameter and larger shall be minimum Class 50.

All pipe shall be made of good quality Ductile Cast Iron and of such chemical composition and structure as is required to meet the physical and mechanical property requirements of the standard.

Sub-section B. Joints:

1. Mechanical Joints: All mechanical joints shall meet requirements of ANSI/AWWA C111/A21.11. All gasket surfaces shall be smooth and free from imperfections. Gaskets shall conform to tests in accordance with specifications and shall be less than one year old.
2. Push-on Joints: All push-on joints shall meet the requirements of ANSI/AWWA C111/A21.11. Gaskets shall be free from defects and not over one year old. Lubricants shall be non-toxic and have no deteriorating effects on gasket materials. It shall not impart taste to water in a pipe. It shall conform in every way to ANSI 21.1
3. Flanged Joints: Flanges shall meet the requirements of ANSI/AWWA C110/A21.10, "American National Standard for Ductile Iron and Gray Iron Fittings, 3-inch Through 48-inch for Water and Other Liquids." Flanged joints shall be bolted firmly with machine, stud or cap bolts of proper size. Flange maybe cast integrally with the pipe or may be screwed on threaded pipe. Flanges shall be faced and drilled and of proper dimensions for size and pressure required. Bolts and nuts, unless otherwise specified, shall be made of the best quality refined iron or metal steel and have clean, well-fitting threads. Bolts will be provided with standard hexagonal nuts and standard hexagonal heads. Bolts shall be of the diameter required for each flange and when installed shall be of length so that no more than 3/8-inch nor less than 1/8-inch extends past face of nut. All buried fittings having steel bolts shall be coated with a non-oxide wax and wrapped with polyethylene.

Gaskets shall be rubber, either ring or full face, and are 1/8th-inch thick. A gasket for each flanged joint of proper size as shown on the drawings.

Sub-section C. Coatings and Linings for Ductile Iron Pipe:

All interior surfaces shall be cement mortar lined with a standard thickness according to ANSI/AWWA C104/A21.4-80.

Sub-section D. Corrosion Protection and Soil Tests:

When the Public Works/Engineer determines that a potential for corrosive conditions exists such as poor drainage or reactive soils, pipe and fittings shall be incased in polyethylene wrap. Polyethylene encasement of ductile iron pipe shall meet the requirements of ANSI A21.5 or AWWA C105.

Sub-section E. Flanges:

Flanges when required shall conform to ANSI/AWWA C115/A21.15-83.

Sub-section F. Fittings:

Fittings for Ductile Iron Pipe shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58.

Section 3.03 PVC PIPE:

Sub-section A. Materials:

Pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C900-81, "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water". The PVC pipe shall have a cast-iron-pipe-equivalent outside diameter. PVC pipe 14-inches and larger shall be manufactured in accordance with AWWA C905, "AWWA Standard for Polyvinyl Chloride (PVC) Water

Transmission Pipe, Nominal Diameters 14-inch through 36-inch". All PVC pipe 4-inch and larger shall be DR. 18 with a working pressure of 150 PSI. Pipe smaller than 4-inch shall be schedule 40 PVC. When permitted for culinary water use PVC pipe shall be blue in color.

Sub-section B. Joints:

Joints shall be push on rubber gasket type. Lubrication shall be water soluble, non-toxic, non-objectionable in taste and odor imparted to the water, non-supporting of bacteria growth, and have no deteriorating effect on the PVC pipe or rubber gaskets.

Sub-section C. Fittings:

All fittings to be used with the PVC pipe shall be the same as fittings for Ductile Iron Pipe and shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58.

Sub-section D. Warning Tape:

All pipe shall include a 3-inch warning tape installed in the pipeline trench approximately 12-inches above the pipe.

Identification tape shall be furnished with white or black printing on a colored field having the words:

CAUTION: POTABLE WATER - BELOW

Sub-section E. Tracer Wire:

All pipe shall include a tracer wire installed at the same elevation as the centerline of the pipe. The wire shall be single strand fourteen (14) gage coated copper. The tracer wire shall be installed adjacent to and paralleling the pipe at a distance of no more than 6" from the outside edge of the pipe. At all tees the wire shall be properly spliced using a grease cap and wire nut or soldering. At all valves the wire shall be brought up into the valve box where it will be easily accessible.

Section 3.04 PIPE INSTALLATION:

Sub-section A. AWWA C600-10 Standard:

Pipe shall be installed according to AWWA C600-10, “Installation of Ductile-Iron Water Mains and Their Appurtenances”.

Sub-section B. Cutting:

Cutting of pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method recommended by the manufacturer. After cutting, the pipe shall be beveled and filed to prevent gasket damage in joint assembly.

Sub-section C. Dewatering of Trench:

Where water is encountered in the trench, it shall be removed during pipe laying operations and the trench so maintained until the ends of the pipe are sealed. See "Control of Groundwater" in Division 2 Trench - Excavation and Backfill.

Sub-section D. Laying of Pipe:

The pipe and pipe coating (where applicable) shall be inspected for defects before installation. Any defects shall be repaired or the pipe shall be replaced, whichever is deemed necessary by the Public Works Representative/Engineer.

All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations. The pipes shall be installed with a **60-inch** minimum cover from finished road surface for culinary water. The Developer/Contractor shall be responsible to install the pipeline to the alignment set by the Public Works Representative/Engineer or as shown on the Drawings.

All pipes, fittings and valves shall be carefully lowered from the truck when unloading or when installing into the trench. This should be done one piece at a time in order to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped from the truck or into the trench.

The Developer/Contractor shall take the necessary precautions such that foreign materials do not enter into the pipe. No debris, tools, or other materials shall be placed in the pipe during laying operations. When laying of pipe is not in progress, the pipe shall be closed by a water-tight plug.

Maximum deflections at pipe joints shall not exceed the joint specifications of AWWA C600 of latest revision, or the recommendations of the pipe manufacturer.

Deflections in PVC pipe shall be made by longitudinal bending of the barrel of the pipe rather than deflecting the pipe joints. Longitudinal bending shall be limited to eighty percent (80%) of the manufactures recommended minimum bending radius.

Sub-section E. Pipe Bedding:

All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

In the event trench materials are not, in the judgment of the Public Works Representative/Engineer, satisfactory for pipe bedding, imported granular bedding will be required. See Division 2 of these specifications.

Sub-section F. Thrust Blocking:

Thrust blocking shall be applied at all tees, valves, plugs, caps and at bends deflecting 11 1/4 degrees or more. The fitting shall be encased in a 12 mil protective plastic wrap before the thrust block is poured. Reaction blocking shall be concrete having a compressive strength of not less than 3000 pounds per square inch at 28 days. Blocking shall be placed between undisturbed soil and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as shown in the Drawings. The blocking shall be so placed that the pipe and the fittings will be accessible for repair.

Sub-section G. Connections to Existing Water Lines:

Information on the drawings regarding existing water lines is taken from "record" drawings from the city or utility company files and may or may not be accurate as to size, type of material or location. The Developer/Contractor will be responsible to determine the proper fittings and materials required, obtain the Public Works Representative/Engineer's approval of the planned connection, and perform the construction in a suitable fashion. Where fitting sizes, such as tees and crosses, are shown on the plans, those sizes will be used. However, no attempt has been made to show all needed fittings or materials.

Sub-section H. Surface Water Crossings:

Above water crossings shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.

Underwater crossings shall have a minimum of 2 feet of cover over the pipe. Where high surface water velocities are present the crossing shall be in a steel casing.

Underwater crossings greater than 15 feet in length shall meet the following requirements:

1. Pipe with joints shall be of special construction, having restrained joints for joints within the surface water course and flexible restrained joints at both edges of the water course.
2. Isolating valves shall be provided on both sides of the water crossing at locations not subject to high ground water or flooding, so that the section can be isolated for testing or repair.
3. A means shall be provided, such as a sampling tap, not subject to flooding, to allow for representative water quality testing on the upstream and downstream side of the crossing.
4. A means shall be provided to pressure test the underground water crossing pipe.

Sub-section I. Separation:

Water mains shall not be run or laid in the same trench as sewer lines. At all locations there shall be at least eighteen (18) inches of separation vertically above the sewer line and ten (10) feet horizontal separation.

Sewer force mains that must cross a waterline shall be enclosed in a continuous sleeve within ten (10) feet of the waterline crossing point.

Sub-section J. Backflow Prevention and Cross Connections:

Water main and service lateral connections which may jeopardize water quality and integrity are not permitted.

1. Backflow devices are required on all cross connections. Installation of backflow devices shall conform to the State-adopted plumbing code.
2. The requirements of the International Plumbing Code and its amendments as adopted by the Department of Commerce shall be met with respect to cross connection control and backflow prevention.

Sub-section K. Dead Ends and Flushing:

1. Tie-ins should be made whenever practical to provide better system reliability and to reduce head loss. Dead end waterlines are discouraged.
2. Whenever a water main line must terminate it should be equipped with a flushing hydrant or blow-off for flushing purposes.
3. No flushing device shall be directly connected to a sewer

Section 3.05 WATER SERVICE LATERALS:

Service lateral installation shall conform to the State-adopted plumbing code and these standards.

Individual booster pumps shall not be allowed for individual service from the public water supply mains. Exceptions to the rule may be granted if it can be shown that the granting of such an exception will not jeopardize the public health. Application for exceptions are jointly handled by the City and the State.

Water service laterals shall be constructed with materials specified and at the locations shown on the Standard Drawings or at the actual location established during construction.

Pipe for water service laterals shall be one-inch (1") Type K-soft copper tubing or larger and shall comply with ASTM Specification B88. Polyethylene Pipe is also allowed per AWWA C901 with 200 psi compression fittings, and ratings according to AWWA C800.

Sub-section A. Extent of Laterals:

New water service laterals shall be located five (5) feet from the side property line extension and shall extend from the water main to fifteen-feet (15') past the front or side property line. When the location of the service lies within the driveway, or within 24" horizontally from the edge of the box to the driveway, it shall be placed in a traffic rated box with a traffic rated lid The lateral shall be installed prior to the installation of the curb and sidewalk but the meter setter, box and cover shall not be installed until after the curb is installed. A two-inch (2") by four-inch (4") by six-foot (6') marker, or approved equal, with the top twelve-inches (12") painted blue, shall be installed to clearly mark the end of each lateral line. Type K-soft copper tubing water services shall not have any joints between the corporation stop at the main and the meter setter.

Water service laterals relocated during construction of new pipelines shall extend from the water main to the water meter if the existing service is other than copper or is in poor condition. Type K-soft copper tubing water services shall not have any joints between the corporation stop and the meter.

Sub-section B. Excavation and Backfill:

Trench excavation and backfill shall conform to the applicable paragraphs of Division 2. Bedding shall meet the requirements of Division 3.

Sub-section C. Connection to Main:

Connections of services to main lines shall be direct tap on ductile iron mains and through a double strap service saddle on PVC mains, corporation type stop and 24-inch gooseneck formed with the tubing. All connections shall be made using pack joints (compression) type fittings. The service saddle shall be a Ford FS202, wide band, stainless steel service saddle with one-inch (1") FIPT tap or a Mueller DR 2 S double strap, stainless steel service saddle with a one-inch (1") FIPT tap. The corporation stop shall be a one-inch (1") Mueller B-25008 "CC" thread for direct tap or a one-inch (1") Ford Pack Joint F1100 for service saddle tap or equivalent.

On existing services the existing connection to main will be used unless damaged or leaking.

Sub-section D. Meter Setter, Box and Cover:

Meter installation shall conform to the State-adopted plumbing code and these standards.

The lateral shall be installed prior to the installation of the curb and sidewalk but the meter setter, box and cover shall not be installed until after the curb is installed. The meter setter shall be three-quarter inch (3/4") Ford dual check unless required to be larger by Morgan City. The meter box shall be 21-inch (21") diameter by thirty-six-inch (36") high white corrugated PVC with smooth interior. The meter cover to be D&L Supply L-2244 with recessed standard waterworks pentagon head locking device and raised cast center rim. The lid shall contain a two inch diameter removable plug to accommodate radio read equipment. The cover shall be marked "Water." Cover to be three-eighths-inch (3/8") above top back of curb. Centerline of cover shall be midway between the back of curb and walk. Meter boxes that are located in the drive approach or driveway or within twenty-four inches (24") of the drive approach or driveway shall be constructed with a traffic rated box and lid.

Temporary “jumpers” are not allowed in meter boxes. If water is needed for construction activities the contractor shall obtain a construction meter from the city.

Connection between the service meter and home or business shall conform to State-adopted plumbing code.

Sub-section E. Special Joints and Fittings:

1. Compression – All connections to the service line at the meter setter shall be made by compression fittings.
2. Solder and Sweat Joints – Not Allowed.
3. Copper Tubing to Screw Pipe Joints – Connections from copper tubing to brass shall be made by the use of brass adapter fittings.

Sub-section F. Separation:

Water service laterals shall not be run or laid in the same trench as a sewer lateral. At all locations there shall be at least eighteen (18) inches of separation vertically above the sewer main or lateral and ten (10) feet horizontal separation.

Sub-section G. Flushing, Testing and Disinfecting:

Flushing, testing and disinfecting of the service line shall be done at the time the water main is flushed, tested and disinfected. The end of the trench where the stub out past the meter is located shall be left open to allow for discharging water out of the service line for proper flushing and to insure that the line has been adequately disinfected. The line shall be flushed thoroughly following installation. Flushing, testing and disinfecting shall conform to the applicable paragraphs of this division.

On existing services the Developer/Contractor shall take precautions to prevent contamination of the pipe and connections during installation. The line shall be flushed thoroughly following installation.

Sub-section H. Damage and Repair of Water Mains and Appurtenances:

The Developer/Contractor shall be responsible for any damage to water mains and water facilities caused by his operations. The Developer/Contractor may be relieved of the responsibility under the following conditions:

1. He has not excavated below or beyond the required excavation lines, and
2. He has given proper and timely notice of his work plans, and
3. He has used reasonable care, and cooperated, minimizing the damage.

Any damage to water gates, hydrants, valve chambers, meter boxes, and other surface appurtenances that result from the Developer/Contractor's operation shall be its sole responsibility.

Section 3.06 FLUSHING, DISINFECTING, AND TESTING:

Sub-section A. Flushing:

All new water systems or extensions to existing systems shall be thoroughly flushed before being placed in service. Flushing shall be accomplished through hydrants, or end of line blow-off assemblies at a minimum flushing velocity of 2.5-feet per second. See chart below:

FLOW RATE AND OPENINGS TO FLUSH PIPELINES (40 - psi Residual Pressure)	
Pipe Size (inches)	Flow Required to Produce 2.5 fps velocity (gpm)
2	26
4	100
6	220
8	390
10	610
12	880
14	1,200
16	1,565
18	1,980
20	2,450
24	3,525
30	5,507

Sub-section B. Disinfection:

After flushing, all culinary water lines shall be disinfected by chlorination. Chlorination shall provide a minimum of 25 ppm residual after 24 hours contact in the pipeline. This may be expected with an application of 50 ppm, although some conditions may require more. Chlorine in the form of a 1% slurry of high-test calcium hypochlorite (HTH, Perchloron, Pittchlor, etc. which are 70% available chlorine by

weight) shall be fed into the pipeline in such a manner as to mix with the water flowing in the pipeline. (A 1% slurry - 10,000 ppm - results from mixing one pound of calcium hypochlorite with 8.40 gallons of water.) When specifically authorized by the City, chlorine pellets or powder may be used. Rechlorination of pipes will always require a slurry.

The following table provides information as to the required quantity of slurry to be used per 100 feet of pipe to provide a chlorine concentration of 50 ppm:

Pipe Size (in.)	Vol. of 100 ft. Length (gal)	Required Amount of 1% Chlorine Slurry (gal)
1 ½	9.18	0.07
2	16.32	0.12
2 ½	25.50	0.18
3	36.73	0.26
4	65.28	0.47
6	146.90	1.05
8	261.10	1.87
10	408.10	2.92
12	587.60	4.20

During the process of chlorinating the pipeline, all valves and other pipeline appurtenances shall be operated several times to provide sufficient contact with the chlorinating agent. Following chlorination, the water line shall be drained and thoroughly flushed according to Section A above and, if necessary, rechlorinated until a satisfactory bacteriological test is obtained.

Disinfection shall conform to the requirements of AWWA C651-14 (or latest edition).

Sub-section C. Pressure Test:

All newly laid pipes or any valved section thereof shall be subjected to a hydrostatic pressure test. A leakage test shall be conducted concurrently with the pressure test.

1. Test Pressure Restrictions:

Test pressures shall:

a. Not be less than 200 psi or 1.5 times the static pressure at the highest point along the test section, whichever is greater.
b. Not exceed pipe or thrust restraint design pressures.
c. Be of at least 2-hour duration.
d. Not vary by more than plus or minus five (+ 5) psi for the duration of the test.
e. Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.
f. Not exceed the rated pressure of the valves when the test boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

2. Pressurization:
Each valved section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Public Works Representative/Engineer.

3. Air Removal:
Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Developer/Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged.

4. Examination:
All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound materials and the test shall be repeated until it is satisfactory to the Owner.

Sub-section D. Leakage Test:

A leakage test shall be conducted concurrently with the pressure test.

1. Leakage Defined:
Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

2. Allowable Leakage:
No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P)^{0.5}}{148{,}000}$$

In which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gage.

a. Allowable leakage at various pressures is shown in Table 1.
b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed.
c. When hydrants are in the test section, the test shall be made against the closed hydrant.

TABLE 1

Allowable Leakage per 1000 ft of Pipeline - gph

Avg Nominal Test Pressure psi (bar)	Pipe Dia - in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450 (31)	0.43	0.57	0.86	1.15	1.43	1.72	2.01	2.29	2.58	2.87	3.44	4.30	5.16	6.02	6.88	7.74
400 (28)	0.41	0.54	0.81	1.08	1.35	1.62	1.89	2.16	2.43	2.70	3.24	4.05	4.86	5.68	6.49	7.30
350 (24)	0.38	0.51	0.76	1.01	1.26	1.52	1.77	2.02	2.28	2.53	3.03	3.79	4.55	5.31	6.07	6.83
300 (21)	0.35	0.47	0.70	0.94	1.17	1.40	1.64	1.87	2.11	2.34	2.81	3.51	4.21	4.92	5.62	6.32
275 (19)	0.34	0.45	0.67	0.90	1.12	1.34	1.57	1.79	2.02	2.24	2.69	3.36	4.03	4.71	5.38	6.05
250 (17)	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85	4.49	5.13	5.77
225 (16)	0.30	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65	4.26	4.86	5.47
200 (14)	0.29	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44	4.01	4.59	5.16
175 (12)	0.27	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22	3.75	4.29	4.83
150 (10)	0.25	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98	3.48	3.97	4.47
125 (9)	0.23	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72	3.17	3.63	4.08
100 (7)	0.20	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43	2.84	3.24	3.65

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
**To obtain leakage in liters/hour, multiply the values in the table by 3.785.

3. Acceptance of Installation:

Acceptance for this test shall be determined on the basis of allowable leakage and visual verification. All visible leaks are to be repaired regardless of the amount of leakage. If any test of pipe laid discloses leakage greater than specified, the Developer/Contractor shall, at its own expense, locate and repair the defective material until the leakage is within the specified allowance.

DIVISION 3A

PRESSURE PIPE
PRESSURE IRRIGATION

Section 3A.01 GENERAL:

This division covers furnishing and installing pressure pipe as shown on the Drawings or established in the field, and all flushing, testing, repairing, as required to ensure adequate and safe operation of the water system. Where conflicts exists between these specifications and the Morgan City Secondary Water Association specifications, the most stringent or restrictive specification shall apply. It shall be the developer's responsibility to satisfy the system requirements of the secondary water supplier and not Morgan City.

Section 3A.02 DUCTILE IRON PIPE:

Sub-section A. Materials:

Ductile iron pipe shall conform to all requirements of ANSI/AWWA C151/A21.51, "American National Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined molds, for Water or Other Liquids." The minimum Pressure Class will be 200. If thickness class pipe is used, the minimum shall be Thickness Class 50.

All pipe shall be made of good quality ductile cast iron and of such chemical composition and structure as is required to meet the physical and mechanical property requirements of the standard.

Sub-section B. Joints:

1. **Mechanical Joints:** All mechanical joints and gaskets shall meet the requirements of ANSI/AWWA C111/A21.11. All gaskets shall be smooth and free or porous areas, foreign materials, and visible defects. Gaskets shall be less than one (1) year old.
2. **Push-on Joints:** All push-on joints and gaskets shall meet the requirements of ANSI/AWWA C111/A21.11. All gaskets shall be smooth and free of porous areas, foreign materials, and visible defects. Gaskets shall be less than one (1) year old. Lubricants shall have no deteriorating effects on gasket materials. Lubricants shall conform to ANSI 21.11.
3. **Flanged Joints:** Flanges, when required, shall conform to ANSI/AWWA C115/A21.15-83. Flanged joints shall meet the requirements of ANSI/AWWA C110/A21.10, "American National Standard for Ductile Iron and Gray Iron Fittings, 3-inch Through 48-inch for Water and Other Liquids." Flanged joints shall be bolted firmly with machine, stud, or cap bolts of proper size. Flanges may be cast integrally with the pipe or may be screwed on a threaded pipe. Flanges shall be faced and drilled and dimensioned properly for the size and pressure required. Bolts and nuts, unless otherwise specified, shall be made of the best quality refined iron or steel, and have clean, well-fitting threads. Bolts will be provided with standard hexagonal nuts and standard hexagonal heads. Bolts shall be of the diameter required for each flange, and when installed shall be of length so that no more than three-eighths inch (3/8") nor less than one-eighth inch (1/8") extends past the face of the nut. All buried metallic fittings and bolts shall be coated with a non-oxide wax and wrapped with polyethylene.

   Gaskets shall be rubber, either ring or full face, and shall be one-eighth-inch (1/8") thick.

Sub-section C. Coatings and Linings for Ductile Iron Pipe:

All interior surfaces shall be cement mortar lined with a standard thickness according to ANSI/AWWA C104/A21.4-80.

Sub-section D. Fittings:

Fittings for ductile iron pipe shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58.

All fittings shall be Mechanical-Joint-(MJ)-type unless otherwise specified by the Public Works Representative/Engineer.

Section 3A.03 PVC PIPE:

Sub-section A. Materials:

Pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C900-81, "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water:" PVC pipe fourteen-inches (14") and larger shall be manufactured in accordance with AWWA C905-88, "AWWA Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch." All PVC pipe four-inch (4") and larger shall be dimension ratio (DR) 18 with a working pressure of 150 psi. The PVC pipe shall have a cast-iron-pipe-equivalent outside diameter. Pipe smaller than four-inches (4") shall be schedule 40 PVC.

Sub-section B. Joints:

Joints shall be the push-on rubber-gasket type. Lubrication shall be water soluble, non-supporting of bacteria growth, and have no deteriorating effect on the PVC pipe or rubber gaskets.

Sub-section C. Fittings:

All fittings to be used with the PVC pipe shall be the same as fittings for ductile iron pipe and shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58. All fittings shall be Mechanical-Joint-(MJ)-type unless otherwise specified by the Public Works Representative/Engineer.

Sub-section D. Locator Tape:

All pipe shall include a three-inch (3") locator tape installed in the pipeline trench approximately twelve inches (12") below the ground surface. This tape shall be prepared with white or black printing on a purple field, color Panatone 512C, having the words:

CAUTION: NONPOTABLE WATER - DO NOT DRINK.

Sub-section E. Tracer Wire:

All pipe shall include a tracer wire installed at the same elevation as the centerline of the pipe. The wire shall be single strand fourteen gage (14) coated copper. The tracer wire shall be installed adjacent to and paralleling the pipe at a distance of no more than 6" from the outside edge of the pipe. At all tees the wire shall be properly spliced using a grease cap and wire nut or soldering. At all valves the wire shall be brought up into the valve box where it will be easily accessible.

Sub-section F. Color:

PVC pipe colors, depending upon use, shall conform to the following:

Culinary Water	Blue
Secondary Water	Purple
Electrical	Grey
Sanitary Sewer	Green
other uses	White

Section 3A.04 PIPE INSTALLATION:

Sub-section A. Cutting:

Cutting of pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method recommended by the manufacturer. After cutting, the pipe shall be beveled and filed to prevent gasket damage in joint assembly.

Sub-section B. Dewatering of Trench:

Where water is encountered in the trench, it shall be removed during pipe-laying operations and until the ends of the pipe are sealed. See "Control of Groundwater" in Division 2 Trench - Excavation and Backfill section 2.05.

Sub-section C. Laying of Pipe:

The pipe and pipe coating (where applicable) shall be inspected for defects before installation. Any defects shall be repaired or the pipe shall be replaced, whichever is deemed necessary by the Public Works Representative/Engineer.

All pipe shall be laid and maintained to the required lines with fittings and valves at the required locations, as shown on the Drawings.

All pipe, fittings, and valves shall be moved carefully, either when lowering from the truck, or when placing in the trench. Under no circumstances shall materials be dropped or dumped from the truck or into the trench.

The Developer/Contractor shall take the necessary precautions to ensure that foreign materials do not enter the pipe. No debris, tools, or other materials shall be placed in the pipe during laying operations. When laying of pipe is not in progress, the pipe shall be closed with a water-tight plug.

Maximum deflections at pipe joints shall not exceed the joint specifications of AWWA C600 of latest revision, or the recommendations of the pipe manufacturer.

Deflections in PVC pipe shall be made by longitudinal bending of the barrel of the pipe rather than deflecting the pipe joints. Longitudinal bending shall be limited to eighty percent (80%) of the manufacturer's recommended minimum bending radius.

Sub-section D. Thrust Blocking:

Thrust blocking shall be applied at all tees, valves, plugs, caps, and at bends that deflect twenty-two and one-half (22-1/2°) degrees or more. The fitting shall be encased in a 12 mil protective plastic wrap before the thrust block is poured. Reaction blocking shall be concrete, having a compressive strength of not less than three-thousand (3000) psi at twenty-eight (28) days. Blocking shall be placed between undisturbed soil and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as shown in the Drawings. The blocking shall be placed so that the pipe and the fittings will be accessible for repair.

Sub-section E. Connections to Existing Water Lines:

Information on the Drawings regarding existing water lines is taken from "record" drawings from the city or utility company files and may or may not be accurate as to size, type of material, or location of those lines. The Developer/Contractor will be responsible to determine the proper fittings and materials required,

obtain the Public Works Representative/Engineer's approval of the planned connection, and perform the construction in a suitable fashion.

Section 3A.06 PRESSURE IRRIGATION SERVICE CONNECTION:

Pressure irrigation service laterals shall be constructed with materials specified and at the locations shown on the Standard Drawings or at the actual location established during construction. This section covers the installation of the service connection from the main to right-of-way line.

Sub-section A. Service Saddle Specifications:

(For use with AWWA C-900 C1 O.D. for PVC plastic pipe.)

All service clamps shall be of a "Full encirclement design," and shall be I.D. controlled, which design will eliminate the possibility of pipe crushing due to the over torquing of the nuts upon installation.

A rigid liner shall be used inside of tubing at the compression fitting on a 1-inch single service connection.

All service clamps shall be manufactured of brass cast in conformance to AWWA C-800, General Section - 1, Paragraph 1.2 (ASTM B-62).

The two sides of the clamp shall be held together by high quality Silicon Bronze Hex Bolts (in sizes 1" and over) or Silicon Bronze Slotted Screws (in sizes under 1"), no dis-similar metals shall be allowed at this point thus eliminating the possibility of galvanic corrosion.

All service clamps shall be Mueller Model H-13490 Series, or Ford Model S-91 Series and Romac 305 Series for 14" or larger.

Sub-section B. Polyethylene Tubing:

Pipe for the transmission of irrigation water from main to utility box and from the utility box to the homeowner's property line shall be Polyethylene CTS tube. Polyethylene CTS tube shall be manufactured in accordance with the standard specification for Polyethylene (PEP plastic tubing as issued by the American Standard for Testing and Materials under ASTM D 2737 and AWWA C-901.

Material designation code:
Polyethylene PE 3408

Plastic Extrusion Compound:
Type III, class C,
Grade 34, as defined
by ASTM D 1248

Standard pipe dimension ratio CTS (SDR) 9 - 200-psi pressure rating.

All tubing for service lines shall be cut and installed in a neat and workmanlike manner by a method recommended by the manufacturer. No joints will be allowed under sidewalks or other paved surfaces.

Tubing shall be WESTFLEX PE 3408 Gold Label or equivalent.

Sub-section C. Compression Connection:

a. The interior surface of the coupling nut, including threads, shall have a baked on, fluorocarbon coating to reduce assembly friction and prevent the gasket from turning and twisting during tightening. The nut shall bottom on a cast or machined shoulder on the body when properly

assembled. This design will provide a visual check to assure connection is properly assembled.

b. The sealing gasket shall be of molded synthetic rubber (ASTM D-2000) with molded in place bronze spring (ASTM A-134 Alloy #6) to eliminate the possible cold flow of the gasket between the pipe and fitting. A gripper band of hardened stainless steel (ANSI Type 401) shall be fitted into the gasket. When the gasket is compressed it will cause the gripper ring to distort the pipe giving the fitting a high resistance to pull out. The gripper band shall overlap itself to prevent cold flow of the gasket into the cavity under the band.

c. When Mueller 110 compression fittings are used with P.E. Pipe, Stainless Steel pipe stiffeners are required to eliminate cold flow of plastic pipe.

d. All fittings are to be for CTS Polyethylene pipe.

e. The Minimum pull out load for the fitting when used with PE plastic pipe shall be as follows for each given size:

Size	Minimum Pull out (ft. lbs)
1¾”	400
1"	400
1 ½"	500
2"	500

MUELLER 110 COMPRESSION COUPLINGS AND FITTINGS OR EQUIVALENT ARE TO BE USED ON ALL P.E. PLASTIC PIPE INSTALLATIONS.

Sub-section D. Service Fittings:

All service fittings such as brass tees, and brass ells shall be Mueller Insta-Tite connections or equivalent.

Sub-section E. Mark II Ori-Seal Valve:

These valves shall be closed bottom design and sealed against external leakage at the top by means of a non-adjustable resilient pressure actuated seal, and shall be provided with a secondary resilient seal disposed above the pressure seal for added protection of the bearing surfaces against ground water infiltration. Shutoff shall be affected by a resilient pressure actuated seal so disposed in the key (or plug) as to completely enclose the inlet body port (flow way), in the closed position. All Curb valves shall be quarter turn valves and the fully open and closed positions shall be controlled by check lugs that are integral parts of the key and body. The maximum pressure rating shall be 165-PSI water at a maximum temperature of 180 degrees Fahrenheit.

All fittings are to be CTS Size, used on CTS (Copper Tube Size) Polyethylene pipe. No IPS polyethylene pipe or fittings are to be used.

Curb stop valves shall be MUELLER H-1512-2, 110 COMPRESSION by FIP thread.

Sub-section F. Service Box:

Service box shall be an 11 3/4-inch by 16-inch standard green, fiberglass irrigation box with cover. Service Box shall be installed over the Ori-Seal valve and hose bib. A sign shall be attached or embossed to or on the cover indicating as follows: "IRRIGATION." Box shall be Brooks 1419 series utility box with lid

recessed and shall be provided with Waterworks Pentagon Head locking device or equivalent.

Sub-section G. Hose Bib:

All hose bibs used in the service connection assembly shall be a 3/4-inch NIBCO, Figure No. 74, Boiler Drain or approved equal.

Sub-section H. Service Pipe Installation:

The polyethylene service pipe shall be installed by use of a "Hole Hog" or other similar device under all existing paved surfaces. Where subsurface materials or conditions will not permit installation by this method, open trenching will be permitted with the approval of the Public Works Representative/Engineer. Open trenching may be used in new streets not yet paved.

Section 3A.07 TESTING AND FLUSHING:

All newly laid pipes or any valved section thereof shall be subjected to a hydrostatic pressure test. A leakage test shall be conducted concurrently with the pressure test. All new lines, and extensions therefrom, shall be flushed thoroughly before being placed into service.

Sub-section A. Pressure Test:

If the pipe section being tested includes concrete thrust blocking, the concrete shall be allowed at least twenty-four (24) hours to set before any testing is conducted.

1. Test Pressure Restrictions:

Test pressures shall:

a. Be at least 1.5 times the working pressure at the highest point along the test section, but not less than 120 psi.
b. Not exceed the pressure rating of the pipe.
c. Be of at least 2 hour duration.
d. Not vary by more than plus or minus five (+ 5) psi for the duration of the test.
e. Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.
f. Not exceed the rated pressure of the valves when the test boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

2. Pressurization:

Each valved section of pipe shall be filled slowly with water to the specified test pressure. Pressurization of the pipe shall be based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage. Pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Public Works Representative/Engineer.

3. Air Removal:

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Developer/Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged.

4. Examination:

All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered during the pressure test shall be repaired or replaced with sound materials and the test shall be repeated. Repairs or replacements to the pipeline and subsequent pressure testing shall be repeated as necessary for the pipeline to pass the pressure test.

Sub-section B. Leakage Test:

A leakage test shall be conducted concurrently with the pressure test.

1. Leakage defined:

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

2. Allowable leakage:

No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P)^{0.5}}{148{,}000}$$

In which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure (gage) during the leakage test, in pounds per square inch. See Table 1.

a. Allowable leakage at various pressures is shown in Table 1.
b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed.
c. When hydrants are in the test section, the test shall be made against the closed hydrant.

TABLE 1

Allowable Leakage per 1000 ft of Pipeline - gph

Avg Nominal Test Pressure psi (bar)	Pipe Dia - in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450 (31)	0.43	0.57	0.86	1.15	1.43	1.72	2.01	2.29	2.58	2.87	3.44	4.30	5.16	6.02	6.88	7.74
400 (28)	0.41	0.54	0.81	1.08	1.35	1.62	1.89	2.16	2.43	2.70	3.24	4.05	4.86	5.68	6.49	7.30
350 (24)	0.38	0.51	0.76	1.01	1.26	1.52	1.77	2.02	2.28	2.53	3.03	3.79	4.55	5.31	6.07	6.83
300 (21)	0.35	0.47	0.70	0.94	1.17	1.40	1.64	1.87	2.11	2.34	2.81	3.51	4.21	4.92	5.62	6.32
275 (19)	0.34	0.45	0.67	0.90	1.12	1.34	1.57	1.79	2.02	2.24	2.69	3.36	4.03	4.71	5.38	6.05
250 (17)	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85	4.49	5.13	5.77
225 (16)	0.30	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65	4.26	4.86	5.47
200 (14)	0.29	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44	4.01	4.59	5.16
175 (12)	0.27	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22	3.75	4.29	4.83
150 (10)	0.25	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98	3.48	3.97	4.47
125 (9)	0.23	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72	3.17	3.63	4.08
100 (7)	0.20	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43	2.84	3.24	3.65

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
**To obtain leakage in liters/hour, multiply the values in the table by 3.785.

3. Examination:

All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered during the leakage test shall be repaired or replaced with sound materials and the test shall be repeated. Repairs or replacements to the pipeline and subsequent leakage testing shall be repented as necessary for the pipeline to pass the leakage test.

Sub-section C. Acceptance of Installation:

Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than specified, the Developer/Contractor shall, at its own expense, locate and repair the defective material until the leakage is within the specified allowance.

All visible leaks are to be repaired regardless of the amount of leakage.

Sub-section D. Flushing:

Flushing shall be accomplished through temporary flushing valves, or end of line blow-off assemblies at a minimum flushing velocity of two and one-half feet per second (2.5 fps). Flow volumes to produce this velocity are shown in the following chart:

FLOW RATE AND OPENINGS TO FLUSH PIPELINES
(40 - psi Residual Pressure)

Pipe Size (inches)	Flow Required to Produce 2.5 fps velocity (gpm)
2	26
4	100
6	220
8	390
10	610
12	880
14	1,200
16	1,565
18	1,980
20	2,450
24	3,525
30	5,507
42	10,800
48	14,100

DIVISION 4

CONCRETE PIPE

Section 4.01 GENERAL:

This section covers the requirements for concrete pipe materials and installation in sanitary sewer, storm drain, and other gravity line construction.

Section 4.02 PIPE:

Concrete pipe used in sewer line, storm drain line and other gravity line construction shall be reinforced concrete pipe or non-reinforced concrete pipe, as required by design loading and fill heights and as follows:

Sub-section A. Reinforced Concrete Pipe:

All reinforced concrete pipe used in the construction shall be of the rubber gasket type, bell and spigot joint design, conforming to the requirements of the latest revision of ASTM Designation C-76. Pipe class shall be as shown on the Drawings. The minimum joint length of all pipes provided shall be 7 ½ feet (D load calculations, submitted to the City Engineer, are required for justification of reinforced and/or non reinforced concrete pipe).

Sub-section B. Non-Reinforced Concrete Pipe:

All non-reinforced concrete pipe used in the construction shall be of the rubber gasket type, bell and spigot joint design, conforming to the requirements of the latest revision of ASTM Designation C-14. Pipe class shall be as shown on the Drawings. The minimum joint length for pipe shall be four feet for pipe up to ten inches and seven and a half feet for all other pipe.

Sub-section C. Bell and Spigot Joints:

Bell and spigot joints, including rubber gaskets, shall conform to the requirements of the latest revision of ASTM Designation C-443. The pipe joint shall be so designed as to provide for self-centering, and when assembled, to compress the gasket to form a watertight seal. The gasket shall be confined in a groove on the spigot, so that pipe movement or hydrostatic pressure cannot displace the gasket.

Sub-section D. Minimum Size and Slope Requirements:

In no case shall sanitary sewer mains be less than eight inches in diameter. Sewers shall be laid with uniform slope between manholes. All sewers shall be designed and constructed to give mean velocities of not less than 2 feet per second when flowing full, based on Manning's formula using an n value of .013. Absolute minimum slope allowed shall be those published by the Utah Department of Environmental Quality, Division of Water Quality Administrative Rules for Design Requirements for Wastewater Collection, Treatment and Disposal System, R317-3, Table R317-3-2.3 (D)(4) Minimum Slopes.

Whenever possible the slope should exceed 0.006 ft/ft. The pipe should be sized to meet anticipated hydraulic loads, increasing the pipe size to reduce the minimum slope requirements shall not be allowed. Sewer slopes shall not exceed 0.12 ft/ft, drop manholes shall be used when steeper slopes are needed, drop manholes shall be used to keep line grade below maximum grade allowed.

Section 4.03 PIPE LAYING:

All concrete pipe installation shall proceed upgrade on a stable foundation, with joints closely and accurately fitted. Rubber gaskets shall be fitted properly in place, and care shall be taken in joining the pipe units to avoid twisting of gaskets. Joints shall be clean and dry, and a joint lubricant as recommended by the pipe supplier shall be applied uniformly to the mating joint surfaces to facilitate easy positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made

to receive pipe bells.

Select material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

Section 4.04 GRAVEL FOUNDATION FOR PIPE:

Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, or where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

Gravel for concrete pipe foundation shall be clean crushed rock or gravel with one hundred percent (100%) passing a one-inch (1") screen and five percent (5%) passing a No. 4 sieve.

Section 4.05 INSTALLATION REQUIREMENTS FOR LINE AND GRADE:

All concrete pipe shall be installed accurately to the defined line and grade with the following limits:

Variance from established line and grade shall not be greater than one-sixteenth (1/16) inch per inch of pipe diameter in ten feet, and not to exceed one-half inch in ten feet, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed one-sixty-fourth (1/64) inch per inch of pipe diameter, or one-half (½) inch maximum.

Section 4.06 PIPE BEDDING:

All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the mid-point of the pipe shall be deposited and compacted in layers not to exceed ten-inches (10") in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses. Bedding materials shall be loose earth, free from lumps; sand or gravel, free from rocks larger than two-inch (2") diameter. All materials shall be free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve-inches (12") above the top of the pipe.

Modified bedding material shall be graded as follows: One-hundred percent (100%) passing a one and one-half inch (1-1/2") screen and five percent (5%) passing a No. 4 sieve.

Section 4.07 TESTS:

The Developer/Contractor will be required to conduct a TV video inspection and air test. Displacement, infiltration, exfiltration, and mandrel tests may be required by the City Engineer; at the cost of the developer depending on results of the previous two tests. All test shall be conducted in the presence of the Public Works Representative/Engineer or his representative. Tests shall be performed as follows:

All gravity flow pipe lines shall be washed and vacuumed out prior to any testing or inspection to prohibit materials from flowing downstream.

Sub-section A. TV video Inspection:

The Developer/Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer and the Contractor) shall furnish labor, equipment, and materials, including camera and video tapes, and shall perform, in presence of the Public Works Representative/Engineer or his representative, an internal television test of the completed pipe before it can be placed in service. The contractor shall supply the City with a copy of the video tape. The television test shall be subject to the City Engineer's approval. Any defects in the pipe or the pipe installation noted on the internal TV inspection shall be corrected by the contractor and the repaired section shall be TV inspected after the repair to verify that the defective section has been corrected. ***Pipelines shall be pressure washed clean immediately prior to TV video inspection.***

Sub-section B. Air Testing:

The Developer/Contractor or his representative (a qualified firm or individual agreed upon by the Public Works Representative/Engineer and the Developer/Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, shall perform, in the presence of the Public Works Representative/Engineer or his representative, air tests of the completed pipe before it can be placed in service. Each section of sanitary sewer pipeline between manholes shall be tested after all the four-inch service laterals (and plugs) have been installed. Each test section shall be pressurized to 4.0 psi. For the purpose of stabilizing the air pressure in each test section, the 4.0 psi pressure shall be maintained for a two-minute period. Each test section shall then be re-pressurized to 4.0 psi for a period of four minutes. The test section shall be accepted if, after four minutes, the pressure gauge indicates 3.5 psi or greater. Failure of the Developer/Contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and re-tested until the minimum air testing requirements have been met.

Sub-section C. Displacement Test:

In conducting the displacement test a light will be flashed between manholes or, if the manholes have not as yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe shows broken, misaligned or displaced pipe or other defects, the defects designated by the Public Works Representative/Engineer or his representative, shall be remedied at the Developer/Contractor's expense.

Sub-section D. Infiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall perform, in the presence of the Public Works Representative/Engineer or his representative, infiltration tests of the completed line before it can be placed into service. The Developer/Contractor shall furnish and install the measuring weirs or other measuring devices. The length of line to be tested at any time shall be subject to the approval of the Public Works Representative/Engineer or his representative. The maximum allowable infiltration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per twenty-four hours (24 hrs) for all installed pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the Public Works Representative/Engineer or his representative at the expense of the Developer/Contractor.

Sub-section E. Exfiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall perform, in the presence of the Public Works Representative/Engineer or his representative, ex-filtration tests of the completed line before it can be placed into service. The length of line to be tested at one time shall be limited to the length between adjacent manholes. The maximum allowable ex-filtration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per 24 hours for all installed pipe. The end of the line which projects into the manhole shall be plugged. The pipe shall then be filled with water from the upper manhole, and the line maintained under a light pressure of four feet (4') of head. The inflow of water necessary to maintain this head shall be recorded as the leakage of the system. If the quantity of ex-filtration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the Public Works Representative/Engineer or his representative at the expense of the

Developer/Contractor.

Sub-section F. Mandrel Test ("GO/NO-GO" MANDREL PROOF TESTING):

Not less than thirty (30) days after installation of the flexible sewer or drain pipe, the City may require that the Developer/Contractor shall test the buried pipe to insure that ring-deflection of the pipe does not exceed five percent (5%) of the pipe's specified minimum inside diameter (ID). This proof test shall establish that the Developer/Contractor has installed the flexible pipe in full compliance with the Project Specifications thereby providing required pipe/soil structural strength.

The Developer/Contractor, with Inspector present, shall pull a "Go/No-Go" Mandrel, inspected and approved by the Public Works Representative/Engineer or his representative, through the full length of installed flexible pipe. The Mandrel shall be fabricated from suitable metal with a minimum of nine (9) properly sized radial fins mounted upon a center pulling shaft. In any case, the Mandrel shall be provided with an odd number of rigidly mounted radial fins. The Mandrel shall be provided with a proof-sizing ring that can demonstrate that the Mandrel's minimum outside diameter (OD) is not less than ninety-five percent (95%) of the specified minimum inside diameter of the installed flexible pipe. The Mandrel shall be pulled by the Developer/Contractor through one hundred percent (100%) of the installed flexible pipe without using mechanical equipment. Failure of the Mandrel to pass through a pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications.

The Public Works Representative/Engineer or his representative may require, if deemed appropriate or necessary, additional proof testing of designated lengths of the buried flexible pipe approximately anytime within the two (2) year guarantee period after installation but prior to the expiration of the Developer/Contractor's Maintenance Bond. The flexible pipeline shall be cleaned adequately prior to performing the "Go/No-Go" Mandrel ring deflection proof test. The Developer/Contractor, with Inspector present, shall pull a Mandrel, approved by the Public Works Representative/Engineer or his representative, through the designated length of pipeline without using mechanical equipment. Failure of the Mandrel to pass through the pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications.

Section 4.08 MANHOLE CONNECTIONS:

Concrete pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber gaskets, positive seal gasket system with 300 series nonmagnetic corrosion-resistant steel bands, or grouting a bell or spigot pipe at the appropriate locations. Connections shall meet the requirements of Division 5 MANHOLES.

Section 4.09 SEWER SERVICE LATERALS:

New service laterals shall be constructed with materials and procedures as specified herein.

Existing service laterals shall be constructed with materials compatible with the existing laterals with appropriate connections for joining the ends of existing laterals. All laterals shall be four-inch (4") in diameter unless shown otherwise.

Sub-section A. Extent and Location of Laterals:

New sewer laterals installed to lots shall be located fifteen-foot (15') uphill of the lowest front property corner. Service laterals shall extend from the sewer main to a point fifteen-foot (15') beyond the property line unless shown or staked otherwise. A two-inch (2") by four-inch (4") by six-foot (6') marker, with the top twelve-inches (12") painted green, shall be installed to clearly mark the end of each lateral line. <u>In addition to the marker, the Developer/Contractor shall station (give a distance) the location of the lateral connection to the main from the nearest downstream manhole.</u> This information shall be provided on the as-built drawings. Laterals shall be capped with a cap suitable to withstand test pressure and prevent any leakage into or out of the lateral.

When an existing sewer lateral is encountered along the line and grade of a new pipeline it shall be relocated using appropriate pipe and fittings and graded to insure adequate slope to drain properly.

Minimum slope shall be one-quarter-inch (1/4") per foot. Sewer laterals shall have at least **ten (10) feet horizontal** separation and **eighteen (18) inches vertical** separation (below) the culinary water service.

Sub-section B. Excavation and Backfill:

Trench excavation and backfill shall conform to the applicable paragraphs of Division 2 and the bedding requirements of this Division.

Sub-section C. Pipe:

Pipe used for new service laterals shall be PVC Plastic Pipe conforming to ASTM D-3034 SDR 35.

Sub-section D. Connection to Main:

Connection to a new main shall be made using a precast wye or tee installed in the main line at time of installation with a 4-inch PVC adapter or rubber gasket into which the 4-inch PVC lateral is inserted to form a water tight connection. In pipes 12-inches and larger the connection may be made using a cored hole in the pipe and a rubber boot. Recommendations of the manufacturer of the materials used shall be carefully followed. Connections onto existing sewer mains shall be made with field installed service saddles (gasketed and clamped or a nose in rubber gasketed connection approved by the City). All connections by field installed service saddles on existing sewer mains shall be done with a sewer tapping machine and all required fittings and materials. Connections shall be made as shown on the Standard Drawing and at the location specified herein, shown on the improvement drawings or as staked in the field.

Sub-section E. Cover Over Sewer Lateral Lines:

There shall be a minimum of three (3) feet of cover over all sewer lateral lines (3'6" minimum at property line.)

Sub-section F. Sewer Clean Outs:

There shall be a maximum distance of four (4) feet from the foundation wall to the first exterior clean out with a maximum distance between clean-outs of ninety (90) feet. There shall be a clean out when a combination of bends is ninety degrees (90°) or greater.

Sub-section G. Testing:

The service laterals shall be tested as a part of the sewer main to which they are connected.

Sub-section H. Damage and Repair of Sewers and Appurtenances:

The Developer/Contractor shall be responsible for the protection of existing improvements, and any damage resulting from its operations shall be its sole responsibility.

Damage to the sewers, laterals, or appurtenances shall be repaired by acceptable and approved methods.

DIVISION 4A

PVC PLASTIC PIPE

Section 4A.01 GENERAL:

This section covers the requirements for PVC plastic sewer pipe materials and installation in sanitary sewer, storm drain, and other gravity line construction.

Section 4A.02 PIPE:

PVC gravity sewer pipe and fittings shall conform to ASTM D-3034, for diameters from four-inch (4") to fifteen-inch (15") and ASTM F-679 for eighteen-inch (18") to twenty-seven-inch (27"), with integral bell gasket joints. Rubber gaskets shall be factory installed and conform to ASTM F-477. Pipe shall be made of PVC plastic having a cell classification of 12454A or 13364B (with minimum tensile modulus of 500,000 PSI) as defined in ASTM D-1784 and shall have a SDR of 35 and minimum pipe stiffness of 46PSI according to ASTM test D-2412.

Pipe shall be installed in compliance with ASTM D-2321 and the manufacturer's requirements.

Sub-section A. Minimum Size and Slope Requirements:

In no case shall sanitary sewer mains be less than eight inches (8") in diameter. Sewers shall be laid with uniform slope between manholes. All sewers shall be designed and constructed to give mean velocities of not less than 2 feet per second when flowing full, based on Manning's formula using an n value of .013. Absolute minimum slope allowed shall be those published by the Utah Department of Environmental Quality, Division of Water Quality as Administrative Rules for Design Requirements for Wastewater Collection, Treatment and Disposal System, R317-3, Table R317-3-2.3 (D)(4) Minimum Slopes.

Whenever possible the slope should exceed 0.006 ft/ft. The pipe should be sized to meet anticipated hydraulic loads, increasing the pipe size to reduce the minimum slope requirements shall not be allowed. Sewer slopes shall not exceed 0.12 ft/ft, drop manholes shall be used when steeper slopes are needed, drop manholes shall be used to keep line grade below maximum grade allowed unless approved by the City Engineer.

Sub-section B. Color:

PVC pipe colors, depending upon use, shall conform to the following:

Culinary Water	Blue
Secondary Water	Purple
Electrical	Grey
Sanitary Sewer	Green
other uses	White

Section 4A.03 FITTINGS:

Fittings shall be made of PVC plastic conforming to ASTM D-1784 and a cell classification as outlined in ASTM D-3034.

Section 4A.04 PIPE LAYING:

All pipe installation shall proceed upgrade on a stable foundation, with joints closely and accurately fitted. Joints shall be clean and dry, and a joint lubricant as recommended by the pipe supplier shall be applied uniformly to the mating joint surfaces to facilitate easy positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.
Select material shall be compacted around the pipe to firmly bed the pipe in position. Haunching material (bed to

springline) should be carefully worked under the haunches of the pipe and compacted from the pipe to the trench wall or two and one half (2-1/2) pipe diameters on each side of the pipe to ensure support. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When pipe laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.
In addition to the above requirements, all pipe installation shall rigidly adhere to the specific requirements of the pipe manufacturer. Installation of PVC pipe shall be in accordance with manufacturer specification. Bell shall be laid up stream unless special circumstances dictate otherwise as determined by the City Engineer.

Section 4A.05 GRAVEL FOUNDATION FOR PIPE:

Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

Gravel for PVC pipe foundation shall be clean crushed rock or gravel with one hundred percent (100%) passing a one-inch (1") screen and less than five percent (5%) passing a No. 4 sieve.

Section 4A.06 INSTALLATION REQUIREMENTS FOR LINE AND GRADE:

All PVC pipe shall be installed accurately to the defined line and grade with the following limits:

Variance from established line and grade shall not be greater than one-sixteenth (1/16) inch per inch of pipe diameter in ten feet, and not to exceed one-half inch in ten feet, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed one-sixty-fourth (1/64) inch per inch of pipe diameter, or one-half (½) inch maximum.

Section 4A.07 PIPE BEDDING:

All pipe sewers and drains shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the mid-point of the pipe shall be deposited and compacted in layers not to exceed ten-inches (10") in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses. Bedding materials shall be loose earth, free from lumps; sand or gravel, free from rocks larger than one-inch (1") diameter; with all materials free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve-inches (12") above the top of the pipe.

Modified bedding material shall be graded as follows: One-hundred percent (100%) passing a one and one-half inch (1-1/2") screen and five percent (5%) passing a No. 4 sieve.

Section 4A.08 TESTS:

The Developer/Contractor will be required to conduct a TV video inspection and air test. Displacement, infiltration, exfiltration, and mandrel tests may be required by the City Engineer; at the cost of the developer depending on results of the previous two tests. All test shall be conducted in the presence of the Public Works

Representative/Engineer or his representative. Tests shall be performed as follows:

All gravity flow pipe lines shall be washed and vacuumed out prior to any testing or inspection to prohibit materials from flowing downstream.

Sub-section A. TV video Inspection:
The Developer/Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer and the Contractor) shall furnish labor, equipment, and materials, including camera and video tapes, and shall perform, in presence of the Public Works Representative/Engineer or his representative, an internal television test of the completed pipe before it can be placed in service. The contractor shall supply the City with a copy of the video tape. The television test shall be subject to the City Engineer's approval. Any defects in the pipe or the pipe installation noted on the internal TV inspection shall be corrected by the contractor and the repaired section shall be TV inspected after the repair to verify that the defective section has been corrected. ***Pipelines shall be pressure washed clean immediately prior to TV video inspection.***

Sub-section B. Air Testing:

The Developer/Contractor or his representative (a qualified firm or individual agreed upon by the Public Works Representative/Engineer and the Developer/Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, shall perform, in the presence of the Public Works Representative/Engineer or his representative, air tests of the completed pipe before it can be placed in service. Each section of sanitary sewer pipeline between manholes shall be tested after all the four-inch service laterals (and plugs) have been installed. Each test section shall be pressurized to 4.0 psi. For the purpose of stabilizing the air pressure in each test section, the 4.0 psi pressure shall be maintained for a two-minute period. Each test section shall then be re-pressurized to 4.0 psi for a period of four minutes. The test section shall be accepted if, after four minutes, the pressure gauge indicates 3.5 psi or greater. Failure of the Developer/Contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and re-tested until the minimum air testing requirements have been met.

Sub-section C. Displacement Test:

In conducting the displacement test a light will be flashed between manholes or, if the manholes have not as yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe shows broken, misaligned or displaced pipe or other defects, the defects designated by the Public Works Representative/Engineer or his representative, shall be remedied at the Developer/Contractor's expense.

Sub-section D. Infiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall perform, in the presence of the Public Works Representative/Engineer or his representative, infiltration tests of the completed line before it can be placed into service. The Developer/Contractor shall furnish and install the measuring weirs or other measuring devices. The length of line to be tested at any time shall be subject to the approval of the Public Works Representative/Engineer or his representative. The maximum allowable infiltration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per twenty-four hours (24 hrs) for all installed pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the Public Works Representative/Engineer or his representative at the expense of the Developer/Contractor.

Sub-section E. Exfiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall perform, in the presence of the Public Works Representative/Engineer or his representative, ex-filtration tests of the completed line before it can be placed into service. The length of line to be tested at one time shall be limited to the length between adjacent manholes. The maximum allowable ex-filtration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per 24 hours for all installed pipe. The end of the line which projects into the manhole shall be plugged. The pipe shall then be filled with water from the upper manhole, and the line maintained under a light pressure of four feet (4') of head. The inflow of water necessary to maintain this head shall be recorded as the leakage of the system. If the quantity of ex-filtration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction

of the Public Works Representative/Engineer or his representative at the expense of the Developer/Contractor.

Sub-section F. Mandrel Test ("GO/NO-GO" MANDREL PROOF TESTING):

Not less than thirty (30) days after installation of the flexible sewer or drain pipe, the City may require that the Developer/Contractor shall test the buried pipe to insure that ring-deflection of the pipe does not exceed five percent (5%) of the pipe's specified minimum inside diameter (ID). This proof test shall establish that the Developer/Contractor has installed the flexible pipe in full compliance with the Project Specifications thereby providing required pipe/soil structural strength.

The Developer/Contractor, with Inspector present, shall pull a "Go/No-Go" Mandrel, inspected and approved by the Public Works Representative/Engineer or his representative, through the full length of installed flexible pipe. The Mandrel shall be fabricated from suitable metal with a minimum of nine (9) properly sized radial fins mounted upon a center pulling shaft. In any case, the Mandrel shall be provided with an odd number of rigidly mounted radial fins. The Mandrel shall be provided with a proof-sizing ring that can demonstrate that the Mandrel's minimum outside diameter (OD) is not less than ninety-five percent (95%) of the specified minimum inside diameter of the installed flexible pipe. The Mandrel shall be pulled by the Developer/Contractor through one hundred percent (100%) of the installed flexible pipe without using mechanical equipment. Failure of the Mandrel to pass through a pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications.

The Public Works Representative/Engineer or his representative may require, if deemed appropriate or necessary, additional proof testing of designated lengths of the buried flexible pipe approximately anytime within the one (1) year guarantee period after installation but prior to the expiration of the Developer/Contractor's Maintenance Bond. The flexible pipeline shall be cleaned adequately prior to performing the "Go/No-Go" Mandrel ring deflection proof test. The Developer/Contractor, with Inspector present, shall pull a Mandrel, approved by the Public Works Representative/Engineer or his representative, through the designated length of pipeline without using mechanical equipment. Failure of the Mandrel to pass through the pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications.

Section 4A.09 MANHOLE CONNECTIONS:

PVC pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber gaskets, or positive seal gasket system with 300 series nonmagnetic corrosion-resistant steel bands. PVC may not be grouted directly to concrete. Connections shall meet the requirements of Division 5 MANHOLES.

Section 4A.10 SEWER LATERAL CONNECTIONS:

All sewer lateral connections onto new sewer mains shall be made through preformed tee fittings installed in the main line at the time of main line installation.

Connections onto existing sewer mains shall be made with field installed service saddles (gasketed and clamped). All connections by field installed service saddles on existing sewer mains shall be done with a sewer tapping machine and all required fittings and materials. Connections shall be made as shown on the Standard Drawing and at the location specified herein, shown on the improvement drawings or as staked in the field.

Section 4A.11 SEWER SERVICE LATERALS:

New service laterals shall be constructed with materials and procedures as specified herein.

Existing service laterals shall be constructed with materials compatible with the existing laterals with appropriate connections for joining the ends of existing laterals.
All laterals shall be four-inch (4") in diameter unless shown otherwise.

Sub-section A. Extent of Laterals and Location of Laterals:

New sewer laterals installed to lots shall be located fifteen-foot (15') uphill of the lowest front property corner. Service laterals shall extend from the sewer main to a point fifteen-foot (15') beyond the property line unless shown or staked otherwise. A two-inch (2") by four-inch (4") by six-foot (6') marker, with the top twelve-inches (12") painted green, shall be installed to clearly mark the end of each lateral line. In addition to the marker, the Developer/Contractor shall station (give a distance) the location of the lateral connection to the main from the nearest downstream manhole. This information shall be provided on the as-built drawings. Laterals shall be capped with a cap suitable to withstand test pressure and prevent any leakage into or out of the lateral.

When an existing sewer lateral is encountered along the line and grade of a new pipeline it shall be relocated using appropriate pipe and fittings and graded to insure adequate slope to drain properly. Minimum slope shall be one-quarter-inch (1/4") per foot.

Sub-section B. Excavation and Backfill:

Trench excavation and backfill shall conform to the applicable paragraphs of Division 2 and the bedding requirements of this Division.

Sub-section C. Pipe:

Pipe used for new service laterals shall be PVC Plastic Pipe conforming to ASTM D-3034 SDR 35.

Sub-section D. Connection to Main:

Connections to the main shall be made as specified in Section 4A.10 SEWER LATERAL CONNECTIONS. Recommendations of manufacturer of the materials used shall be carefully followed.

Sub-section E. Cover Over Sewer Lateral Lines:

There shall be a minimum of three (3) feet of cover over all sewer lateral lines (3'6" minimum at property line.)

Sub-section F. Sewer Clean Outs:

There shall be a maximum distance of four (4) feet from the foundation wall to the first exterior clean out with a maximum distance between clean-outs of one hundred (100) feet from the entry point of one clean out to the next (top of clean out to top of cleanout). Cleanouts must be equipped with a threaded brass plug. PVC plugs are not permitted. There shall be a clean out when a combination of bends is ninety degree (90°) or greater.

Sub-section G. Testing:

The service laterals shall be tested as a part of the sewer main to which they are connected.

Sub-section H. Damage and Repairs of Sewers and Appurtenances:

The Developer/Contractor shall be responsible for the protection of existing improvements, and any damage resulting from its operations shall be its sole responsibility.

Damage to the sewers, laterals, or appurtenances shall be repaired by acceptable and approved methods.

Section 4A.12 "GO/NO-GO" MANDREL PROOF TESTING:

Not less than thirty (30) days after installation of the flexible sewer or drain pipe, the City may require that the Developer/Contractor shall test the buried pipe to insure that ring-deflection of the pipe does not exceed five percent (5%) of the pipe's specified minimum inside diameter (ID). This proof test shall establish that the Developer/Contractor has installed the flexible pipe in full compliance with the Project Specifications thereby providing required pipe/soil structural strength.

The Developer/Contractor, with Inspector present, shall pull a "Go/No-Go" Mandrel, inspected and approved by the Public Works Representative/Engineer, through the full length of installed flexible pipe. The Mandrel shall be fabricated from suitable metal with a minimum of nine (9) properly sized radial fins mounted upon a center pulling shaft. In any case, the Mandrel shall be provided with an odd number of rigidly mounted radial fins. The Mandrel shall be provided with a proof-sizing ring that can demonstrate that the Mandrel's minimum outside diameter (OD) is not less than ninety-five percent (95%) of the specified minimum inside diameter of the installed flexible pipe. The Mandrel shall be pulled by the Developer/Contractor through one hundred percent (100%) of the installed flexible pipe without using mechanical equipment. Failure of the Mandrel to pass through a pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications.

The Public Works Representative/Engineer may require, if deemed appropriate or necessary, additional proof testing of designated lengths of the buried flexible pipe approximately one year (1 yr.) after installation but prior to the expiration of the Developer/Contractor's Maintenance Bond. The flexible pipeline shall be cleaned adequately prior to performing the "Go/No-Go" Mandrel ring deflection proof test. The Developer/Contractor, with Inspector present, shall pull a Mandrel, approved by the Public Works Representative/Engineer, through the designated length of pipeline without using mechanical equipment. Failure of the Mandrel to pass through the pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications.

DIVISION 5

MANHOLES

Section 5.01 GENERAL:

This division covers the requirements for manhole materials and installation. Manholes shall be installed at the locations and at the depth shown on the drawings. Manholes shall be furnished complete with cast-iron rings and covers.

Section 5.02 CONCRETE BASE:

Unless otherwise noted manhole bases shall be precast and shall have pipe inverts and a resilient connection between pipe and manhole for each pipe connecting to the manhole.

Where sewer lines pass through or enter manholes, the invert channels shall be smooth and semi-circular in cross section, conforming to the details shown on the Drawings. Changes of direction of flow within the manholes shall be made with a smooth curve with as long a radius as possible. The floor of the manhole outside the flow channels shall be smooth and slope toward the channel at not less than one-half inch (½") per foot.

Concrete pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber gaskets, positive seal gasket system, or grouting a bell or spigot pipe at the appropriate locations. Rubber gaskets or boots shall be made of rubber compound meeting ASTM C-923 Specifications for resilient connections between pipe and manhole. They shall meet all other applicable ASTM specifications, including ASTM F-477.

Positive seal gasket systems boot shall have a wall thickness of three-eighths inch (3/8"). The boot shall either be "cast-in-place" in the precast base or attached to the precast base by means of an internal expanding band. When the boot is attached to the precast base, a watertight seal between the boot and the precast base must be accomplished. An external band (take-up clamp) shall be supplied and used to clamp and seal the boot to the pipe. The band shall be made of 300 series nonmagnetic corrosion-resistant steel. After the band has been placed, it shall be completely coated with a bituminous material approved by the Public Works Representative/Engineer.

PVC pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber gaskets, or positive seal gasket system. PVC may not be grouted directly to concrete.

The maximum size pipe that can be used in a 48-inch manhole is twenty-four (24") inch PVC or twenty-one (21") inch concrete. For pipes larger than these require a 60-inch manhole or concrete box.

Concrete for manhole bases shall comply with the requirements of Division 8, Concrete, of these Specifications.

When cast-in-place manholes are authorized, they must be watertight and conform in dimension and design to the standard drawings. Cast-in-place manholes will only be considered on concrete sewer lines. A gasket placed over the outside of the pipe or other means of providing a watertight seal is required.

Section 5.03 WALL AND CONE SECTIONS:

All manholes shall be precast, sectional, reinforced concrete pipe of forty-eight-inch (48") or sixty-inch (60") diameter as specified. Both cylindrical and taper sections shall conform to all requirements of ASTM Designation C-478-88 (or latest revision) for Precast Reinforced Concrete Manhole Sections with the following exceptions:

A. The throat section of the manhole shall be adjustable, by use of manhole sections, up to forty-eight inches (48") in height.

B. The taper section shall be a maximum of thirty-six inches (36") in height for 48-inch manholes and thirty-nine inches (39") for 60-inch manholes, shall be of eccentric conical design, and shall taper uniformly to thirty inches (30") inside diameter.

C. The pipe used in the base section shall be furnished in section lengths of one, two, three, and four-feet (1, 2,

3, and 4 feet) as required.

All joint surfaces of precast sections and the face of the manhole base shall be thoroughly cleaned and wet prior to setting precast sections. All joints, including grade rings, shall be set in mortar or butyl rubber gasket. The mortar shall consist of one (1) part cement and one and one-half (1-1/2) parts sand with sufficient water added to bring the mixture to workable consistency or the joints shall be sealed with a butyl rubber gasket that is permanently flexible and non-shrinking. All joints shall be water tight and free from appreciable irregularities in the interior wall surface.

Sub-section A. Manholes Shall Be Furnished With Steps:

The steps are to be made of co-polymer polypropylene. The co-polymer polypropylene used shall conform to ASTM D-4101-82 PP200B33450Z02. The steel used in manufacturing of this product shall be a deformed ½" reinforcing rod. This material shall be grade 60 and conform to the requirements of ASTM A-615. Manhole sections shall be turned so that the steps line up vertically.

Section 5.04 DROP MANHOLES:

When the difference in elevation of an incoming sewer is 12-inches or greater a drop manhole shall be used. The drop manhole shall be constructed as shown in the Standard Drawings. The piping from the wye to the manhole on both legs shall be ductile iron or PVC pipe with appropriate fittings. If the sewer main that the drop manhole is a part of is concrete, then a transition coupling (Fernco) shall be used to connect the main with the drop pipe assembly.

The drop pipe assembly shall be encased in flowable fill. The flowable fill shall be placed to the minimum thickness as shown on the Standard Drawings.

Sub-section A. Cement:

Use Portland Cement, Type II per Division 8, Portland Cement Concrete.

Sub-section B. Fly Ash:

Supply fly ash that complies with ASTM C-618 Class F except that the loss on ignition must be 3 percent or less.

Sub-section C. Fine Aggregate:

Use natural sand. The sand shall meet the following gradation when tested in accordance with AASHTO T-27.

Fine Aggregate	
Sieve Size	**Percent Passing**
No. 3/4	**100**
No. 100	**0-10**

Sub-section D. Mix Design:

The mix design shall meet the following requirements:

Mix design compressive strength (28 day) – between 50 to 150 psi.
Portland Cement – at least 50 pounds per cubic yard.
Fly Ash – at least 300 pounds per cubic yard.
Slump – 6 to 10 inches maximum.

Section 5.05 MANHOLE RINGS AND COVERS:

All iron casting shall conform to the requirements of ASTM Designation A-48 (Class 35) for grey iron castings, free from blowholes and shrinkage defects. Castings shall be free from fins and burrs and shall be shot-blasted to remove sand and other foreign matter.

Rings and covers shall be equal to the twenty-four inch (24") Standard circular, with machined bearing surfaces, gravity, solid, non-rocking type. The minimum weight of the cover shall be one hundred sixty (160) pounds. The minimum weight of the ring shall be two hundred eighty (280 lbs.). Flat rings and covers shall be allowed only when specifically authorized. Each cover shall contain one (1) pick hole but shall not contain air vent holes. Vented covers may be specified for certain areas. Use vented covers only when authorized. The tops of the cover and ring shall be flush and there shall be 1/8-inch clearance between the cover and the ring. In addition to the foundry name and year of manufacture, the cover shall be marked "SEWER," "STORM DRAIN," "DRAIN," (meaning land drain) or "IRRIGATION" as appropriate.

Sub-section A. Setting of Manhole Frames and Covers:

Manhole rings shall be set in place in with the shaft in a bed of cement sand mortar, which mix shall be one part cement to two parts sand or Kent Seal. Covers shall be set to the finished grade and contour of the existing street. Rings and covers shall be protected during backfilling and compaction of the soil and during the placing or replacing of road surfaces. Any rings or covers loosened from the manhole sections shall be reset in cement mortar and any rings or covers damaged or broken shall be replaced by the Developer/Contractor at its expense. Manholes placed in asphalt surfacing shall be set in a concrete collar. The collar shall be at least eight inches (8") thick and extend to a minimum of twelve inches (12") and a maximum of eighteen (18) inches from the cast iron ring. The concrete collar shall be constructed such that at the interface with the asphalt, the collar shall be one-half inch (½") lower than the pavement. The cast iron ring shall be constructed such that it is three-fourths inch (3/4") lower than the pavement. The cement shall be finished with one-quarter (1/4) inch slope from the asphalt to the cast iron ring. See detail drawings.

Only concrete or cast iron adaptor rings shall be allowed to raise manhole covers to grade. Brick or any other type of material shall not be used to raise the manhole. Cones shall not be broken out to lower the ring to meet the road grade. Sections shall be removed and grade rings or adapter rings (riser) used.

Section 5.06 CONNECTIONS TO EXISTING SEWER:

Manholes used to connect the sewer to the existing sewer shall be plumb and centered on the existing pipe at the elevation designated and the base placed as specified. Care shall be taken not to disturb the alignment of the existing sewer.

The cutting of the existing sewer pipe shall be done in the presence of the Public Works Representative/Engineer. The cut shall be full area of the new pipe and shall be finished so as to leave no projections that will restrict the flow or catch solids.

Every precaution shall be taken to prevent any material from entering the sewer main. Any such materials entering the sewer shall be removed.

Section 5.07 INCOMING SEWER LINES:

In no case shall an incoming sanitary sewer be allowed to drop more that 12-inches to the base. Sewer lines where the grade is higher than twelve (12) inches above the existing base; a drop manhole connection shall be used. In all cases the base shall have a channel for the incoming sewage.

DIVISION 6

VALVES, COUPLINGS, AND FIRE HYDRANTS

Section 6.01 GENERAL:

This section covers distribution valves to be used in the water system, couplings, and fire hydrants.

Sub-section A. Valve Spacing:

Valves used for isolation purposes should be located so as to offer flexibility in water system management and minimize inconvenience when maintenance or future extension may be required. Space isolation valves as follows:

1. 500 feet in commercial districts
2. At one block intervals or 800 feet maximum in non-commercial districts
3. At a maximum of one mile in areas of widely scattered customers and no expected future development.

Section 6.02 RESILIENT SEATED GATE VALVE:

Valves in sizes 4" through 12" shall be of the iron body, non rising bronze stem, resilient seated type, manufactured to equal or exceed all applicable AWWA standards of C-509 latest revision and all specific requirements outlined in these specifications.

A. Valves shall open left and be provided with 2" square operating wrench nuts unless otherwise specified.
B. When valves have Mechanical Joints, they shall be furnished with all necessary glands, followers, and bolts and nuts to complete installation.
C. The disc shall have integrally cast ASTM B-62 bronze stem nut to prevent twisting, binding or angling of the stem. Designs with loose stem nuts are not acceptable.
D. Bronze valve stems shall be interchangeable with stems of the double disc valves of the same size, direction of opening and manufacture.
E. All internal ferrous surfaces shall be coated, holiday free, to a minimum thickness of 4 mills with a two part thermo setting epoxy coating. Said coating shall be non-toxic, impart no taste to the water, formulated from materials deemed acceptable in the Food and Drug Administration Document Title 21 of the Federal Regulations on food additives, Section 121.2514 entitled Resins and Polymeric Coatings. It shall protect all seating and adjacent surfaces from corrosion and prevent build-up of scale or tuberculation.
G. The sealing element shall be secured to the disc with self locking stainless steel screws, and it shall be field replaceable, and shall be such that it cannot be installed improperly.
G. Stem failure from over torquing in either the open or closing position shall occur externally at such a point as to enable the stem to be safely turned by use of a readily available tool after exposure of the valve through excavation.
H. Valve design shall incorporate a positive metal to metal stop to prevent over-compression of the sealing element.
I. A full faced composition gasket placed between machined body and bonnet flanges is required to eliminate cold flow or creep action present with "O" ring gasketed bodies.
J. Valves shall have a test plug in the bonnet area to vent air and allow line pressure testing.
K. The exterior of the valves shall be Asphalt Varnish, JAN-P-450. If exterior epoxy is used, all bolts and nuts shall be made of Stainless Steel to prevent galvanic corrosion of said nuts and bolts due to insulation from the ferrous valve and line.

Section 6.03 BUTTERFLY VALVE:

All butterfly valves shall conform to the latest revision of AWWA Standard C-504, Class 150-B, and comply with the following:

A. Valve bodies shall be cast iron, ASTM A-126 Class B. Body ends shall be flanged with facing and drilling in accordance with ANSI B16.1, Class 125; or mechanical joint in accordance with AWWA C-111. All mechanical joint end valves shall be furnished complete with joint accessories (bolts, nuts, gaskets, and

glands). All valves shall conform to AWWA Standard C-504, Table 3, Laying Lengths for Flanged Valves and Minimum Body Shell Thickness for all Body Types.

B. Valve disc shall be ductile iron ASTM A-536, grade 65-45-12. Valve disc shall be of the offset design providing 360 degree uninterrupted seating.

C. The resilient seat shall be natural rubber bonded to an 18-8, Type 304 stainless steel retaining ring secured to the disc by 18-8, Type 304 stainless steel screws. The seat shall be capable of mechanical adjustment in the field and field replaceable without the need for special tools. Valve body seat shall be 18-8, Type 304 Stainless Steel.

D. Valve shafts shall be 18-8, Type 304 stainless steel. Shafts shall be of the two piece stub design and attached to the disc by means of "O" ring sealed taper pins with lock nuts.

E. The valve assembly shall be furnished with a non-adjustable factory set thrust bearing designed to center the valve disc at all times.

F. Shaft bearings shall be contained in the integral hubs of the valve body and shall be self-lubricated sleeve type.

G. Valve shaft seal shall consist of "O" Rings. Where the valve shaft projects through the valve body for actuator connection, the "O" Ring packing seal shall be field replaceable as a part of a removable bronze cartridge.

H. When manual actuators are required they shall be of the traveling nut design capable of withstanding 450 foot pounds of input torque against the open and closed stops. All actuators shall have adjustable mechanical stop limits. The closed position stop shall be externally adjustable. Valves shall be installed with the shaft horizontal unless otherwise directed by the Public Works Representative/Engineer and shall be provided with a 2-inch square operating nut for manually operating the valve with a "T" handle wrench.

I. All valves shall be coated with epoxy in conformance to AWWA Standard C-550, latest revision. Interior wetted ferrous surfaces shall be coated nominal 10 mils thick for long life; and body exterior shall have a minimum of 3 to 4 mils coating thickness in order to provide superior base for field-applied finish coats.

Section 6.04 VALVE BOXES:

All buried valves shall be installed complete with two-piece, cast iron, 5-1/4-inch shaft valve box.

Valves and valve boxes shall be installed where shown on the drawings. Valves and valve boxes shall be set plumb. Valve boxes shall be centered directly over the valve. Valves shall be aligned with property lines where possible. Earth fill shall be carefully tamped around the valve box to a distance of four (4) feet on all sides of the box, or to the undisturbed trench face if less than four (4) feet. Valves shall have the interiors cleaned of all foreign matter before installation. All valve boxes located in streets shall be installed to grade. Valves placed in asphalt surfacing shall be set in a concrete collar. The collar shall be at least eight inches (8") thick extend to a minimum of twelve inches (12") and a maximum of eighteen (18) inches from the valve box. The concrete collar shall be constructed such that at the interface with the asphalt, the collar shall be one-half inch (½") lower than the pavement. The valve box shall be constructed such that it is three-fourths inch (3/4") lower than the pavement (see detail drawings).

Valve boxes in off-road or unpaved areas shall have a concrete collar and marked for easy locating in the future. Approved markers shall be permanent above grade warning signs marked with wording such as “Warning-Water Valve”. Where markers conflict with the operation of equipment, vehicles, or pedestrian pathways they can be offset to a protected location.

Section 6.05 COUPLINGS:

Couplings shall be equal to the product of Smith-Blair or Dresser with ductile iron couplings being used on all ductile iron and PVC pipe. Couplings shall be of the straight, transition, or reducing style as required by the specific installation. Where the coupling is used to join a ductile iron line to a steel line appropriate transition gaskets will be used. All steel fittings and bolts shall be coated with a non-oxide coating and wrapped with polyethylene.

Section 6.06 FIRE HYDRANTS:

Fire hydrants shall be located as recommended in the State-adopted fire code and as determined by the local fire code official.

Fire hydrants shall be "traffic model" type designed to conform to AWWA Specification C-502 and shall be of either the compression or toggle joint type. Hydrants shall be Mueller "Super Centurion 200", "Centurion A-442" or

Clow “Medallion”.

Hydrant valves shall be a minimum of 6-inch size. Hydrants shall be supplied complete with two 2 1/2-inch hose nozzles and one 4 1/2-inch pumper nozzle. All nozzles shall be provided with National Standard threading. A one cubic yard washed rock sump shall be provided at each hydrant. All hydrants shall be mechanical joint end and shall be connected to the main by means of a mechanical joint by flanged tee and flanged by mechanical joint auxiliary gate valve and box as shown on the Standard Drawings. Each hydrant shall also be supplied with O-ring seals, a National Standard pentagon operating nut which is designed for clockwise rotation closing, and a 6-inch mechanical joint inlet.

Section 6.07 BLOWOFF VALVE:

A blow-off valve is required on the culinary system in cul-de-sac's and in temporary dead-end streets. The installation in cul-de-sacs shall be permanent and shall come off the end of the culinary water line. On temporary dead-ended streets the connection shall be made using a main size by three-inch MJ tee.

1. Whenever a water main line must terminate it should be equipped with a flushing hydrant or blow-off for flushing purposes.
2. No flushing device shall be directly connected to a sewer.

The blow-off valve shall be an Eclipse Model 85 blow-off hydrant.

Section 6.08 AIR/VACUUM RELIEF STATION:

The connection to the main for the air inlet and removal facility shall be by a bronze service clamp, Ford FS202 (Mueller Model DR 2 S) with stainless steel bands. Air inlet and removal facilities shall be placed at high points or uphill end points in the system. Tapping the main through the service clamp will be accomplished with standard tapping equipment before the system is put into service.

Connection to the service clamp shall be by two (2) inch galvanized piping or rigid copper piping. See standard drawings for details.

No air relief/vacuum discharge line shall be directly connected to a sewer.

DIVISION 7

EARTHWORK

Section 7.01 GENERAL:

This section defines the requirements for excavation and backfill for structures, construction requirements of earth embankments and earth fills, and subgrade preparation required by the Standard Drawings and Specifications.

Section 7.02 EXCAVATION FOR STRUCTURES:

Where suitable subgrade soils exist, structures shall be founded on undisturbed original subsoil. All unauthorized excavation below the specified subgrade shall be replaced with concrete, monolithic with that of the slab above or with coarse gravel thoroughly compacted into place.

Subgrade soils for structures not suitable for proper support shall be replaced with firm, dense, thoroughly compacted and consolidated material free from mud and muck. Coarse gravel or crushed stone may be used for subsoil reinforcement if satisfactory results can be obtained thereby. Such material shall be applied in thin layers, each layer being embedded in the subsoil by thorough tamping. All excess soil shall be removed to compensate for the displacement of the gravel or crushed stone and the finished elevation of any subsoil reinforced in this manner shall not be above the specified subgrade elevation.

Section 7.03 GRANULAR FOUNDATION BORROW:

Granular foundation borrow shall be compacted to not less than 95% of maximum dry density as determined by ASTM D-1557.

Section 7.04 BACKFILL AROUND STRUCTURES:

No backfilling around or behind structures shall be initiated until the concrete is fully cured for seven days. Backfill around structures shall be placed to the lines shown on the drawings, or as directed. After completion of foundation footings and walls and other construction below the elevation of the final grades, and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Hand compacted fill, including fill compacted by manually-directed power tampers, shall be placed in layers whose thickness before compaction is not greater than four (4) inches. Material for backfilling shall consist of suitable excavated material or imported sand, gravel, or other suitable material with no rocks whose greatest dimension is larger than two (2) inches.

Fill shall be placed in a manner that will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure. Each layer shall be compacted by hand or machine tampers or by other suitable equipment to a density equal to 95% of maximum dry density as measured by ASTM D1557.

Section 7.05 CONSTRUCTION OF EMBANKMENTS AND FILLS:

Sub-section A. Foundation Preparation:

Foundations for earth fill shall have unsuitable materials, such as weeds, sod, roots larger than 1/4-inch in diameter, vegetation, or other organic material shall be removed by clearing, stripping, and/or grubbing. Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of six inches. The moisture content of the loosened material shall be controlled as specified for the earth fill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earth fill as specified for subsequent layers of earth fill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of 2 inches in depth normal to the slope and shall be at such a moisture content that the earth fill can be compacted against them to effect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose material by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earth fill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Sub-section B. Placement:

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the Public Works Representative/Engineer and any Regulatory Agency having authority over the project. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually-directed power tampers, shall be placed in layers whose thickness before compaction is not greater than four (4) inches. All rock whose greatest dimension is larger than two-inch (2") shall be removed from the material receiving compaction by manually directed power tampers.

Earth fill designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

1. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material.
2. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill, to a depth of not less than 2 inches before the next layer is placed.
3. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of not less than 2 percent shall be maintained to ensure effective drainage, and except as otherwise specified for drain fill zones. If the Drawings or specifications require or the Public Works Representative/Engineer directs that fill be placed at a higher level in one part of the embankment than another is, the top surface of each part shall be maintained as specified above.
4. Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction of inlet and outlet pipes are specifically authorized in the contract.
5. Embankments built at different levels as described in 3 and 4 shall be constructed so that the slope of the bonding surfaces between the embankment in place and embankment to be placed is not steeper than 2 feet horizontal to 1-foot vertical. The bonding surface of the embankment in place shall be stripped of all loose material, scarified, moistened and recompacted when the new fill is placed against it. This is needed to ensure a good bond with the new fill, to obtain the specified moisture content and specified density at the junction of the in-place and new fill.

Sub-section C. Borrow:

When the embankment or fill exceeds the amount of excavation, sufficient additional material shall be obtained from borrow pits provided by the Developer/Contractor. All material proposed to be imported shall be subject to the review and approval of the Public Works Representative/Engineer prior to starting of hauling operations.

The materials used for embankment and fill construction shall be free from sod, grass, roots larger than 1/4-inch diameter, trash, clods, rocks larger than six inches in diameter, and all other material unsuitable for construction of compacted fills. Rotomilled asphalt meeting the large rock requirement may be used as borrow.

Grading of completed embankments and fills shall bring the surfaces to a smooth, uniform condition with

final grades being within 0.1 foot of the design grade.

Section 7.06 COMPACTION OF MATERIALS:

The material shall be deposited in horizontal layers having a thickness of not more than eight-inches (8") prior to being compacted as hereinafter specified. The distribution of materials shall be such that the compacted material will be homogeneous and free from lenses, pockets, or other imperfections.

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range, and the moisture content shall be uniform throughout the layers. Discing, blading or other approved methods prior to compaction of the layer shall obtain uniform moisture distribution. The moisture shall be controlled at a level to permit compaction of the fill as specified, but in no case greater or less than two percent plus or minus of the optimum moisture as determined by AASHTO T-99.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary.

Material that is too wet when deposited on the fill shall either be removed or dried to specified moisture content prior to compaction.

If the top surface of the preceding layer, a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall be scarified and moistened by sprinkling to the required moisture content prior to placement of the next layer of fill.

When the material has been conditioned as here in before specified the backfill or embankment shall be compacted to a minimum of 96% of maximum dry density as determined by AASHTO T-99. Densification of earth fill shall be performed by equipment designated solely for that purpose. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified.

Sub-section A. Under Roadways:

Under roadways and extending one foot beyond the proposed curb-line the fill or embankment material shall be compacted to a minimum of 96% of maximum density specified above.

Sub-section B. Under Sidewalks and Driveways:

Under sidewalks and driveways extending <u>one foot each side</u> of the edge of slab the fill or embankment material shall be compacted to a minimum of 96% of maximum density specified above.

7.07 REMOVAL AND PLACEMENT OF DEFECTIVE FILL:

Fill placement at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced with acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is place shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

DIVISION 8

PORTLAND CEMENT CONCRETE

Section 8.01 GENERAL:

The work shall consist of furnishing, forming, placing, finishing, and curing Portland cement concrete, as required.

Section 8.02 MATERIALS:

Sub-section A. Portland Cement:

Portland cement shall be Type II and shall comply with the Standard Specification for Portland Cement, ASTM C-150.

If air-entraining cement is to be used, the Developer/Contractor shall furnish the manufacturers written statement giving the source, amount and brand name of the air-entraining addition.

Cement shall be stored in such a manner as to be protected from weather, dampness or other destructive agents. Cement that is partially hydrated or otherwise damaged will be rejected.

Sub-section B. Aggregates:

Aggregates shall conform to Tentative Specifications for Concrete Aggregates, ASTM C-33 for the specified sizes. Aggregates that fail to meet any requirement may be accepted only when: (1) the specified alternate conditions of acceptance can be proved prior to the use of the aggregates on the job and within a period of time such that no work under the contract will be delayed by the requirements of such proof; or, (2) the specification for concrete expressly contains a provision of special mix requirements to compensate for the effects of the deficiencies.

The potential reactivity of aggregates with the alkalies in cement shall be evaluated by petrographic examination and, where applicable, the chemical method of test, ASTM Designation C 289, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM Specification C-33, Appendix A1.

Aggregates indicated by any of the above to be potentially reactive shall not be used, except under one of the following conditions:

1. Applicable test results of mortar bar tests, made according to ASTM Method C-227, are available which indicate an expansion of less than 0.10 per cent at six months in mortar bars made with cement containing not less than 0.8 per cent alkalies expressed as sodium oxide; or

2. Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

Aggregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with "low alkali" cement, containing less than 0.60 per cent alkalies expressed as sodium oxide.

Aggregate of each class and size shall be stored and handled by methods that prevent segregation of particle sizes or contamination by intermixing with other materials.

Sub-section C. Water:

Water shall be cleaned and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Sub-section D. Air-Entraining Agent:

Air-entraining agent shall be used in all concrete exposed to the weather. The agent shall conform to ASTM Designation C-175 and C-260, except that the relative durability factor in the freezing and thawing test shall be not less than 95.

Sub-section E.

Steel reinforcement shall be free from rust, oil, grease, paint or other deleterious matter.

Steel bars for concrete reinforcement requiring bends shall be deformed billet-steel bars conforming to ASTM Specification A-615, Grade 40 or Grade 60.

Straight steel bars shall be deformed bars conforming to one of the following specifications:

Deformed Billet-Steel Bars for Concrete Reinforcement (Grade 40 or Grade 60) - ASTM Designation A-615.

Rail-Steel Deformed Bars for Concrete Reinforcement (Grade 50 or Grade 60) - ASTM Designation A-616.

Axle-Steel Deformed Bars for Concrete Reinforcement (Grade 40 or Grade 60) - ASTM Designation A-617.

Fabricated Steel bar mats shall conform to the requirements of ASTM Specification A-184.

Welded steel wire fabric reinforcement shall conform to the requirements of ASTM Specification A-185.

Welded deformed steel wire fabric for concrete reinforcement shall conform to the requirements of ASTM Specification A-497.

Cold-drawn steel wire reinforcement shall conform to the requirements of ASTM Specification A-82.

Deformed steel wire for concrete reinforcement shall conform to the requirements of ASTM Specification A-496.

Gages, spacing and arrangement of wires in welded steel wire fabric shall be as defined in ACI Standard 315 of the American Concrete Institute for the specified style designations.

Steel reinforcement stored at the site of the work shall be stored above the ground surface on platforms, skids or other supports and shall be protected from mechanical injury and corrosion.

Sub-section F. Water-Reducing and Set-Retarding Admixtures:

Water-reducing and set-retarding admixtures shall conform to the requirements of ASTM Specification C-494, except that resistance to freezing and thawing shall be determined in all cases, and the minimum relative durability factor shall be 95.

Admixtures shall be Type A, Water-Reducing or Type D, Water-Reducing and Retarding, as defined in ASTM Specification C-494.

When added, in the manner and amount recommended by the manufacturer, to the concrete used on the job, with no change in the cement content or proportions of the aggregates, admixtures shall have the following effects:

Type A or Type D: The water content at the required slump shall be at least 5 per cent less with the admixture than without. The air content shall remain within the range specified, but shall not exceed 8 per-

cent in any case.

Type D: The time of initial setting, determined as prescribed in ASTM C-494, shall be from 1 to 3 hours longer with the admixture than without.

Sub-section G. Curing Compound:

Curing compound for concrete shall meet the requirements of ASTM Specification C-309.

Unless otherwise specified, the compound shall be Type 2.

All curing compound shall be delivered to the site of the work in the original container bearing the name of the manufacturer and the brand name. The compound shall be stored in a manner to prevent damage to the containers and to protect water-emulsion types from freezing.

Section 8.03 CLASS OF CONCRETE:

For the purpose of practical identification, concrete has been divided into four classes: Class AA(AE), A(AE), B(AE) and C(AE). The specific use for each Class is identified in the Division in which the concrete is used. The symbol (AE) designates air-entrainment. Basic requirements for each class are as follows:

Concrete	Maximum Net Class of Water Content (gallons/bag)	Minimum Cement Content (bags/cu.yd.)	Minimum 28-day Comp. Strength (psi)
AA(AE)	5	6 ½	4,000
A(AE)	6	6	3,500
B(AE)	7	5	2,500
C(AE)	8	4	2,000

Section 8.04 COMPOSITION OF CONCRETE:

Sub-section A. Aggregates:

Aggregates maximum size shall be not larger than one-fifth (1/5) of the narrowest dimension between forms within which the concrete is to be cast, nor larger than three-fourths (3/4) of the minimum clear spacing between reinforcing bars or between reinforcing bars and forms. For un-reinforced concrete slabs, the maximum size of aggregates shall not be larger than one-fourth (1/4) the slab thickness.

Sub-section B. Water:

Water shall be added to the mix to produce concrete with the minimum practicable slump. The slump of mechanically vibrated concrete shall not exceed four-inch (4"). No concrete shall be placed with a slump in excess of five-inch (5").

Sub-section C. Air-Content:
Air-Content for air-entrained concrete shall comply with the following:

Course Aggregate Size (in.)	Air Content (percent)
1 ½ to 2 ½	5 ± 1
3/4 or 1	6 ± 1
3/8 or ½	7 ± 1

The air-entraining agent shall be added as liquid to the mixing water by means of mechanical equipment capable of accurate measurement and control.

Sub-section D. Water Reducing:

Water reducing, set retarding admixtures shall not be used except with previous approval from the Public Works Representative/Engineer and shall in such a case, conform to the standards of materials set forth in the specification.

Section 8.05 DESIGN OF THE CONCRETE MIX:

The proportions of the aggregates shall be such as to produce a concrete mixture that will work readily into the corners and angles of the forms and around reinforcement when consolidated, but will not segregate or exclude free water during consolidation.

Prior to placement of concrete, the Developer/Contractor shall furnish the Public Works Representative/Engineer, for approval, a statement of the materials and mix proportions (including admixtures, if any) it intends to use. The statement shall include evidence satisfactory to the Public Works Representative/Engineer that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the "job mix." After the job mix has been reviewed for conformance to specification by the Public Works Representative/Engineer, neither the source, character, grading of the aggregates, the type and brand of cement, nor admixture shall be changed without prior notice to the Public Works Representative/Engineer. If such changes are necessary, no concrete containing such new or altered materials shall be placed until the Public Works Representative/Engineer has approved a revised job mix.

Section 8.06 OBSERVATION AND TESTING:

The Public Works Representative/Engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the Public Works Representative/Engineer to observe the materials, equipment and processes and to obtain samples of the concrete. All tests and observations will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

Section 8.07 HANDLING AND MEASUREMENT OF MATERIALS:

Materials shall be stockpiled and batched by methods that will prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix.

Except as otherwise provided in Division 8, cement and aggregates shall be measures as follows:

Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

Water shall be measured by weight, to accuracy within one per cent of the total quantity of water required for the batch.

Admixtures shall be measured within a limit of accuracy of three (3) percent.

Section 8.08 MIXERS AND MIXING:

Concrete shall be uniform and thoroughly mixed when delivered to the work. Variations in slump of more than one (1) inch within a batch will be considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other means. For stationary mixers, the mixing time after all cement and aggregates are in the mixer

drum shall be not less than 1½ minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 or more than 100.

Unless otherwise specified, volumetric batching and continuous mixing at the construction site will be permitted if approved by Public Works Representative/Engineer. The batching and mixing equipment shall conform to the requirements of ASTM Specification C-685 and shall be demonstrated prior to placement of concrete, by tests with the job mix, to produce concrete meeting the specified proportioning and uniformity requirements. Concrete made by this method shall be produced, inspected, and certified in conformance with Sections 6, 7, 8, 13, and 14 of ASTM Specification C-685.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

Section 8.09 FORMS:

Forms shall be of wood, plywood, steel or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags or other irregularities. Forms shall be coated with a non-staining form oil before being set into place.

Metal ties or anchors within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete.

All edges that will be exposed to view when the structure is completed shall be chamfered by placing molding in the forms, unless finishing with molding tools.

Section 8.10 PREPARATION OF FORMS AND SUBGRADE:

Prior to placement of concrete the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting or wire brush scrubbing, as necessary, and shall be wetted immediately prior to placement of concrete. Earth surfaces shall be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill or frozen subgrade will not be permitted.

Unless otherwise specified, when concrete is to be placed over drain fill, the contact surface of the drain fill shall be covered with a layer of asphalt-impregnated building paper or polyvinyl sheeting prior to placement of the concrete. Forms for weepholes shall extend through this layer into the drain fill.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous materials.

Section 8.11 CONVEYING:

Concrete shall be delivered to the site and discharged into the forms within 1 ½ hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. The Public Works Representative/Engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar.

Concrete shall not be dropped more than five feet vertically unless suitable equipment is used to prevent segregation.

Section 8.12 PLACING:

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved. No concrete shall be placed except in the presence of the Public Works Representative/Engineer. The Developer/Contractor shall give 48-hour notice to the Public Works Representative/Engineer each time it intends to place concrete. Such notice will give the Public Works Representative/Engineer adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with the specifications before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcements and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Unless otherwise specified, slab concrete shall be placed to design thickness in one continuous layer. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Hoppers and chutes, pipes or "elephant trunks" shall be used as necessary to prevent splashing of mortar on the forms and reinforcing steel above the layers being placed.

Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tramping or vibration as necessary to insure smooth surfaces and dense concrete. Each layer shall be consolidated to insure monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the Developer/Contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified.

If placing is discontinued when a incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

Section 8.13 CONSTRUCTION JOINTS:

Construction joints shall be made at the locations shown on the Drawings. If construction joints are needed which are not shown on the Drawings, they shall be placed in locations approved by the Public Works Representative/Engineer.

Where a featheredge would be produced at a construction joint, as in the top surface of a sloping wall, an inset form shall be used so that the resulting edge thickness on either side of the joint is not less than six-inches (6").

In walls and columns, as each lift is completed, the top surfaces shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardening concrete has cured at least 12 hours.

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the Public Works Representative/Engineer. The surfaces shall be kept moist for at least one hour prior to placement of the new concrete.

Section 8.14 EXPANSION AND CONTRACTION JOINTS:

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

Open joints, when specified, shall be constructed by the insertion and subsequent removal of a wooden strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of open joints shall be finished with an edging tool prior to removal of the joint strips.

Section 8.15 WATERSTOP:

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be soldered, brazed or welded. Joints in rubber or plastic waterstops shall be cemented, welded or vulcanized as recommended by the manufacturer.

Section 8.16 REMOVAL OF FORMS:

Forms shall not be removed without the approval of the Public Works Representative/Engineer. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

Section 8.17 FINISHING FORMED SURFACES:

Immediately after the removal of the forms:

A. All fins and irregular projections shall be removed from exposed surfaces.

B. On all surfaces, the holes produced by the removal of form ties, cone-bolts, and she-bolts shall be cleaned, wetted and filled with a dry-pack mortar consisting of one part Portland cement, three parts sand that will pass a No. 16 sieve, and water just sufficient to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

Section 8.18 FINISHING UNFORMED SURFACES:

All exposed surfaces on the concrete shall be accurately screeded to grade and then float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft will not be permitted.

The addition of dry cement or water to the surface of the screeded concrete to expedite finishing will not be allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

Section 8.19 CURING AND PROTECTION:

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Sprinkling, flooding or fog spraying shall maintain moisture or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Wood forms (except plywood) left in place during the curing period shall be kept wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

As soon as the concrete has hardened sufficiently to prevent damage, the finished surface shall be protected for curing one of the following ways:

A. Ponding of water on the surface or continuous sprinkling.
B. Application of absorptive mats such as three-inches (3") of cured hay, clean straw or fabric kept continuously wet.
C. Application of two-inches (2") of moist earth or sand uniformly distributed on the surface and kept saturated by spraying with water.
D. Application of light colored waterproof plastic materials, conforming to "Specifications for Waterproof Sheet Materials for Curing Concrete" ASTM C-171, placed and maintained in contact with the surface of the concrete.
E. Application of a curing compound, conforming to "Specifications for Liquid Membrane - Forming Compounds for Curing Concrete" ASTM C-309. The compound shall be light in color and shall be applied in accordance with the manufacturers recommendations immediately after any water sheen, which may

develop after finishing, has disappeared from the concrete surface.

Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be re-sprayed at the rate of application specified above.

Section 8.20 REMOVAL OR REPAIR:

When concrete is honey combed, damaged or otherwise defective, the Developer/Contractor shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective concrete. Prior to starting repair work the Developer/Contractor shall obtain the Public Works Representative/Engineer's approval of its plan for effecting the repair. The Developer/Contractor shall perform all repair work in the presence of the Public Works Representative/Engineer.

Section 8.21 CONCRETING IN COLD WEATHER:

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40 degrees unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds will not be allowed.

Section 8.22 CONCRETING IN HOT WEATHER:

The Developer/Contractor shall apply effective means to maintain the temperature of the concrete below 90 degrees during mixing, conveying and placing.

DIVISION 9

REINFORCING STEEL

Section 9.01 GENERAL:

Furnish and place reinforcing steel and reinforcing steel (epoxy-coated). Use deformed billet-steel bars as specified. All reinforcing bars shall be Grade 40 or Grade 60 as required. Wire Fabric shall conform to ASTM A185-70.

Before supply of steel, the Developer/Contractor shall provide all order lists and bending diagrams for approval of the Public Works Representative/Engineer. The approval of such lists and diagrams shall in no way relieve the Developer/Contractor of responsibility for the correctness of reinforcing supplied and all expenses incidental to revision of furnished reinforcing steel shall be carried by the Developer/Contractor.

Section 9.02 FABRICATION AND PLACING REINFORCEMENT:

Sub-section A. Fabrication:

Reinforcement shall be cold bent to the shapes shown in accordance with ACI 1997 Standard Code (ACI 318-97) Chapter 7 Section 7.1.

Sub-section B. Clearances:

All bars shall be of the size specified and shall be placed in the positions shown on the Drawings in such a manner as to be firmly held during the placing of the concrete. Where not otherwise indicated, minimum clearance and cover as required by the ACI Code, Section 7.7 shall be maintained.

Reinforced Clearances Cast in Place Concrete (Non Prestressed)	Minimum Cover (Inches)
Concrete cast against and permanently exposed to earth	3
Concrete exposed to earth or weather:	
No. 6 through No. 18 Bar	2
No. 5 Bar, W31 or D31 wire, and smaller	1 ½
Concrete not exposed to weather or in contact with ground:	
Slabs, Walls, and Joists-	
No. 14 and No. 18 Bar	1 ½
No. 11 Bar and smaller	3/4
Beams, Columns-	
Primary reinforcements, ties, stirrups, spirals	1 ½
Shells, Folded Plate Members	
No. 6 Bar and larger	3/4
No. 5 Bar, W31 or D31 wire, and smaller	½

Reinforced Clearances Precast Concrete (Manufactured Under Plant Controlled Conditions)	Minimum Cover (Inches)
Concrete Exposed to earth or weather-	
Wall Panels:	
No. 14 and No. 18 Bars	1 ½
No. 11 Bar and smaller	3/4
Other Members:	
No. 14 and No. 18 bars	
No. 6 through No. 11 Bars	1 ½
No. 5 Bar, W31 or D31 wire, and smaller	1 1/4
Concrete not exposed to weather or in contact with ground:-	
Slabs, Walls, and Joists:	
No. 4 and No. 18 Bars	1 1/4
No. 11 Bar and smaller	5/8
Beams, Columns:	
Primary reinforcement	1 ½
Ties, stirrups, spirals	3/8
Shells, folded plate members:	
No. 6 Bar and larger	5/8
No. 5 Bar, W31 or D31, and smaller	3/8

Sub-section C. Support:

Bars shall be tied at all intersections except where the spacing is less than twelve inches (12") where alternate intersections shall be tied. Distance from supports shall be by means of ties, hangers, or other approved supports. Metal chairs of approved design shall be used to hold reinforcement from contact with the forms. Metal chairs that are in contact with the exterior surface of the concrete shall be galvanized. Layers of bars or when placing concrete directly on a prepared subgrade reinforcing shall be separated by precast mortar blocks or by other equally suitable devices. The use of stones, pieces of broken brick, metal pipe, or wooden blocks shall not be permitted. Reinforcement in any member shall be placed and then inspected and approved by the Public Works Representative/Engineer before the placement of concrete begins. Concrete placed in violation of this provision may be rejected in which case removal will be required.

If the fabric reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.

Sub-section D. Splicing:

All splices shall be staggered so that splices in adjacent bars shall be not less than four feet (4') apart, and shall conform to ACI Code Section 12.15.

Section 9.03 EPOXY COATING:

Sub-section A. Prequalify all Coatings:

Ensure that epoxy coating applicator has Concrete Reinforcing Steel Institute (CRSI) fusion bonded epoxy coating applicator plant certification. Furnish a copy of the Prequalification Test Report to the Public Works Representative/Engineer. Provide an 8-ounce sample of the coating material from each batch.

Sub-section B. Coat Bars as Specified:

The following requirements shall be followed:

Maintain the coating thickness between 8 and 12 mils.

Coat bars after bending, unless the fabricator can show that satisfactory results can be obtained by coating before bending

Reject any bent bars with visible cracks or damage in the coating.

Sub-section C: Handling:

Do not damage the bars or the coating during handling and storage.

Use systems with padded contact areas when handling coated bars.

Pad all bundling bands.

Lift all bundles with strong back, multiple supports, or a platform bridge.

Do not drop or drag bars.

Repair damaged bars or coating at no additional cost to the Owner.

Use patching material per manufacturer's recommendation to repair damaged coating.

Have the coated bars inspected for damage to the coating after the bars are in place and immediately before concrete placement.

Repair all visible defects using the specified patching or repair material.

Section 9.04 FIELD CUTTING:

Sub-section A. Cutting:

Saw or shear epoxy-coated bars that are specified to be cut in the field. Do not flame cut.

Sub-section B. Repairing:

Repair the sawed or sheared end using the specified patching or repair material.

DIVISION 10

RESTORATION OF SURFACE IMPROVEMENTS

Section 10.01 GENERAL:

The Developer/Contractor shall be responsible for the protection and the restoration or replacement of any improvements existing on public or private property at the start of work or placed there during the progress of the work.

Existing improvements shall include but not be limited to permanent surfacing, curbs, gutters, sidewalks, planted areas, ditches, driveways, culverts, fences, and walls. All improvements shall be reconstructed to equal or better, in all respects, than the existing improvements removed.

Section 10.02 FIELD VERIFICATION OF IMPROVEMENTS:

In submitting a bid, the Developer/Contractor will be deemed to have carefully examined the site of the work and to have acquainted itself with all conditions relating to the protection and restoration of existing improvements. The Public Works Representative/Engineer does not guarantee that all improvements are shown on the Drawings, and it shall be the Developer/Contractor's responsibility to provide in its bid for the protection and restoration of all existing improvements whether or not each is provided for specifically on the Drawings and/or Bid Form.

Section 10.03 REMOVAL OF PAVEMENT, SIDEWALKS, CURBS, ETC.:

The pavement, sidewalk, curb and gutter, driveway, etc. shall be cut vertically along the lines forming the trench, or nearest full joint, in such a manner as to not cause damage to adjoining pavement, sidewalk, curb and gutter, driveway, etc. An undercut level at the rate of one inch (1") per foot of thickness or an underlap joint will be provided at the proposed junction between old and new surfaces. The portion to be removed shall be broken up in a manner that will not cause damage to the pavement or concrete outside the limits of the trench; however, any pavement damaged by operations outside the limits of the trench shall be replaced at the Developer/Contractor's expense. Broken paving materials shall be removed immediately from the site of the work.

Section 10.04 MATERIALS:

Materials used for repair or replacement of surface improvements shall be equal to or better than the material removed

Sub-section A. Untreated Base Course:

Untreated base course shall comply with the requirements of Division 11, Section 11.08, Base Course. The Public Works Representative/Engineer shall take samples of the untreated base course on a random basis. All materials not meeting the tolerance requirements shall be removed from the project and replaced with specification material.

Sub-section B. Bituminous Surface Course.

The bituminous surface shall be hot-rolled plant mix in accordance with Division 11, Section 11.09, Bituminous Asphalt Cement Pavement.

Sub-section C. Concrete:

Concrete shall comply with Division 8 of these Standard Specifications. Concrete shall be Class AA(AE).

Section 10.05 RESTORING BITUMINOUS, CONCRETE, OR ASPHALT STREET SURFACES:

Where trenches are in or cross bituminous or concrete surfaced roads, traffic lanes, driveways, parking areas, etc., the bituminous or concrete surface shall be cut, restored as quickly as there is sufficient quantity to make it practical, weather permitting, and maintained as follows:

Sub-section A. Before Excavation.

All existing asphalt or concrete surfaces shall be saw cut or roto-milled to a square edge before excavation.

Sub-section B. Temporary Graded Surface.

Until resurfacing can be done in paved areas a temporary gravel surface shall be placed deep enough to provide a minimum of eight inches (8") below the bottom of the bituminous surface and shall be brought flush with the paved surface.

The untreated base shall be placed in the trench at the time it is backfilled. Excess material shall be removed from the premises immediately. The Developer/Contractor will maintain the temporary gravel surface until the asphalt is placed.

Sub-section C. Preparation for Paving.

The area over trenches to be resurfaced shall be graded and rolled with a roller weighing not less than 12 tons, or with the rear wheels of a five-yard truck loaded to capacity, until the subgrade is firm and unyielding. Mud or other soft or spongy material shall be removed and the void filled with gravel and rolled and tamped thoroughly in layers not exceeding six inches in thickness. The edges of trenches, which are broken down during the making of subgrade, shall be removed and trimmed neatly before resurfacing.

Before any permanent resurfacing is placed, the Developer/Contractor shall trim the existing paving to clean straight lines as nearly parallel to the centerline of the trench as practicable. Said straight lines shall be thirty feet minimum lengths and no deviations from such lines shall be made except as specifically permitted by the Public Works Representative/Engineer.

Sub-section D. T-Patch

Existing bituminous paving shall be saw cut or roto-milled back a minimum of twelve (12) inches beyond the limits of any excavation or cave-in along the trench so that the edges of the new paving will rest on at least twelve (12) inches of undisturbed soil. If a cut is made in an asphalt surface three (3) years old or less, the roadway will be saw cut, removed or replaced for a distance of two feet (2) from the edge of each cut, or to the next designated lane divider, whichever is greater. New asphalt must then be placed for the length and width of the area saw cut, removed or replaced.

Sub-section E. Pavement Degradation

When construction occurs on an existing paved road every effort shall be made to preserve the condition of the pavement surface. This includes appearance of the paved surface as well as structural integrity. Scarring, cracking, or rutting caused by equipment tracks, gouging caused by bucket scraping (especially those with teeth), and damage from stabilization jacks, for example, shall be carefully avoided. If the city inspector feels that adequate precaution was not used then the contractor shall be responsible to replace the pavement surface or restore it by crack filling, overlay, or seal coat.

Sub-section F. Pot-holing and Sub-surface Investigation

Utilities that are located by pot-holing shall be properly backfilled and compacted so that the pavement patch does not settle. Mechanical equipment is necessary to achieve proper compaction of lose fill material. When the horizontal dimensions of a pot-hole are too small for compaction equipment the pot-hole can be backfilled with flowable fill.

Existing bituminous paving around pot-holes shall be saw-cut back a minimum of six inches beyond the limits of any excavation or cave-in so that the edges of the new paving will rest on at least six-inches (6") of undisturbed soil in a T-patch style.

Permanent asphalt patch or had mix can be used as an alternative to the T-patch for pot-holes less than twelve inches (12") in diameter. "Aqua Patch" or City approved alternates may be used for the permanent patch material.

Sub-section G. Bituminous Surface.

The bituminous surface over trenches shall be restored by standard paving practices to a minimum thickness of three inches (3"). Gradation of aggregate shall conform to the 3/4-inch gradation limits as defined in the Standard Specifications for Road and Bridge Construction.

Pavement restoration shall include priming of pavement edges with Type MC-70 bituminous material and placing rolled plant hot mix bituminous material to the level of the adjacent pavement surfaces.

Section 10.06 GRAVEL SURFACE:

Where trenches are excavated through gravel-surfaced areas such as roads and shoulders, parking areas, unpaved driveways, etc., the gravel surface shall be restored and maintained as follows:

Sub-section A:

The gravel shall be placed deep enough to provide a minimum of six inches of material.

Sub-section B:
The gravel shall be placed in the trench at the time it is backfilled. The surface shall be maintained by blading, sprinkling, rolling, adding gravel, etc., to maintain a safe, uniform surface. Excess material shall be removed from the premises immediately.

Sub-section C:

Material for use on gravel surfaces shall be obtained from sound, tough, durable gravel or rock meeting the following requirements for gradation:

Passing 1-inch sieve	100%
Passing 1/2-inch sieve	79-91%
Passing No. 4 sieve	49-61%
Passing No. 16 sieve	27-35%
Passing No. 200 sieve	7-11%

Section 10.07 MISCELLANEOUS IMPROVEMENTS:

It shall be the Developer/Contractor's responsibility to restore to their original condition all irrigation canals, levees, culverts, gates, fences, drainage ditches, and all such improvements which are cut or disturbed during construction. Topsoil in farming areas or along road edges shall be stored separate from subsoil during pipe trench excavation. Topsoil shall be replaced during backfill operations as nearly as possible to its original condition, thereby assuring suitable soil for reseeding.

Section 10.08 RESTORATION OF SURFACES:

Unless otherwise directed, all street surfacing, curbs, gutters, sidewalks, driveways, or other hard surface that must be removed in the performance of the work shall be restored in kind by the Developer/Contractor in accordance with the Specifications contained herein. Deviation of more than one-fourth inch (1/4") between old and new work or within new construction shall be corrected. Such measurement shall be made from a ten-foot (10') minimum length straight edge. Adjoining surfaces between old and new must be flush.

Section 10.09 CLEANUP:

At the completion of each area of work all equipment, barricades, and similar items shall be removed from the area. All excess material will be removed. Adjacent borrow pits and road shoulders used for storage of excavating materials will be smoothed and returned to its original contour.

Section 10.10 PAVEMENT MARKINGS:

The Developer/Contractor shall be responsible for restoration of pavement markings on all City and/or County roadways. Restoration of pavement markings shall conform to the applicable local and state specifications.

On roadways under UDOT jurisdiction temporary pavement markings shall be provided for any removed or obliterated markings. The temporary markings shall conform to UDOT standards and specifications. Permanent pavement markings will be replaced by UDOT.

DIVISION 11

ROADWAY CONSTRUCTION

Section 11.01 GENERAL:

This Division covers roadway construction. Work shall consist of pulverizing existing asphalt, earthwork, roadway excavation, 6-inch curb walls, 24-inch curb and gutter, 6-foot monolithic curb gutter and sidewalk, and drive approaches. It will also include imported granular borrow, curb face inlet boxes including connection to existing storm drain, subgrade preparation, untreated base course, asphalt surface and raising manholes and valve boxes to grade.

Section 11.02 PULVERIZING:

The Developer/Contractor shall pulverize the existing asphalt and roadbase to a depth of 6 to 8 inches. The limits of the area to be pulverized will be as shown on the improvement drawings. This material will be used for granular borrow or untreated roadbase. The Developer/Contractor has the option of methods he feels will result in the least work and best product in breaking up the existing asphalt, provided that the maximum size for a single piece of asphalt does not exceed 3-inches. Placing, grading and compacting of this material shall comply with the requirements of borrow or roadbase. The existing asphalt edges where the pulverizing terminates shall be saw cut following or prior to being pulverized.

Section 11.03 EARTHWORK:

The earthwork needed for roadway construction shall meet the requirements of Division 7, Earthwork.

Section 11.04 ROADWAY EXCAVATION:

Following completion of the curb and gutter improvements the roadway between lip of gutters shall be excavated to the lines and grades shown on the improvements drawings. Materials not suitable for use as granular borrow or roadbase shall be removed from the road section. Excavation may be done on one-half of the road at a time.

Section 11.05 SUBGRADE PREPARATION:

This work shall consist of the shaping and compacting of the subgrade in accordance with these specifications and in conformity with the lines, grades, and typical cross sections shown on the Drawings or as established by the Public Works Representative/Engineer.

Following roadway excavation the subgrade shall be proof rolled by running moderate-weight rubber tire-mounted construction equipment uniformly over the surface at least twice. During the rolling operation moisture content of the subgrade layer shall be maintained at not less than 97% or more than 105% of the optimum moisture content. Rolling shall be continued until the entire roadbed is compacted to the specified density to a minimum depth of 8 inches.

Section 11.06 GRANULAR BORROW:

Granular borrow (foundation or roadway) material shall consist of well graded granular bank run natural aggregate material with a maximum size of 3 inches and less than 15% passing a No. 200 sieve. The material shall meet the following gradation:

Sieve Size	Percent Passing
No. 10	50 max.
No. 40	30 max.
No. 200	15 max.

The granular borrow material shall be compacted to not less than 96% maximum dry density as determined by AASHTO T-99. Granular foundation borrow shall be compacted to not less than 95% of maximum dry density as determined by ASTM D-1557. Surfaces shall be true to the established grade with thickness being not less than 1/4-inch from the required layer thickness and with the surface elevation varying not more than 3/8-inch in ten feet from the true profile and cross section.

Section 11.07 GRANULAR BACKFILL BORROW:

Granular backfill borrow shall be free draining natural aggregate material meeting the following gradation:

Sieve Size	Percent Passing
1 - ½ inch	100
1 inch	95-100
½ inch	25-60
No. 4	0-10

Section 11.08 BASE COURSE:

Base for all streets shall consist of select material, either natural aggregate or crushed slag, and shall be graded as follows:

Sieve Size	Percent Passing
3/4 inch	100
3/8 inch	78-92
No. 4 sieve	55-67
No. 16 sieve	28-38
No. 200 sieve	7-11

Slag 4133 (3/4 inch minus) and slag 4120 (3/4 inch minus) can be used.

The material shall be deposited and spread in a uniform layer, without segregation of size, with such depth that when compacted the layer will have the required thickness as stated below.
Each layer shall be compacted for the full width and depth. Alternate blading and rolling will be required to provide a smooth, even and uniformly compacted course true to cross section and grade. Places inaccessible to rolling shall be compacted with mechanically operated hand tampers.

The gravel base shall be compacted to not less than 96% maximum dry density as determined by AASHTO T-180. Surfaces shall be true to the established grade with thickness being not less than 1/4-inch from the required layer thickness and with the surface elevation varying not more than 3/8-inch in ten feet from the true profile and cross section.

Section 11.09 BITUMINOUS ASPHALT CEMENT PAVEMENT:

Standards Adoption. The most current edition of the “Manual of Standard Specifications - APWA SECTION 32 12 05” published by the Utah LTAP Center, including revisions, are hereby adopted by Morgan City and by this reference are made part of these public works standards to the same extent and effect as though such were fully set

forth herein subject to the additions, deletions and changes provided in this Chapter.

Revise Section 2.3 as follows:

2.3 ADDITIVES

A. Mineral Filler: None
B. Recycle Agent: None
C. Anti-strip Agent: 1% Lime Slurry
D. RAP or ROSP (By weight or binder, whichever is lesser): Allowed up to 15%

2.4 MIX DESIGN

Replace paragraph A with the following:

A. Project Specific Requirements:
   a. Road Category: Class II
   b. Mix Designator (Compaction Effort): 50 Blow
   c. Binder Grade: PG 58-28
   d. Master Grading Band: DM-1/2”

TACK COAT
Standards Adoption. The most current edition of the “Manual of Standard Specifications - APWA SECTION 32 12 13.13” published by the Utah LTAP Center, including revisions, are hereby adopted by Morgan City and by this reference are made part of these public works standards to the same extent and effect as though such were fully set forth herein subject to the additions, deletions and changes provided in this Chapter.

PLANT-MIX BITUMINOUS PAVING
Standards Adoption. The most current edition of the “Manual of Standard Specifications - APWA SECTION 32 12 16.13” published by the Utah LTAP Center, including revisions, are hereby adopted by Morgan City and by this reference are made part of these public works standards to the same extent and effect as though such were fully set forth herein subject to the additions, deletions and changes provided in this Chapter.

Section 11.10 ADJUSTING MANHOLES AND VALVE BOXES TO FINAL GRADE:

This section covers the requirements for adjusting manholes and valves to final grade. The adjustment shall be made with cast-iron ring inserts concrete grade rings or cast-in-place concrete collars. Cast-in-place concrete collars shall be constructed after the asphalt surface has been placed.

When concrete rings are used the concrete shall conform to the requirements of Division 8. Concrete shall be Class AA(AE). The concrete mix shall be one part cement to two parts sand or Kent Seal.

Manhole rings shall be set to the grade and slope of the road – shim and grout ring into place.

Manholes, valves *and monuments* placed in asphalt surfacing shall be set in a concrete collar. The collar shall be at least *eleven inches (11")* thick and extend at least twelve to eighteen inches (12" to 18") from the cast iron ring or valve box. The concrete collar shall be constructed such that at the interface with the asphalt, the collar shall be one-half inch (½") lower than the pavement. The cast iron ring or valve box shall be constructed such that it is three-fourths inch (3/4") lower than the pavement. *All collars shall be installed within fourteen days (14) of asphalt placement.*

Where manholes are to be raised this is be accomplished by removing the cover and frame and raising the manhole to proper elevation with concrete.

Rings and covers shall be protected during backfilling and compaction of the soil and during the placing or replacing of road surfaces. Any ring or cover loosened from the manhole section shall be resent in cement mortar and any ring or cover damaged or broken shall be replaced by the Developer/Developer/Contractor at its expense.

Section 11.11 SLURRY SEAL COAT:

Slurry Seal shall consist of a properly proportioned mixture of fine graded aggregate, mineral filler, emulsified asphalt and water mixed and evenly spread as a surface treatment. The cured slurry shall have a homogeneous appearance, fill all cracks, adhere firmly to the surface and have skid resistant texture.

A. The emulsified asphalt shall meet the current specifications of the American Society of Testing and Materials (ASTM) for cationic emulsified asphalt grade CSS-1hr (ASTM D 2397), grade SS-1hr for anionic emulsified asphalt (ASTM D 977) or quick setting asphalt emulsion (QSH) or (CQS-1hr).

B. Aggregate: The mineral aggregate shall consist of natural or manufactured sand, slag, crushed fines or a combination thereof. The aggregate shall be clean and free from other materials. The aggregate blend shall have a sand equivalent of not less than forty-five (45). The mineral aggregate shall conform to the quality requirements of ASTM D 1073.

C. Mineral Filler: Mineral filler shall be portland cement, hydrated lime or aluminum sulfate conforming to ASTM D 242.

D. The combined aggregate and mineral filler shall conform to the following gradation:

AMOUNT PASSING SIEVE SIZE SIEVE SIZE	PERCENT PASSING BY WEIGHT TYPE III
No. 4	100
No. 8	85-100
No. 16	10-25
No. 50	0-5
No. 200	0-2

E. The aggregate spread shall be an average of eighteen (18) pounds per square yard and not less than fifteen (15) pounds shall receive a second application at the contractors expense.

F. Water: All water used with the slurry mixture shall be potable and free from harmful soluble slats.

G. Selection of materials and rate or percentage of each in the slurry mix shall be in accordance with the following:

The contractor shall provide the Engineer with test results from an independent laboratory of materials he intends to use. The tests results shall conform to the requirements of ASTM D 3910-80a and shall be as follows:

1. Consistency Test 4.4.4
2. Set Time 4.4.5
3. Cure Time 4.4.6
4. Wet Track Abrasion Test 4.4.7

The contractor shall include the cost of the above tests in the unit bid price for Asphalt for Slurry Seal Coat.

H. Equipment. The equipment shall be designed specifically for the blending, mixture and placing of "Slurry Seal" similar and/or equal to the #804 Young Continuous Mix Slurry Machine. The slurry machine shall have been calibrated in advance to ensure proper proportioning of the materials, and all equipment used in the performance of this work shall be maintained in satisfactory working order at all times.

Preparation of Surfaces: Immediately prior to applying the slurry, unsatisfactory areas shall be repaired and the surface shall be cleaned of all oil spots, loose paint, silt spots, vegetation, and other loose and objectionable material. Any standard cleaning method may be used, except that water flushing will not be permitted in areas where considerable cracks are present in the pavement surface. Areas that have been subject to fuel or oil spillage shall be wire-brushed to remove any dirt accumulations. The area shall then be primed with shellac or a synthetic resin to prevent the sealcoat from debonding. The authorized representative of the owner shall give final approval that the

surface has been prepared properly.

Application: The surface shall be pre-wetted by fogging ahead of the slurry box. Water shall be applied at a rate of 0.02 to 0.05 gals/yd². No free water shall be on the surface of the pavement in front of the slurry box. The slurry mixture shall be of the desired consistency upon deposit on the surface and no additional elements shall be added. A sufficient amount of slurry shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading of the spreader shall be avoided. No lumping, balling or unmixed aggregate shall be permitted. No segregation of the emulsion and aggregate fines from the coarse shall be permitted. No excessive breaking of emulsion shall be allowed in the spreader box. No streaks, such as those caused by oversized aggregate will be left in the finished pavement.

Joints: Build up on longitudinal and traverse joints shall not be permitted. Slurry seal placed adjacent to concrete pavements or concrete curb and gutter shall be placed with a straight longitudinal edge and shall not overlap the concrete by more than two (2") inches. All edges shall be straight and neat in appearance.

Hand Work: Approved squeegees shall be used to spread slurry in non-accessible areas to slurry mixer. Care should be exercised not to leave an unsightly appearance from handwork.

Curing: Treated areas shall be allowed to cure until such time as the Engineer permits opening to traffic.

Weather Limitations: No slurry shall be applied, a) when there is any danger that the unfinished product will freeze before it cures completely; b) when the pavement or air temperature is 55°F (13°C) or below and falling, but may be applied when both air and pavement temperature are 45°F (7°C) or above and rising; or c) in the period following a rain while puddles of water remain on the surface to be coated. Slurries that cure by evaporation should not be laid during periods of abnormally high humidity, or when rain may fall within a few hours. Slurries that cure by chemical ejection of water may be laid without regard to existing humidity, even during periods of light rainfall.

Traffic Control: Suitable methods such as barricades, flagmen, pilot cars, etc., shall be used to protect the uncured slurry surface from all types of traffic. Any damage to the uncured slurry will be the responsibility of the contractor. Unless otherwise approved, all traffic control devices are to remain in place at least 24 hours.

11.12 CHIP & SEAL COAT

11.12.1 CHIP & SEAL COAT: Following installation of surface course, all completed asphalt areas shall receive a chip & seal coat or slurry seal coat, as specified by the public works director, preferably a minimum of 12 months after bituminous paving. Emulsion shall be CRS-2P, LMCRS-2, PASS CR, or other approved equal as directed. Cover material shall consist of clean, hard, rough, durable, and sound fragments of broken stone, crushed gravel, lightweight aggregate or crushed slag conforming to the following requirements

A. The dry mineral aggregate shall be uniformly graded to the gradation limits specified below, when tested in accordance with AASHTO Designation T-27.

Standard Gravel Aggregate / Slag			Lightweight Aggregate	
Sieve Size	UDOT Type A	UDOT Type C	Type A	Type C
1/2 inch	100	100	100	100
3/8 inch	85-100	70-90	90-100	70-90
1/4 inch	-	-	70-90	-
No. 4	0-20	0-5	5-60	0-5
No. 8	0-5	0-3	0-5	0-3
No. 200	0-1	0-2	0-1	0-1

Acceptance of cover material with respect to gradation shall be based on the average gradation of five samples taken from a test lot of 5,000 tons. The samples shall be obtained from the stockpile prior to use. A

test lot shall be obtained when the average gradation of the five samples is within the specified gradation band and when the number of individual samples in each test lot outside the gradation band does not exceed two and when they are not outside the band by more than two percentage points on any one sieve.

The total amount of material passing the No. 200 sieve shall be determined by washing with water in accordance with AASHTO Designation T-11.

B. That portion of the aggregate retained on the No. 4 sieve shall be clean and free of clay coatings and shall have not less than 80 percent by weight, of particles with at least one clean mechanically fractured face, when tested in accordance with UDOT Department Test Procedure 8-929.

C. The aggregate shall have a percentage of wear not exceeding 30 when tested in accordance with AASHTO Designation T-96.

D. The crushed mineral aggregate shall have a weighted percent of loss not exceeding 10 percent by weight when subjected to five cycles of sodium sulfate and tested in accordance with AASHTO Designation T-104.

E. The aggregate shall be of such nature that when the particles are thoroughly coated with the bituminous material specified for the project not less than 90 percent of the coating shall be retained when tested in accordance with Department Test Procedure 8-945.

F. The maximum dry unit weight of standard gravel aggregate material shall not exceed 100 pounds per cubic foot when measured according to the loose weight determination as described in AASHTO Designation T-19 and the moisture content shall be determined according to ASTM D-2216.

11.12.2 SEAL COAT PREPARATION: Seal coat operations shall not be started until the surface to be sealed has been thoroughly compacted. In no event shall seal coat be placed on newly constructed bituminous surfaces within thirty (30) days after such surfaces are laid and preferably a minimum of 12 months after placing asphalt pavement as directed by the City Engineer. The surface shall be crack sealed 30 days prior to placing the seal coat.

Two days prior to placing the seal coat, the existing surface shall be swept, washed, and cleaned of all dirt, sand, dust, or other objectionable material. All weeds shall be removed from crack lines and curb lines.

11.12.3 APPLICATION OF EMULSION MATERIAL: The material shall be sprayed over the prepared surface by means of a pressure distributor. The material shall be applied in such a manner that an inspection of the spread can be made and any defects corrected before the cover material is applied. The rate of application shall be as specified in the table below. Modifications to the application rates indicated may be required as observed in the field and determined by the City inspection representative. Application of emulsion material shall not be more than 100 feet in advance of the placing of cover material.

Emulsion Application Rate Table (gal/s.y.)						
	Standard Gravel Aggregate		Slag Aggregate		Lightweight Aggregate	
Emulsion Type	Type A	Type C	Type A	Type C	Type A	Type C
CRS-2P	0.40±	0.44±	0.37±	0.41±	0.35±	0.39±
LMCRS-2	0.40±	0.44±	0.37±	0.41±	0.35±	0.39±
PASS CR	0.37±	0.40±	0.34±	0.38±	0.33±	0.34±

The contractor shall be responsible to cover all existing manholes and valve boxes along with their concrete collars with felt paper prior to the installation of the seal coat to protect these facilities from being covered with the bituminous seal coat materials.

Joints between applications shall be made by starting and stopping the distributor on building paper. Valve action shall be instantaneous, both in starting and cut off. The distributor shall attain the proper application speed at the time the spray bar is opened.
The contractor shall be responsible to furnish and place the required asphalt emulsion at a uniform rate and application coverage consistent with the application rate table above or as directed by the City Engineer. The emulsion shall be CRS-2P, LMCRS-2 or PASS CR as directed by the City Engineer. The material shall be sprayed over the prepared surface by means of a pressure distributor.

The temperature range of the emulsion material at the time of application shall be consistent with manufacturer recommendations.

11.12.4 SPREADING AND COMPACTING OF SEAL COAT COVER MATERIAL: Prior to the placing of the cover material, the contractor shall perform a test of the spreading equipment at a location approved by the City. The test shall determine the exact rate of application of the emulsion and cover material and provide a means to calibrate the contractor's equipment. Aggregate and slag materials shall be moistened prior to use with CRS-2P and LMCRS-2 products as directed by the City Engineer. When using PASS CR, the aggregate/slag material shall <u>not</u> be moistened.

The cover material shall be spread immediately after applying the emulsion material by means of an approved spreader which can be adjusted to uniformly spread the required amount of aggregate. The aggregate shall be applied at the specified rate and shall be adjusted up or down so that no "bleed through" occurs during rolling, and so that very little "double stacking" of chips occurs, with the goal being a uniform, single layer of chip being applied. Provisions shall be made so that the larger particles will be deposited first. The rate of cover material application shall be as specified below or as directed by the City inspection representative in the field. Immediately after spreading, the cover material shall be hand broomed, if necessary, to distribute the aggregate uniformly over the surface.

Cover Material Application Rate Table (lbs/s.y.)						
	Standard Gravel Aggregate		Slag Aggregate		Lightweight Aggregate	
Emulsion Type	Type A	Type C	Type A	Type C	Type A	Type C
CRS-2P	18.0±	22.0±	20.0±	24.0±	11.0±	16.0±
LMCRS-2	18.0±	22.0±	20.0±	24.0±	11.0±	16.0±
PASS CR	27.0±	31.0±	31.0±	35.0±	14.0±	20.0±

After the cover material has been satisfactorily spread, the surface shall be rolled by pneumatic-tired rollers in a longitudinal direction with a minimum of two (2) 12-ton pneumatic-tired rollers, maintaining 80 PSI in each tire. Rolling performed with pneumatic-tire rollers shall adequately seat the cover material and shall consist of at least three complete coverages. Rolling shall be completed at a maximum speed of 5 mph and be completed before the emulsion breaks, the same day the emulsion and cover material are applied, approximately 15 minutes to 20 minutes. The rollers are to stay within 500 feet of the chip spreader.

On completion of final rolling, traffic shall be permitted to travel over the seal coat.

11.12.5 FOG SEAL: Where directed CSS-1 shall be used as the Fog Seal with a 2 to 1 dilute and shall be applied to the road surface at a rate of 0.10 - 0.12 gal. per square yard. Fog seal shall be placed on a freshly swept chip & seal surface. The surface of the chipped road shall be swept within 2 or 3 days after placing and compacting the chip and seal cover material. The Fog Seal should be placed immediately after sweeping. If the Fog Seal can't be placed at this time and is placed 2 or three weeks after the sweeping, the road surface will need to be swept again to remove any loose chips before placing the fog seal.

11.12.6 SEAL COAT WEATHER AND SEASONAL LIMITATIONS: Seal coat shall be applied only between June 1 and August 15 and when the air temperature in the shade and the roadbed temperature are above 70° F. Seal coat shall not be applied during rain, fog, or other adverse weather conditions. Seal coat placed after August 15 shall be placed only upon written authorization from the Engineer, and then only when the air temperature in the shade and the roadbed temperature are above 70° F.

11.13 CRACK SEAL

11.13.1 GENERAL: This work consists of furnishing all materials, equipment, and labor for sealing cracks in the existing pavement in the treatment areas. Crack sealing shall be in accordance with these specification and in conformance with details and at the locations shown on the plans.

11.13.2 EQUIPMENT: The equipment used by the Contractor shall include but not be limited to the following:

A. Hot-Compressed Air-Lance (HCA): The hot-compressed air-lance shall provide clean, oil free compressed air at a volume of 100 cubic feet per minute, at a pressure of 120 pounds per square inch, and at a temperature of 2,000 degrees F.
B. Application Wand: The crack fill applicator wand shall be attached to a heated hose attached to a heated sealant chamber. Temperature controls shall be capable of maintaining the temperature of the sealant within the manufacturers' tolerances.
C. Material Heating Equipment: Heat material using an indirect heating unit (double boiler or circulating hot oil heat transfer). Do not use direct heat transfer units (tar pots). The heating unit must have means of constant agitation.

11.13.3 MATERIALS: The crack fill material shall be NUVO CS Formulation B or an approved equal as specified by the Streets Division Supervisor. Material shall be a polymer modified rubber asphalt and shall conform to the requirements of ASTM Designation D 5078 when tested in accordance with ASTM Designation D 3407. Crack sealant shall be obtained from a source selected by the Contractor. Crack sealant material shall be furnished from one production lot.

11.13.4 PLACEMENT:

A. Surface Preparation: The pavement area to be treated shall be clean and dry with no standing or flowing water on the surface.
B. Cracks to be Treated: All cracks greater than 12 inches in length, and greater than 1/8 inch width shall be treated.
C. Cleaning the Cracks: Cracks shall be blown clean. Remove foreign matter, loosened particles, and weeds. When surfaces are wet or when the air temperature is less than 40 degrees, cracks are to be blown clean and dry. Each crack shall be filled to within ¼ inch of the existing surface.
D. Protection: Place sand on the surface of the crack repair product if traffic or construction activities are likely to cause pull out. Replace pulled out product at no additional cost to the OWNER. Repair vehicles or other property damage by crack repair operation.

E. Acceptance of Work: Following the application of the crack fill material and prior to opening the roadway to traffic, the crack seal area will be visually inspected by the City Engineer or Inspection representative for areas exhibiting adhesion failure, damage to the sealant from construction equipment or personnel, missed cracks, foreign objects in the sealant, or other problems which will accelerate sealant failure or indicate the project is not acceptable. Portions of the crack seal area identified by the inspection representative that do not meet these criteria will be repaired and resealed until satisfactory to the Engineer. Resealing of any area will be at the expense of the Contractor.

F. Quality Assurance: Do not use crack repair product that has been over-heated, suffered prolonged heating, or which ravels or can be pulled out by hand after placement. Do not mix different manufacturer's brands of or different types of crack repair material.

Section 11.14 ASPHALT PAVING:

All streets shall be surfaced in accordance with the following, unless otherwise specified by the City Engineer.

Local Streets:

A. 8-inch minimum crushed gravel base course over prepared subgrade.
B. 3-inch minimum compacted thickness plant mix asphalt surfacing on streets.

Collector Streets:

A. 10-inch minimum crushed gravel base course over prepared subgrade.
B. 4-inch minimum compacted thickness plant mix asphalt surfacing on streets.

Minor Arterial Streets:
A. 10-inch minimum crushed gravel base course over prepared subgrade.
B. 4-inch minimum compacted thickness plant mix asphalt surfacing on streets.

Arterial Streets:

A. Pavement structure will be based on specific design to meet specific conditions.

Note – The developer may be required to submit a pavement design for review on any street.

DIVISION 12

CONCRETE CURB AND GUTTER AND SIDEWALK

Section 12.01 GENERAL:

This section covers installation of curb and gutter, sidewalk, combination of curb, gutter and sidewalk, cross gutter, drive approaches handicap ramps and curb returns. All improvements shall be constructed to the dimensions and thickness shown on the Standard Drawings.

Section 12.02 CONCRETE:

Concrete shall be Class AA(AE) and shall meet all of the requirements of Division 8, Portland Cement Concrete. Under no condition shall the water cement ratio exceed 0.53.

Section 12.03 GRADE:

After construction, gutters shall be checked by flowing water. The Public Works Representative/Public Works Representative/Engineer shall be present during the flow test. Removing concrete and replacing to the correct grade shall repair any high spots or depressions (which exceed 0.02 feet). (Minimum flow line grade shall be 0.5 percent.)

Section 12.04 FORMS:

All forms shall be steel, except at curves with a radius smaller than 200 feet. They shall be of a size to match the sections shown on the Drawings. Forms shall be held firmly in place with stakes or other approved means and shall be true to line and grade.

All forms shall be clean and coated with a light oil to prevent the concrete from adhering to them. Clamps, spreaders and braces shall be used where required to insure rigidity in the forms.

Forms shall not vary from vertical grade by more than 0.02 feet and from horizontal alignment by more than 0.05 feet. All forms shall have smooth even lines in both the horizontal and vertical plane.

Forms for curved sections shall be so constructed and placed that the finish surface of walls and edge of sidewalks, curbs and gutters will not deviate from the arc of the curve.

Section 12.05 SUBGRADE PREPARATION:

The developer/Developer/Contractor shall grade to the line and grade approved by the City. No concrete shall be placed without approved cut sheets. The sub-grade shall be properly shaped to conform with the cross section shown on the Standard Drawings, graded and compacted. Compaction shall meet the requirements of Division 7 Earthwork.

All excess material excavated by the Developer/Developer/Contractor shall be removed from the site. Removal of the excavated material shall be done before or immediately after the concrete is placed. The Developer/Developer/Contractor shall maintain adequate barricades and other devices to protect the public until excavated material is removed.

Placement of concrete on unsuitable materials shall not be permitted. The subgrade surface shall have a 4-inch roadbase foundation as shown on the Standard Drawings. Immediately prior to the placing of concrete, the subgrade shall be compacted using a mechanical foot compactor, with compaction being at least ninety-six percent (96%) density.

Section 12.06 CONSTRUCTION OF CURB, GUTTER AND SIDEWALK:

Concrete curb, gutter and sidewalk may be constructed by first constructing the curb and gutter and then constructing the sidewalk behind it. If this method is used the joint between the back of curb and front edge of sidewalk shall be sealed. The curb and gutter may be placed using stationary forms or the slip method of forming.

Concrete curb, gutter and sidewalk may be constructed at the same time, combination curb, gutter and sidewalk. Stationary forms can be used to place combination curb, gutter and sidewalk or the slip form method can be used if it can be demonstrated that the tolerances specified herein can be met.

Curb and gutter to be installed with bituminous asphalt cement pavement shall have contraction joints placed every 10 feet by use of 1/8-inch steel template of the exact cross section of the curb and gutter. Remove the templates as the concrete takes initial set. Cut the joint 1-1/2 inches deep when using the slip form method to place the concrete. Use 1/2-inch thick, pre-molded, expansion joint filler at curb and gutter radii, where the curb and gutter abuts a solid object and at intervals not to exceed 50 feet, unless otherwise specified by the Public Works Representative/Engineer or his representative.

Joints in sidewalk, when placed separately and adjacent to the curb shall match the contraction and expansion joints in the curb and gutter as well as where the sidewalk abuts a solid object. Sidewalks not placed adjacent the curb shall have contraction joints set at an interval equal to the width of the sidewalk but not to exceed 10-feet. The joints shall be approximately 3/16 inch wide and approximately one-fourth of the total slab thickness in depth. Expansion joints shall be 1/2-inch thick, shall be placed every 32 feet, adjoins existing sidewalks, or abuts a solid object.

Material for 1/2-inch expansion joints shall be as specified in AASHTO M-153 and AASHTO M-213, and shall be installed with its top approximately 1/4-inch below the concrete surface.

After the concrete placed for a sidewalk has been brought to the established grade and screeded, it shall be float finished, edged and then given a light broom finish. In no case shall dry cement or a mixture of dry cement and sand be sprinkled on the surface to absorb moisture or hasten hardening. Surface edges of all slabs shall be rounded to a radius of ½ inch.

After concrete has been placed in curb and gutter forms, it shall be consolidated so as to insure a thorough mixture, eliminate air pockets, and create uniform, smooth sides. As the concrete takes its initial set the forms shall be removed and all exposed surfaces shall be float finished, edged and broomed lightly. The curb and gutter shall be constructed to the dimensions shown in the Standard Drawings.

The top and face of the curb and also the top of the apron on combination curb and gutter must be finished true to line and grade and without any noticeable irregularities of surface. No portion of the surface or face of the curb and gutter shall depart more than 1/4 inch from a straight edge ten feet in length, placed on the curb parallel to the street center line nor shall any part of the exposed surface present a wavy appearance.

Section 12.07 CONCRETE CURB WALL:

Concrete curb wall shall be Class AA(AE) and shall meet all of the requirements of Division 8, Portland Cement Concrete.

Reinforcing steel shall meet the requirements of Division 9, Reinforcing Steel.

Excavation for and backfill around the curb walls shall meet all the requirements of Division 7, Earthwork.

The curb walls shall be constructed to the dimensions and grades shown on the Standard Drawings or improvement drawings or as determined by the Public Works Representative/Engineer.

Section 12.08 6-INCH CONCRETE DRIVE APPROACH:

The concrete to be used for the drive approach shall be Class AA(AE) and shall meet the requirements of Division 8, Portland Cement Concrete.

When the location of a residential driveway is known, it shall be a minimum of six (6) inches thick. On commercial sites the drive approach shall be a minimum of six (6) inches thick. They shall be constructed to the dimensions shown on the Standard Drawings. The concrete shall be finished as described above for sidewalks.

The driveways shall have a compacted 4-inch untreated base course under them.

Section 12.09 AMERICAN DISABILITIES ACCESSIBILITY STANDARDS IN PUBLIC STREET RIGHT-OF-WAYS:

This section sets guidelines for accessibility to places of public accommodation and commercial facilities by individuals with disabilities. These guidelines are to be applied during the design, construction, and alteration of street construction or public buildings. The construction of curb ramps and drive approaches shall conform to the Standard Drawings.

Sub-section A. Curb Ramp Location:

Curb ramps complying with Section 12.05 shall be provided wherever an accessible route crosses a curb.

Sub-section B. Curb Ramp Slope:

Slope of curb ramps shall be the least possible slope. The maximum slope of a ramp in new construction shall be 1:12. The maximum rise for any run shall be thirty (30) inches. Transitions from ramps to walks, gutters, or streets shall be flush and free of abrupt changes. Maximum slopes of adjoining gutters, road surface immediately adjacent to the curb ramp, or accessible route shall not exceed 1:20.

Sub-section C. Curb Ramp Width:

The minimum width of a curb ramp shall be forty-eight (48) inches, exclusive of flared sides.

Sub-section D. Curb Ramp Surface:

Surface of curb ramps shall include an ADA approved detectable warning surface.

Sub-section E. Sides of Curb Ramps:

If a curb ramp is located where pedestrians must walk across the ramp, or where it is not protected by hand rails or guardrails, it shall have flared sides: the maximum slope of the flare shall be 1:12 (see Standard Drawings). Curb ramps with returned curbs may be used where pedestrians would not normally walk across the ramp.

Sub-section E. Built up Curb Ramps:

Built-up curb ramps shall be located so that they do not project into vehicular traffic lanes.

Sub-section G. Obstructions:

Curb ramps shall be located or protected to prevent their obstruction by parked vehicles.

Sub-section H. Location of Marked Crossings:

Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides.

Sub-section I. Diagonal Curb Ramps:

If diagonal (or corner type) curb ramps have returned curbs or other well defined edges, such edges shall be parallel to the direction of pedestrian flow. The bottom of diagonal curb ramps shall have a forty-eight (48) inch minimum clear space. If diagonal curb ramps are provided at marked crossings, the forty-eight (48) inch clear space shall be within the markings. If diagonal curb ramps have flared sides, they shall also have at least a twenty-four (24) inch long segment of straight curb located on each side of the curb ramp and within the marked crossing.

Sub-section J. Islands:

Any raised islands in crossing shall be cut through level with the street or have curb ramps at both sides and

a level area at least forty-eight (48) inches long between the curb ramp in the part of the island intersected by the crossing.

Section 12.10 LANDSCAPE RESTORATION:

Areas of new construction that cover or disturb existing landscaped areas with fills and cuts or areas disturbed by construction of retaining walls shall have the landscape restored. Areas that have lawn or flower beds shall be restored including sprinkling systems that might be damaged or relocated because of construction. Lawn covered or removed shall be replaced by sod.

The topsoil shall be fertile, sandy loam topsoil, obtained from well-drained areas. It shall be without admixture of subsoil or slag and shall be free of stones, lumps, sticks, plants or their roots, toxic substances or other extraneous matter that may be harmful to plant growth and would interfere with future maintenance. Topsoil pH range shall be 5.3 to 6.0.

DIVISION 13

STORM DRAINS

Section 13.01 GENERAL:

This section covers installation of storm drainpipe, manholes, and curb face inlet boxes. All improvements shall be constructed to the dimension and thickness shown on the Standard Drawings.

Section 13.02 PIPE INSTALLATION:

Installation of pipe shall be in an open trench unless otherwise shown. Trench and backfill shall meet the requirements of Division 2, Trench Excavation and Backfill.

Section 13.03 PIPE:

Pipe and pipe laying shall meet the requirements of Division 4, Concrete Pipe, and Division 4A. Pipe shall be laid with the bells up grade.

Section 13.04 MANHOLES:

Manholes shall meet the requirements of Division 5, Manholes. Where the size of the storm drain does not permit use of manholes, precast or cast-in-place reinforced concrete boxes shall be used. Concrete used in precast or cast-in-place boxes shall be Class AA(AE).

Section 13.05 CONCRETE:

Concrete shall meet the requirements of Division 8, Portland Cement Concrete.

Section 13.06 REINFORCING STEEL:

Reinforcing steel shall meet the requirements of Division 9, Reinforcing Steel.

Section 13.07 STORM DRAIN INLET BOXES:

The concrete to be used for the storm drain inlet boxes shall be Class AA(AE). The boxes shall be built to the dimensions and reinforced as shown on the Standard Drawings. The boxes may be precast or cast-in-place.

Excavation and backfill of the boxes shall meet the requirements of Division 7, Earthwork.

The storm drain inlet grate and frame shall be a D & L Supply I-3518 single unit with curb box with type "V" grate or equal. Grates and frames are to be dipped in cold tar epoxy following fabrication.

Section 13.08 PIPE CONNECTING INLET BOXES TO EXISTING STORM DRAINS:

The pipe to be used for connecting a new inlet box to an existing storm drain shall be of the same type of pipe as the existing pipe to which it is being connected. Where possible such connections shall be made by installation of a manhole. The Public Works Representative/Engineer shall approve connection locations and methods.

Connections to concrete pipe shall be by coring a hole in the pipe and then grouting the connecting pipe to the concrete pipe. Connections to PVC pipe shall be as per manufacture's recommendations. These recommendations will be reviewed with the Public Works Representative/Engineer prior to construction.

Section 13.09 STORM DRAIN LATERALS:

Where storm drain laterals are required to drain commercial sites, the minimum diameter shall be 6". A two-inch (2") by four-inch (4") by six-foot (6') marker, with the top twelve-inches (12") painted yellow, shall be installed to clearly mark the end of each lateral line.

DIVISION 14

SUBSURFACE DRAIN PIPE

14.1 GENERAL:

Buried drain pipe with closed or open joints or perforated pipe shall be provided for the drains in the locations shown on the drawings. The Contractor shall furnish and lay the drain pipe.

14.2 MATERIAL:

Closed Joint Subsurface Drain Pipe Systems:

All closed joint subsurface drainage piping shall be PVC plastic sewer pipe and shall be made of compound conforming to ASTM D-1784 with a cell classification of 13364-B with a minimum tensile modular of 500,000 psi. PVC sewer pipe must meet all the dimensional, chemical, and physical requirements outlined in ASTM D-3034, shall have a SDR of 35.0 and shall be supplied in 13.0-foot laying lengths. Pipe shall carry the IAPMO UPC Seal of Approval or as otherwise specified by the City. SDR and laying length may be modified as conditions dictate when approved by the City Engineer.

PVC sewer pipe shall be installed according to the requirements of ASTM D-2321 and the manufacturer's requirements.

Joints for PVC plastic sewer pipe shall be of the rubber gasket bell and spigot type, and the rubber gaskets shall conform to ASTM D-1869.

Fittings shall be made of PVC plastic conforming to ASTM D-1784, have a cell classification as outlined in ASTM D-3034, and carry the IAPMO UPC Seal of Approval.

4" Closed joint sewer pipe service laterals to individual residential lots shall be PVC sewer pipe as defined in this section and shall be pipe color other than white.

Open Joint or Perforated Drain Pipe:

Drain pipe may be perforated PVC pipe (ASTM D-1784), perforated or non-perforated concrete sewer pipe. Corrugated polyethylene piping per ASTM F-405-77a may also be used if installed with direct burial laser grade control equipment.

Non-perforated pipe shall be extra-strength non-reinforced concrete pipe. The pipe may be furnished with either bell-and-spigot or tongue-and-groove joints. Laying lengths of the pipe shall not exceed four feet. To insure open joints between lengths of pipe, spacer lugs approximately 1/8 inch high located on the 1/3 or 1/4 points around the perimeter shall be provided at each joint between lengths of drain pipe. The lugs may be cast on one end of the pipe during manufacture and similar to the details shown on the drawings, or may be gasket-type lugs of plastic, metal, or other suitable material cemented to the pipe by the Contractor and approved by the City Engineer.

Perforated pipe shall be PVC, extra-strength non-reinforced concrete pipe (ASTM - C 14) or reinforced concrete pipe (ASTM - C-76). All of which shall have 1/4" diameter perforations or as approved by the City Engineer. Concrete pipe may be furnished with bell-and-spigot or tongue-and-groove joints. Laying lengths of pipe shall not exceed five feet.

14.3 LAYING PIPE:

For open joint or perforated pipe, gravel backfill shall be placed under the over the pipe to the minimum depth as shown on the drawings. A geotextile drainage fabric, approved by the City Engineer shall be used to enclose the gravel envelope around the pipe section. The pipe shall be laid carefully on the gravel in a workmanlike manner and to the lines and grades shown on the drawings or established by the City Engineer. The joints for unperforated pipe shall be covered with asphalt-saturated felt strips placed to extend over the upper half of the circumference of the pipe and to not less than 4 ½ inches in each direction from the joint.

The maximum allowable departure from grade shall not exceed 10 percent of the inside diameter of the drain pipe, and in no case shall the departure exceed 0.1 foot. Where departures occur, the rate of return to established grade shall not exceed 2 percent of the pipe diameter per joint of pipe. The maximum allowable departure from alignment shall not exceed 20 percent of the inside diameter of the drain pipe, with a rate of return to the established line not to exceed 5 percent per joint of pipe.

The finished bed for all pipe shall be made smooth, including removal of material under the bell, so that the full length of pipe will be evenly and uniformly supported. The pipe shall be laid and completed with adjacent ends closely abutted and with the bell ends upgrade. Where necessary, as determined by the City Engineer, mechanical means shall be used to hold the pipe in place. Any pipe which is broken, cracked, or otherwise unsuitable, as determined by the City Engineer, shall be removed and replaced at the Contractor's expense. The water level in the trench area where the pipe is being laid shall be held to a minimum. During placement of the pipe, the water level in the trench shall not exceed 50 percent of the diameter of the pipe above the invert of the pipe. Water may be removed by permitting the water in the trench to flow down the previously installed drain pipe, provided that a screen cover is kept continuously in place over the exposed end of the pipe at all times, except when additional pipe is actually being placed. The screen used for this purpose shall be approved by the City Engineer and shall have maximum mesh openings of 1/8 inch. The pipe shall not be covered with backfill until it has been inspected and approved by the City Engineer. Unless otherwise approved by the City Engineer, the pipe shall not be covered with backfill except in the presence of a duly authorized City Inspector. After approval, the trench shall be backfilled as prescribed in Section 6.

The Contractor shall keep the pipe drain and manholes free from deposits of mud, sand, gravel, or other foreign matter and in good working condition until the construction is complete and accepted. Upon completion of the drain, if a clear and unobstructed view of the whole bore of the pipe cannot be obtained between manholes by use of a light or a sun reflector, a device approved by the City Engineer, having a diameter one inch less than the drain tile to be tested, shall be pulled through the drain between manholes. Any obstruction found in the drain shall be removed by the Contractor without cost to the City. Any methods used by the Contractor to remove deposits of mud, sand, gravel, or other foreign matter from the drains, such as use of water or air pressure, shall be subject to the approval of the Engineer.

DIVISION 15

CASINGS

Section 15.01 GENERAL:

This division defines the materials and construction requirements for steel casings under canals, railroad tracks, highways and Interstates. All construction operations shall be subject to the approval of the canal, Railroad Company or UDOT whose facility is being crossed. The Developer/Contractor shall make application to and secure permission from the canal, Railroad Company or UDOT before commencing work within the right-of-way. The Developer/Contractor shall provide all insurance and the services of all watchmen and flagmen required by the Railroad Company or UDOT. The Developer/Contractor will pay the Railroad Company and UDOT for their inspection services.

Section 15.02 MATERIALS:

The pipe shall be welded steel pipe conforming to ASTM Designation A-139, Grade A. Pipe wall thickness shall be a minimum of point three seven five inches (0.375") or as shown on the Drawings.

Section 15.03 CONSTRUCTION METHODS:

The steel pipe casing shall be jacked under the railroad tracks, highway or Interstate using methods submitted to the Public Works Representative/Engineer for review by the Public Works Representative/Engineer. Circular pipe joints shall be field welded as the jacking process progresses. The pipe interior shall be completely excavated and cleaned prior to installation of the carrier pipe.

Steel pipe casing shall be installed by open cut under canals. These installations shall be as per details approved by the canal company.

All required approach trenches or working pits shall be excavated and shored as defined in Division 2, Trench Excavation and Backfill. Provisions shall be made for a drain sump in one corner of the working pit to allow for the accumulation and pumping of seepage water, if ground water is expected to be encountered.

Section 15.04 LINE AND GRADE:

Casings shall be installed accurately to the line and grade shown on the Drawings. Casings shall be installed to grade with sufficient accuracy to permit installation of the carrier pipe to the design grade shown on the Drawings or to the cover depth required. The Developer's Public Works Representative/Engineer will provide base lines and bench marks at each casing location. Instrument checks of the line and grade shall be made by the Developer/Contractor at intervals sufficient to maintain the casing on line and grade.

Section 15.05 CARRIER PIPE INSTALLATION THROUGH CASINGS:

The carrier pipe shall be installed to the grade shown on the Drawings. Casing insulators or chocks shall be fastened to the carrier pipe as per the manufacturer's recommendations. For ductile iron pipe or PVC pipe, insulators shall be installed within one foot on each side of the bell and one in the center of the joint when 18' or 20' long joints are used. Metal components of the insulators or chocks shall be manufactured from 14 Ga. Steel, hot rolled and pickled and plastic coated or Type 304(18-8) stainless steel. The liner shall be polyvinyl chloride or Neoprene Rubber with antioxidant and antiozonant properties for extended service life. Runners shall be glass-reinforced plastic or UHMW polyethylene. Runners shall have high abrasion resistance and a low friction coefficient. If previously approved by the City Engineer, following installation of the carrier pipe, it may be required that the annular space between the inside of the casing and the outside of the carrier pipe is to be blown full of sand. The sanding operation shall be carried out such that sand is placed in the center of the casing first and the annular space filled as the placing pipe is withdrawn. The Developer/Contractor shall not be allowed to wash sand in from the end of the casing.

DIVISION 16

POWER, GAS, TELEPHONE AND T.V. CABLE

Section 16.01 POWER:

All power improvements shall comply with the current Morgan City Electrical Department Standards. The standard location for power shall be 1' beyond the property line within the 10' utility easement. Where the power is required to cross the right-of-way a conduit with a minimum 4" diameter shall be installed. This conduit shall extend at least 1' beyond the right-of-way line (See standard drawings).

Section 16.02 GAS:

All gas improvements shall comply with the standards of the gas provider as a minimum. The standard location for gas shall be 9' beyond the property line within the 10' utility easement (See standard drawings).

Section 16.03 TELEPHONE:

All telephone improvements shall comply with standards of the telephone provider as a minimum. The standard location for telephone shall be 5' beyond the property line within the 10' utility easement. Where the telephone is required to cross the right-of-way a conduit with a minimum 4" diameter conduit shall be installed. This conduit shall extend at least 1' beyond the right-of-way line (See standard drawings).

Section 16.04 T.V. CABLE:

All T.V. cable improvements shall comply with standards of the cable T.V. provider as a minimum. The standard location for cable T.V. shall be 5' beyond the property line within the 10' utility easement. Where the cable T.V. is required to cross the right-of-way a conduit with a minimum 2" diameter conduit shall be installed. This conduit shall extend at least 1' beyond the right-of-way line (See standard drawings).

Section 16.05 FIBER OPTIC:

All fiber optic. cable improvements shall comply with standards of the fiber optic. provider as a minimum. The standard location for fiber optic lines shall be 5' beyond the property line within the 10' utility easement. Where the fiber optic line. is required to cross the right-of-way a conduit with a minimum 2" diameter conduit shall be installed. This conduit shall extend at least 1' beyond the right-of-way line (See standard drawings).

As an alternate location, the fiber optic line may be installed 1’ beyond the property line within the 10’ utility easement to utilize the same trench as the Morgan City power line. This must be approved by the Morgan City power department. Locating a fiber optic line near a Rocky Mountain Power cable must be approved by Rocky Mountain Power.

DIVISION 17

SURVEY

Section 17.01 GENERAL:

This division covers surveying issues as they relate to development within Morgan City. All surveying activities and products shall comply with this division, any existing Morgan County regulations, Utah Code Title 17 Chapter 23,

Section 17.02 MONUMENTATION:

Each and every corner on the boundaries of the parcel or tract of land being surveyed should be monumented. Where monuments exist but are not of a durable material they should be replaced. In such cases where the placement of a required monument at its proper location is impractical, it is permissible to set a reference monument close by the point, and if such reference monument is set its location shall be properly shown on the plat of survey. When conditions warrant setting a monument on an offset, the location shall be selected so the monument lies on a line of the survey or on the prolongation of such line. Offsets should not be in fractional feet unless a physical obstruction affects their location.
Artificial monuments should be constructed of durable material capable of being detected by commonly used magnetic locators. Where practical, monuments shall be solid and substantially free from movement. These monuments shall have affixed thereto a cap or other device bearing the registration number of the surveyor in responsible charge, or the regular business name or the governmental agency legibly stamped or imprinted thereon. Unless extenuating circumstances dictate, the minimum size monument should be not less that 5/8 inch in diameter, the minimum length should be 24 inches.

Following the construction of the curb, a nail shall be permanently placed in the curb at the point of intersection of the extension of the lot line with the curb line.

Section 17.03 GRAPHIC REPRESENTATION OF LAND SURVEYS:

This section covers the graphical representation that are to be submitted by the surveyor.

Sub-Section A Plats of Survey:

Surveyors should:

1. Complete and file plats or certificates with proper local authority, in accordance with Utah Code 17-23-17 or other local regulations,
2. Prepare survey records on stable, durable media capable of reproduction, recording, digitizing, and permanent storage,
3. Clearly and understandably portray conflicting monuments or property lines showing gaps or overlaps with adjoining properties and inform clients, of their existence,
4. Show actual measured values on plats and certificates, to enable their future retracement. Values from the record should be shown in record units for comparison,
5. Clearly indicate lines of occupation, and the extent of any encroachment relative to parcel boundaries, and
6. Label adjoining properties with owner(s) name if known, include reference to documents of record.

Sub-Section B Survey Certification:

Surveyors should:

1. Identify the record legal descriptions of the parcels being surveyed giving reference to the recordation information (i.e. Book, Page and Entry Number) of the document relied upon for the record description,
2. When establishing new boundaries not previously of record, include reference to the parent parcel description together with the description of the created parcel. Include a description of the remainder of the parent parcel if known, and

3. When preparing a composite description of several surveyed parcels, identify the record legal descriptions of the parcels (See paragraph 1 above) and include a statement of purpose for the composite in the narrative of the survey.

Sub-Section C Survey Narrative:

Surveyors should:

1. Explain and identify the purpose of the survey and its intended use such as, construction of improvements, determination of encroachments, transfer of ownership, parcel division, etc.,
2. Clearly indicate two existing monumented fixed points of reference relied upon for the basis of bearings defining the orientation for the lines of the survey,
3. Include reference to documents of record relied upon for preparation of the survey,
4. Include methods of interpretation of deed elements and physical evidence upon which conclusions were reached, and
5. Indicate the theory of location for corners utilized to resolve record conflicts and to draw conclusions in accordance with law or precedence (refer to Section 4.4).

Sub-Section D Legal Descriptions:

Surveyors should:

1. Include a sufficient caption, body, and where applicable, augmenting and qualifying clauses when preparing a legal description,
2. State clearly the relationship between the real property being described and the survey control or basis of unique location,
3. State clearly the basis of bearings or language which otherwise makes definite the method of direction and orientation for the lines of the subject property being described and the survey control related thereto when applicable,
4. Make full and complete citation to maps, plats, documents, and other matters of record, fact or pertinence, which are intended to be incorporated into and made a part of the legal description by reference thereto,
5. Call for complete and detailed descriptions of physical monuments, both natural and artificial, such as to facilitate future recovery and to enable positive identification,
6. When appropriate, incorporate either directly or by citation, sufficient data to enable a check of mathematical closure for the subject property being described, and
7. Affix their validated land surveyor(s) seal to the legal description.

Section 17.04 CORNER RECORDATION:

Surveyors should:

A. File a written record in accordance with Utah Code 17-23-17.5 for each government corner used as control unless the record currently reflects the existing conditions,
B. Set a monument of durable quality witnessed by at least four reference monuments when rehabilitating a government corner,
C. Set a witness monument wherever the nature of the ground will not allow the setting of a monument at the exact corner,
D. Carefully describe the monument and all references including their bearings and distances,
E. Include the state plane coordinates of the corner pursuant to Utah Code 57-10, Utah Coordinate System, if known, and
F. Utilize a form which portrays the information in a clear fashion as suggested on the attached monument recordation form.

DIVISION 18

FENCING SPECIFICATIONS

Section 18.1 GENERAL:

This section shall cover the requirements for temporary construction fencing and permanent fencing along boundaries, property lines or open ditches as may be required by Morgan City.

Section 18.2 CHAIN LINK FENCE SPECIFICATIONS:

Sub-Section A. Material:

1. Fabric to be chain link which has been galvanized after weaving with a minimum of 1.2 oz. per square foot of wire surface. Six (6) foot high of two (2) inch mesh, 9 gauge.
2. Tension wire for bottom only, No. 7 gauge spring coil.
3. Top Rail: 1-5/8 inch #40 or sch. 40 tubular rail.
4. Corner, Gate, or End Posts: Minimum diameter 2-3/8 inch O.D. #40 or schedule 40 galvanized pipe w/o slats; 2-7/8 inch O.D. #40 or schedule 40 galvanized pipe w/slats.
5. Line Posts: Minimum diameter of 1-7/8 inch O.D. #40 or schedule 40 galvanized pipe w/o slats; 2-3/8 inch O.D. #40 or schedule 40 galvanized pipe w/slats.
6. Braces: For all corner and gate posts - 1-5/8 inch O.D. galvanized pipe and adjustable 3/8 inch truss rods.

Sub-Section B. Concrete:

Concrete shall conform to the provisions of Section 8 Class C

Sub-Section C. Construction Methods:

The steel posts shall be set true to line and grade in concrete bases:

The distances between posts in any section shall be uniform, but shall not exceed the following spacing:

Tangent sections and curves down to 500 foot radius: not more than 10 feet.
Curves 500 foot radius to 200 foot radius: not more than 8 feet.
Curves 200 foot radius to 100 foot radius: not more than 6 feet.
Curves 100 foot radius: not more than 5 feet.

A minimum of six inches of concrete shall be provided below the bottom of each post. End posts, pull post, corner post, and gate posts shall have a concrete base at least 10 inches in diameter. Bases for line posts shall be at least 8 inches in diameter.

Pull posts shall be provided at 500 foot maximum intervals. Changes in line of 30 degrees or more shall be considered as corners.

Fence fabric shall be placed on the roadway side of posts unless otherwise specified. The fabric shall be placed approximately one inch above the ground, and on a straight grade between posts by excavating high points of the ground. Filling depressions will be permitted only upon approval of the City Engineer.

The fabric shall be stretched taut and securely fastened to the posts. Fastening to end, gate, corner, and pull posts shall be with stretcher bars and metal bands spaced at one foot intervals. The fabric shall be cut and each span fastened independently at all pull and corner posts. Fastening to line posts shall be with tie wire, metal bonds, or other approved methods at 14 inch intervals. The top edge of fabric shall be attached to the top rail at approximately 24 inch intervals. The bottom tension wire shall be attached to the fabric with tie wires at 24 inch intervals and shall be secured to the end or pull posts with brace bands.

Section 18.3 WOOD FENCE SPECIFICATIONS:

Sub-Section A. Materials:

1. Slats: Redwood, cedar, combed spruce, or other wood covering acceptable to the City Engineer or his representative.
2. Bottom and Top Rail: Minimum 2 inch x 4 inch x 8 foot cedar stud.
3. Corner, Gate, End, or Line Posts: Minimum size 4 inch x 4 inch cedar wood post.

Sub-Seciton B. Concrete:

All corner, gate, end, or line wood posts shall be set in concrete. All concrete used for post bases shall conform to the provisions of Section 8, Class C of the Subdivision Technical Specifications.

Sub-Section C. Construction Methods:

The cedar posts shall be set true to line and grade in concrete bases at least two (2) feet in depth. All posts shall be sound and free from all decay, splits, multiple cracks, or any other defect which would weaken the posts or otherwise cause them to be structurally unsuitable for the purpose intended.

The maximum distance between posts in any section shall not exceed eight (8) feet. The top and bottom railings shall be securely fastened to the posts with galvanized nails or other acceptable means. Changes in line of 30 degrees or more shall be considered as corners. A minimum of six (6) inches of gravel shall be provided below the bottom of each post. End posts, corner posts, and gate posts shall have a concrete base at least twelve (12) inches in diameter. Bases for line posts shall also be twelve (12) inches in diameter. Fence slats shall be placed on the roadway side of posts unless otherwise specified. The slats shall be placed approximately one (1) inch above the ground, and on a straight grade between posts by excavating high points of the ground. Filling depressions will be permitted only upon approval of the City Engineer. The slats shall be sound and free from all major decay or defects which would weaken or otherwise cause them to be unsuitable for fence slats. Fastening to top and bottom railings shall be done with two (2) galvanized nails at both the top and bottom rail.

Section 18.4 CONSTRUCTION FENCE SPECIFICATIONS - TYPE "D":

Sub-Section A. Material:

1. Fabric to be wire mesh which shall conform to ASTM Designation A-116, nominal 0.9999 inch Farm Grade with standard six (6) inch graduated spacing. The wire mesh shall have a Class 1 zinc coating.
2. Corner, gate, end or line posts shall be painted metal tee, U or Y channel, angular, or other approved shapes 6'6" in length.

Sub-Section B. Construction Methods:

Metal fence posts shall be spaced a maximum interval of sixteen (16) feet. Post spacing measurements shall be made parallel to the ground slope. All posts shall be placed in a vertical position. Metal posts may be installed by driving, if this can be done without damage to the post. Otherwise, they shall be installed to the specified depth (2'6") in larger drilled or dug holes and backfilled and compacted.

Corner posts shall be braced in two directions. End and gate posts shall be braced in one direction.

Wire mesh fabric shall be drawn tight enough to eliminate all sag without causing the "tension crimps" to fail to function.

Any high points along the ground surface which interfere with the placing of wire mesh shall be excavated to provide at least two (2) inches of ground clearance. Every alternate lateral wire in the mesh fabric shall be fastened to each post by means of a clamp.

Section 18.5 VINYL FENCE SPECIFICATIONS:

Sub-Section A. Material:

1. An 8' tall PVC fence shall be installed when fence is used to separate a residential area from a commercial area. A 6' tall PVC fence shall be used in residential areas.
2. Any PVC fence installed shall be a privacy style fence.
3. Posts, rails, pickets, gate uprights, post caps, and accessories shall be of high impact, Ultra Violet (U.V.) resistant, rigid PVC, and shall comply with ASTM D 1784, Class 14344B.
4. All fence parts made from PVC shall have a minimum thickness of 0.17 in except where specified otherwise.
5. Post Caps: Molded, one piece.
   a. Cross Section: Match post or gate upright cross section.
   b. Thickness: 0.095" minimum
   c. Configuration: Flat or four-sided as required for installation to top of posts and gate.
6. Accessories: standard gate brace, screw caps, rail end reinforcers, and other accessories as required.

Sub-Section B. Miscellaneous Materials:

1. Stiffener Chemicals: Galvanized steel structural channel. Configure channels for concealed installation within PVC rails with pre-drilled holes for drainage. Aluminum extruded channel available upon request.
   a. Cross Section: 3.00" x 3.00" x 1.500" hourglass shape to grip picket.
   b. Thickness: 0.040 Gauge (minimum)
2. Fasteners and Anchorage: Stainless Steel. All fasteners to be concealed or have colored heads to match. Provide sizes as recommended by fence manufacturer.
3. PVC Cement: As recommended by fence manufacturer.

Sub-Section C. Gate Hardware and Accessories:

1. General: Provide hardware and accessories for each gate according to the following requirements:

   a. Hinges: Size and material to suit gate size, non lift-off type, self closing, glass filled nylon with stainless steel adjuster plate, offset to permit 120 degree gate opening. Provide one pair of hinges for each gate.
   b. Stainless Steel, painted with carbo zinc base.
   c. Finish: Pre painted, 2 coats "Polane."
   d. Color: Black Gravity Latch or dual access gravity latch.

2. Latch: Manufacturers' standard self latching, thumb latch, pre-finished steel or stainless steel gravity latch. Provide one latch per gate.
   a. Finish: Match gate hinge finish.
3. Hardware: Stainless Steel. Provide sizes as recommended by fence manufacturer.
   a. Finish: Match gate hinge finish.

Sub-Section D Concrete:

1. Concrete: Provide concrete consisting of portland cement per ASTM C 150, aggregates per ASTM C 33, and potable water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2000 psi. Use at lease four sacks of cement per cubic yard, 1-inch maximum size aggregate, 3-inch maximum slump. Use ½ inch maximum size aggregate in post where required.

2. Packages Concrete Mix: Mix dry-packaged normal-weight concrete conforming to ASTM C 387 with clean water to obtain a 2 to 3 inch slump.

Sub-Section E. Reinforcement for Filled Posts:

1. Reinforcing Steel:

   a. Steel Reinforcing Bars: ASTM A 615. Grade 60. Deformed (#4 or ½"). Install 2 bars for each corner or gate post as specified in the drawings.

Sub-Section F. Execution - Installation, General:

1. Install fence in compliance with manufacturer's written instructions. During installation, PVC components shall be carefully handled and stored to avoid contact with abrasive surfaces. Install components in sequence as recommended by fence manufacturer.

   a. Install fencing as indicated on the drawings provided.
   b. Variations from the installation indicated must be approved.
   c. Variations from the fence and gate installation indicated and all costs for removal and replacement will be the responsibility of the contractor.

Sub-Section G. Fence Installation:

1. Excavation: Drill or hand-excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

   a. If not indicated on drawings, excavate holes for each post to a minimum diameter of 12 inches.
   b. Unless otherwise indicated, excavate hole depths not less than 30 inches or to frost line.

2. Posts: Install posts in one piece, plumb and in line. Space as noted in the drawings. Enlarge excavation as required to provide clearance indicated between post and side of excavation.

   a. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.

      I. Unless otherwise indicated, terminate top of concrete footings 3 inches below adjacent grade and trowel to a crown to shed water.
      II. Secure posts in position for manufacturers' recommendations until concrete sets.
      III. After installation of rails and unless otherwise indicated, install reinforcing in posts in opposing corners of post as shown and fill end and gate posts with concrete to level as indicated. Concrete fill shall completely cover the reinforcing steel and gate hardware fasteners. Consolidate the concrete by striking the post face with a rubber mallet, carefully tamping around the exposed post bottom.
      IV. Install post caps. Use #8 screws, nylon washers and snap caps.
      V. Remove concrete splatters from PVC fence materials with care to avoid scratching.

3. Top and Bottom Rails: Install rails in one piece into routed hole fabricated into posts to receive top and bottom rails, and middle where necessary. Except at sloping terrain, install rails level.

   a. Prior to installation of rails into posts, insert concealed steel channel stiffeners in top rail, where necessary. Bottom rails shall include minimum 2-¼" drainage holes.
   b. At posts to receive concrete fill, tape rail ends to prevent seepage when filling post with concrete.

4. Middle Rails: Where necessary, install middle rails in one piece into routed hole in posts with larger holes facing down. Except at sloping terrain, install middle rails level. Secure mid rail to pickets with 2-#8 x 1-1/2" screws evenly spaced.

   a. At posts to receive concrete fill, tape rail ends to prevent seepage when filling post with

concrete.

5. Pickets: Install pickets in one piece as per manufacturer recommendations. Install pickets plumb.
6. Fence Installation at Sloping Terrain: At sloping terrain rails may be racked (sloped) or stepped to comply with manufacturers' recommendations.

Sub-Section H. Gate Installation:

1. Prior to installation of rails into posts, apply PVC cement into sockets per manufacturer's recommendations. Bottom rail shall include minimum 2-¼" drainage holes.
2. Assemble gate prior to fence installation to accurately locate hinge and latch post. Align gate horizontal rails with fence horizontal rails.
3. Install gates plumb, level, and secure for full opening without interference according to manufacturer's instructions.
4. Gate Latch Installation. Install gate latch according to manufacturer's instructions.
5. Allow minimum 72 hours to let concrete set-up before opening gates.

Sub-Section I. Adjusting and Cleaning:

1. Remove all traces of dirt and soiled areas.

DIVISION 19

STORM DRAIN POLICY

Section 19.1 GENERAL:

This specification contains standard design and construction information for private and public storm water facilities. This policy is based on the requirements of the Clean Water Act phase II and the General Permit for Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) issued by the State of Utah, Department of Environmental Quality (DEQ) and the Utah Pollutant Discharge Elimination System (UPDES). Morgan City is not currently regulated as an MS4; however, many of the basic principles within those regulations are referenced in this specification.

All commercial and mixed-use sites shall address storm water runoff unless deemed negligible by the City Engineer. Residential subdivisions larger than 1 acre shall also address storm water runoff. If storm water issues are present or appear to be problematic, smaller residential developments may be required to address storm water runoff as required by city staff or the city engineer.

Section 19.2 STORM DRAIN POLICY DEFINITIONS:

Best Management Practices – Construction practices and control measures necessary to protect against pollution generated by construction sites.

Detention Basin - A depression designed to detain or slow down storm water runoff until downstream storm sewer resources are less heavily taxed. A detention basin contains an inlet and an outlet, allows debris to settle out, and regulates water flow.

Development - Any man-made change to improved or unimproved real estate, including but not limited to site preparation, filling, grading, paving, excavation, and construction of buildings or other structures.

Disturb - To alter the physical condition, natural terrain or vegetation of land by clearing, grubbing, grading, excavating, filling, building or other construction activity.

Drain Inlet - A point of entry into a sump, storm drain basin, or storm drain system.

Drinking Water Source Protection Zone - Zones determined by geo-hydrology designed to protect groundwater aquifers of a well or other water source in a culinary water system.

Freeboard – The vertical distance between the emergency spillway and the top of the basin embankment.

General Permit for discharges from MS4 (Permit): Authorization for a municipal separate storm sewer system to discharge storm water into waters of the United States.

Infiltration – The passage of water from the surface of the ground into the soil. Typically measured in units of inches per hour.

Infiltration System (storm water) – A system which is designed to return storm water runoff into an underground aquifer. Bioretention facilities, rain gardens, and tree boxes that are designed to slow down and hold storm water runoff for biological treatment and use by vegetative uptake are not considered to be infiltration systems or underground injection wells if they are isolated from groundwater. Groundwater isolation may be achieved with impermeable liners or an underdrain that does not discharge into a dug, bored, drilled or driven well, improved sinkhole or other subsurface fluid distribution system. The discharge of storm water below grade for the purpose of infiltration is considered a class V injection well facility. Above grade facilities such as a retention or detention basin are generally not considered class V injection wells even though infiltration occurs through the surrounding soils.

Injection Well, Class V – A class V injection well is often used to pass storm water flows from the surface to underground soil and rock formations containing an aquifer or zone of saturation. In order to protect underground sources of drinking water (USDW) facilities that meet the definition of a Class V Injection Well will not be permitted for storm water disposal in Zone 1. Nor with they be allowed in Zone 2 of a drinking water source unless approved pretreatment measures are included. Class V injection wells may be allowed in Zone 3 or 4 of a drinking water source without pretreatment if approved by the city engineer. The city must keep an inventory of all class V injection wells and provide that information to the state Underground Injection Control (UIC) program office.

Low Impact Development (LID) – Development that reduces or minimizes the quantity of storm water runoff and improves water quality in receiving water bodies.

Municipal Separate Storm Sewer System (MS4) – The storm water conveyance system owned by the City which includes streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains. For a full definition see 40 CFR 122.26(b)(8).

Retention Basin - A depression or cavity designed to retain or hold back all storm water runoff from flowing downstream. A retention basin contains an inlet with no outlet other than infiltration or evaporation. A retention basin allows debris to settle out.

Spillway, Emergency – A storm water basin feature that controls and guides excess storm water to a safe location as it spills over the embankment.

Spillway, Internal – A storm water basin feature that allows excess water to leave the basin through discharge piping which is set at an elevation below the emergency spillway.

Storm Drain System - The system of conveyances (including sidewalks, roads with drainage systems, streets, catch basins, detention basins, curbs, gutters, ditches, man-made channels, sumps, storm drains, and ground water) owned and operated publicly or privately, which is designed and used for collecting or conveying storm water.

Storm Water Pollutant – Chemicals, sediment, trash, disease-carrying organisms, and other contaminants picked up by storm water which is conveyed into rivers, streams, and other water bodies.

Storm Water Pollution Prevention Plan (SWPPP) – A construction plan that minimizes the impact of pollutants on storm water through the use of control measures and activities that target pollution sources.

Storm Water Report – A written analysis of a development or redevelopment site that estimates the volume and rate of storm water runoff generated by the proposed improvements. The report establishes the sizing of storm water piping and storage facilities so that the possibility of downstream flooding is greatly reduced.

Storm Water Runoff – Precipitation that is not intercepted or otherwise captured at a site which eventually enters into natural water bodies such as rivers, streams, and lakes.

Section 19.3 RAINFALL HYDROLOGY:

Policy: All storm drain systems shall be sized for the 100-year storm.

Sub-Section A. STORM SPECIFICATION AND SIZING OF STORM WATER FACILITIES:

Storm water piping: Storm drain piping shall at a minimum convey the 10-year storm where the road or other above ground conveyance will carry the difference to the 100-year storm. If the road or above ground conveyance system will not carry the 100-year storm (in low spots or areas where water may pond in streets) then piping shall be sized to carry the 100-year storm flow rates.

Storm water basins: Basins are required to contain the 100-year storm event. The intensity used for the sizing of detention basins shall be based upon the time frame associated with the greatest volume rather than the time of concentration. See 19.5(F) for information regarding the discharge rate from storm water basins. In making decisions regarding the size requirements for storm water basins the city engineer and city staff shall consider the potential for flooding and past flooding events. Criteria for determining the required size of a storm water basin also include geographic conditions and the ability to effectively convey storm water to a receiving body or appropriate infrastructure.

Sub-Section B. INTENSITY-DURATION-FREQUENCY (IDF):

For the use of the Rational Method, an IDF curve shall be obtained from the project location and approved by the City Engineer.

The rational equation may be used for sites under one square mile. For larger sites a City Engineer-approved computer model shall be used.

Sub-Section C. RAINFALL PATTERN:

For the use of computer models the following rainfall pattern shall be used. This pattern is based upon the Farmer-Fletcher Distribution. This pattern is for a 1" storm and must be modified for storms of other magnitudes.

1	0	11	0.004	21	0.033	31	0.052	41	0.012	51	0.005
2	0	12	0.005	22	0.034	32	0.045	42	0.011	52	0.005
3	0.002	13	0.008	23	0.035	33	0.04	43	0.01	53	0.004
4	0.002	14	0.009	24	0.038	34	0.035	44	0.009	54	0.004
5	0.002	15	0.009	25	0.039	35	0.03	45	0.009	55	0.004
6	0.002	16	0.013	26	0.045	36	0.022	46	0.008	56	0.003
7	0.002	17	0.017	27	0.052	37	0.02	47	0.006	57	0.003
8	0.002	18	0.02	28	0.054	38	0.018	48	0.006	58	0.002
9	0.003	19	0.024	29	0.054	39	0.016	49	0.005	59	0.002
10	0.003	20	0.029	30	0.054	40	0.014	50	0.005	60	0.001

Sub-Section D. RAINFALL TOTAL:

For the use of the above rainfall pattern, a rainfall total from the NOAA Atlas for the site must be obtained.

Sub-Section E. DIRECTLY CONNECTED IMPERVIOUS AREA: The storm water modeling method used must account for areas directly connected to the storm drain system independently from landscaped or unimproved areas.

Section 19.4 CONVEYANCE:

Policy: *It is the policy of the city that storm waters are not carried in irrigation ditches, nor that irrigation water be conveyed in storm drain systems.*

Policy: *Local pipes shall be sized for the 10-year storm where above ground facilities can control the difference to the 100-year storm.*

Sub-Section A. PIPING:

Storm drain lines shall be reinforced concrete pipe (non-reinforced may be used outside of traffic areas), of appropriate class. Minimum size for storm water mains shall be 15-inch diameter. Pipe specifications are included in the Public Works Standards. Pipe sizing shall be determined by calculating flow rates for the time of concentration. Where determined by the City Engineer larger drain lines shall be installed to accommodate future development. The cost to provide adequate storm drain facilities for a development shall be paid for by the Developer. If the developer is required to install piping in excess of the development needs then the City shall pay for the material cost to increase the size of the piping.

Sub-Section B. ACCESS:

Drain lines shall have clean-out boxes, inlets or manholes installed at all changes in grade or alignment, with a maximum distance of 400-feet between accesses. Structures shall be installed in accordance with the standard drawings.

Policy: *It is the policy of the City that new storm drain facilities remain accessible in a public right-of-way where they can be conveniently accessed by maintenance equipment and personnel without entering private property.*

Where topography or other conditions are such as to make impractical the inclusion of drainage facilities within road rights of way, perpetual, unobstructed easements of adequate width, but in no case less than ten feet (10') in width for such drainage facilities shall be provided across property outside the road lines and with satisfactory access to the public right-of-way. Easements shall be indicated on the plat. Drainage easements shall be carried from the road to a natural watercourse or to other drainage facilities.

Section 19.5 BASIN DESIGN:

Storm water runoff shall be controlled using storm drain facilities such as detention basins, retention basins, and subsurface infiltration galleries.

Policy: *It is the policy of the City to limit the amount of storm water runoff for new development and redevelopment. Storm water basins and facilities shall be utilized when development or redevelopment will increase storm water runoff. Development or redevelopment in areas of known flooding or potential risk to flooding shall address additional concerns raised by the city engineer or city staff.*

Sub-Section A. STORM WATER CONTROLS:

Basins are to be equipped with head gates or orifice plates to allow for additional storm water control and management. Head gates are usually required since they provide variable storm water discharge flow rates. Orifice plates are used less often and are intended for locations that are less accessible or where control of outflow rate is not as critical.

Monitoring equipment may be connected to a storm drain control facility. Supervisory Control and Data Acquisition (SCADA) systems may be implemented to help city personnel monitor and manage storm water runoff. Connection to the city's telemetry system may be required for development. The cost for the SCADA equipment shall be the responsibility of the city; however, development will need to coordinate with the city for the installation of the proposed monitoring equipment.

The implementation of Best Management Practices (BMPs) is to be incorporated in storm water facility designs. Facilities are to be designed with input from city staff and the city engineer. Sizing of storm water facilities and calculations shall be reviewed and approved by the city engineer.

Sub-Section B. BASIN LOCATION, OWNERSHIP, AND AMENITIES:

Commercial storm water basins may be located onsite. Residential storm water basins shall not be located on any parcel which contains a residential dwelling. In residential areas storm water basin facilities shall be located on a separate accessible parcel owned by a Homeowner's Association (HOA) or the city. Basin property maintained by an HOA must be covered by a storm water utility easement. If the basin is to be maintained by the city, then the property for the basin is to be deeded to the city.

City owned basins should be designed as multi-use facilities to allow for maximum public use of space in a development. The amenities and the size of the facility are to be planned in a cooperative manner with input from the developer, city planner, land use authority, the parks department and others as invited by the City. Funding for amenities and additional land needed for such facilities should be obtained in a fair manner from appropriate sources and budgets. Property reserved for storm water facilities must take into consideration the access requirements in 19.4 (B).

The intended ownership of storm water basins shall be established by the preliminary design review process. However, the city may, at its own discretion, change the ownership requirements at any time during the approval process to act in its own best interest.

Sub-Section C. PROPERTY DEEDS, EASEMENTS, AND AGREEMENTS:

1. Private Basins: Where the development will have a homeowner's association or in commercial applications private detention basins shall be constructed by the developer and owned and maintained by the commercial property owner or owning association. Private detention basins shall not be part of any parcel which contains a residential dwelling. In residential areas private detention basins shall be located on a separate accessible parcel owned by a political subdivision such as a homeowner's association and dedicated as a public utility with vehicular access, including necessary cross easements, given to the City for inspection and/or maintenance as requested.

   Owners of private storm water facilities are required to sign a **Long-Term Storm Water Maintenance Agreement** to ensure that the facilities are maintained and functional.

2. City Owned Basins: In residential or commercial subdivisions, basins constructed by the developer may be deeded, if approved, to the city as part of the public storm water utility infrastructure.

   Following acceptance of the construction, the ownership, operation and maintenance may be conveyed to and maintained by the City as previously agreed upon as a condition of development. City Owned storm water detention basins shall be located on a separate accessible parcel deeded to the City and dedicated as a public utility with vehicular access, including necessary cross easements, given to the City for inspection and maintenance. Actual ownership and responsibility shall be specifically defined in the Owners Dedication Certificates or Development Agreements or by Deed.

3. Storm Water Conveyance: Attention shall be given to overflow locations and pathways to safe locations downstream as discussed above. Easements shall be obtained, and pipes or swales sized

to handle the 100-year flow.

Sub-Section D. INFILTRATION:

No reduction due to infiltration for detention basins volumes shall be permitted in design. Retention basins may utilize groundwater infiltration at 50% of the rate established by an approved soil investigation and calculation method. This is due to reduced infiltration rates over time as silts are deposited on the surface. The allowable infiltration rate shall not exceed six (6) incher per hour to allow for needed biofiltration processes to occur.

Policy: *It is the policy of the City to eliminate standing water wherever possible as an effort to minimize a mosquito problem and associated viruses. Low flow bypass pipes may be required.*

Sub-Section E. BASIN CONSTRUCTION:

Policy: *Basins must be construction to enhance safety, health and aesthetics of the area.*

Engineering: Basins, whether detention or retention, must be designed and stamped by a Licensed Civil Engineer.

Location: Detention basins shall be located with convenient access for maintenance and repair by maintenance personnel. This generally means that the basin property has frontage along a public roadway. Storage volume in ditches or roadside swales, where approved, may be considered in the volume calculation.

Depth: The depth of a storm water basin shall not exceed 4-feet from outlet to high-water.

Fencing: Fencing may be required as directed by the planning commission for any storm water basin. Factors to consider are adjacent uses and proximity, basin depth, retention time, etc. If fencing is required, it shall conform to City Zoning Requirements.

Side slopes: Side slopes of 4.5:1 (horizontal to vertical) are required for ease of mowing and access. In special circumstances steeper slopes may be approved but should not exceed a 3:1 slope.

Bottom Slope: The basin floor shall be designed to prevent the permanent ponding of water. The slope of the floor of the basin shall not be less than 1% to provide drainage of water to the outlet grate and prevent prolonged wet, soggy, or unstable soil conditions. The preferred minimum slope is 2%.

Freeboard: There should be at least one foot of freeboard (berm above the high-water mark).

Spillways: Spillways must be considered and a path with a maintained swale and drainage easement to a safe location. Attention should be given to the design of the spillway to avoid erosion. **Overflow spillways** are intended to introduce flows back into the main pipe and are typically downstream of the outlet control. **Emergency Spillways** are intended to carry flows overland to a safe downstream location. All spillways shall be designed to protect adjacent embankments, nearby structures, and surrounding properties.

Outlet Control: Most basins shall have movable screw-type head gates (Waterman C-10 or approved equal) set at a calculated opening height for the discharge rate. Private basins may be allowed to have calculated fixed orifice plates mounted on the outlet of the basin with city approval.

Grates: All grates on inlets and outlets must be hot dipped galvanized (not painted) with bars at spacing to prohibit feet from falling in and yet avoid clogging with debris. Generally, bar spacing should never exceed 3" spacing.

Low Flow Piping: If the inlet and outlet structures are in different areas of the basin a buried pipe should be provided to convey any base flows that enter and exit the basin. If approved by the planning commission a cross gutter may be used when circumstances require it. The minimum pipe size and material for the low flow shall be as approved by the City Engineer.

Ground Covers: The surface area of the basin may either be sodded or covered with fabric and cobbles as specified by the city. Cobble size shall be 8" or greater overlying a city-approved weed barrier fabric. Sod areas shall receive a minimum of 4" of topsoil prior to sod placement. Sodded basins shall be provided with an automated sprinkler irrigation system approved by the city public works department. All detention basins, whether private or public, shall be regularly maintained and well cared for.

Embankment (Fill) Construction: If a raised embankment is constructed for a basin, it shall be provided

with a minimum of 6" of clay cover on the inside of the berm to prevent water passage through the soil.

Excavation (Cut) Construction: If the basin is constructed primarily by excavation, then it may be necessary to provide an impermeable liner and land drain system when constructed in the proximity of basements or other below grade structures as determined by a Geotechnical evaluation.

Groundwater: The bottom of detention basins shall be located a minimum of two feet above the highest groundwater table elevation.

Policy: *Storm water naturally progresses through the soil and into the ground. Groundwater levels respond and fluctuate accordingly. Groundwater containment is not the responsibility of the city.*

Multi-Use Basins: Basins may be designed as multi-use facilities when appropriate precautions are incorporated into the design. If amenities such as pavilions, playground equipment, volleyball courts, etc. are to be constructed within the water detention area of a basin they shall be designed appropriately. Structures shall be designed for saturated soil conditions and bearing capacities are to be reduced accordingly. Restrooms shall not be in areas of inundation. Inlet and outlet structures should be located as far as possible from all facilities. No wood chips or floatable objects may be used in the area that will be inundated.

Pretreatment: Storm water detention basins near a stream or river or within Drinking Water Source Protection Zone Two as defined by the State Division of Drinking Water Rules shall provide pretreatment approved by the city storm water manager and/or engineer.

Sub-Section F. DISCHARGE LIMITS:

Detention basins shall be sized with the predevelopment discharge rate. In no case shall the predevelopment discharge rate exceed 0.1 cfs/acre.

Retention Basins shall be designed to percolate within 72 hours following the end of the storm. No more than **50% of the natural infiltration rate** may be used for retention basin design. Basins having soils with particularly low rates of infiltration may need to be enlarged to drain within the maximum 72-hour limit.

Discharge from retention basins is regulated by the Utah Administrative Code (UAC) and shall **not be permitted within Zone 1 of any Drinking Water Source Protection Zone**. This includes infiltration basins, injection wells, etc.

Surface flows are often concentrated to one or more locations by development where historically sheet flow at slower flow rates may have left the site. Attempts shall be made to minimize concentrated surface runoff which mobilizes and carries suspended sediments or debris downstream and which may cause erosion especially along slopes.

Best Management Practices (BMP's) shall be used to maintain, to the maximum practicable extend, the quality of the water to the pre-developed condition. BMPs are included in the Storm Water Management Plan for the City and must be approved by the City Engineer.

Groundwater quality is to be considered in the design of storm water systems. Pollutants carried in storm runoff can make their way into the groundwater. The application of best management practices and appropriate infrastructure is to be utilized to protect groundwater quality.

No discharge shall be permitted to irrigation ditches and canals unless express permission is obtained from the responsible ditch company or ditch owners.

Policy: *It is the policy of the City to control storm water runoff near development sources and minimize the potential for flooding downstream. Storm water runoff leaving a site or subdivision shall not exceed, as much as practicable, the pre-developed flow rate and quality.*

Sub-Section G. RETENTION BASINS:

Policy: *Detention basins are preferred over retention basins due to higher maintenance needs for retention basins. When permitted, retention basins shall adhere to additional design practices.*

1. When permitted, retention basin should meet the following criteria:

   - The Basin is greater than **500 feet** or 50 feet times the number of lots in the entire development (whichever is greater) from the City Storm Drain System or water way, and

is topographically capable of draining to the City System and

- The basin is not located within a hazardous area (such as a steep slope) or some other fragile area (such as Zone 1 of a drinking water source).
- Retention basins shall be designed and constructed with all elements outlined in Sections 19.3 to 19.5

2. Retention Basin Design Volume: If permitted, local storm retention basins shall be designed for the 100-year, 3-hour storm, based upon the Intensity-Duration-Frequency (IDF) Curve for the area as approved by the City Engineer.

3. Retention Basins shall be designed to fully infiltrate within 72 hours following the end of the storm. No more than **50% of the natural infiltration rate** may be used for retention basin design. This is due to reduced infiltration rates over time as silts are deposited on the surface. Basins with particularly low rates of infiltration may need to be enlarged to drain within the maximum 72-hour limit. The allowable infiltration rate shall not exceed six (6) incher per hour to allow for needed biofiltration processes to occur.

4. Provide a hydrodynamic separator at the basin inflow.

5. Retention basins shall not be part of any parcel which contains a residential dwelling. In residential areas retention basins shall be located on a separate accessible parcel owned by the City or political subdivision such as a homeowner's association and dedicated as a public utility with access, including cross easements, given to the city for inspection and/or maintenance.

6. Retention basins may be a part of a commercial site only after consideration and approval by the city engineer.

Section 19.6 STORM WATER DRAINAGE SUMPS (Class V Injection Wells):

Policy: *Storm water basins are preferred; however, storm water drainage sumps may be utilized on public or private streets and parking lots when access to storm water conveyance piping is not feasible.*

Sub-Section A. SIZING:

When approved by the city, storm water drainage sumps are to be sized to the same requirements as retention basins. Calculations are to be submitted to and approved by the city engineer.

Sub-Section B. LOCATION AND PRETREATMENT:

Sumps are not allowed in Zone 1 of a drinking water source. Pretreatment is required for Zone 2. Sites with increased potential for storm water contamination will also be required to provide pretreatment as approved by the city engineer. The type of pretreatment is dependent upon the risk and type of contamination present at the stie.

Sub-Section C. UNDERGROUND INJECTION CONTROL (UIC):

Owners/operators of Class V injection wells must submit inventory information to the Utah Department of Environmental Quality, Division of Water Quality. See the Utah Administrative Code R317-7-6.

Sub-Section D. OWNERSHIP:

When sumps are permitted in public roadways, it is the intention of the city to own and maintain them. Other sumps will be privately owned and properly maintained.

Section 19.7 APPROVALS, PERMITS & PRACTICES:

Policy: *It shall be the policy of the city to comply with the requirements of the Clean Water Act phase II, and all other State and Federal requirements. This is to include applications, permits, plans and implementation.*

Sub-Section A. APPROVALS / PERMITS:

Additional development permits may be necessary for the construction of storm drain facilities. Copies of these third party permits and approvals should be submitted to the City. The design engineer should research the following permits:

1. Connecting to an Existing Storm Drain: Any connection to the existing storm drain system will

require approval from the public works direction and the city engineer.

2. A Storm Water Pollution Prevention Plan (SWPPP, or Erosion Control Plan or Pollution Prevention Plan) must be prepared for each development. As a minimum, the Best Management Practices discussed in Section 9.7(B) must be addressed.

3. Stream Alteration Permit: A Stream Alteration Permit is filed with the State Department of Natural Resources, Division of Water Rights. This permit overlaps the 404 wetlands permit, discussed below, because it is applicable to the area equal to the stream plus two times the bank full width (up to 30 feet). Any modifications to the stream or banks within this area must comply with the Stream Alteration Permit.

4. EPA 404 Wetlands Permit: This permit is filed with the US Army Corp of Engineers. It is applicable for all wetlands within a development. This will apply to all wetlands depending upon the presence of water, soils type and vegetation as determined in a Wetlands Delineation Report. All "waters of the US" are affected to the normal high-water mark. No fee is typically required for this permit. A letter of non-regulated wetlands may also be applicable. Any mitigation that may be required, must be done prior to recording a Final Plat.

5. Floodplain Development Permit: A permit is required whenever development occurs within the established floodplain or floodway per the Flood Insurance Rate Map (FIRM) developed by the Federal Emergency Management Agency (FEMA).

6. Underground Injection Control (UIC): Class V injection wells are to be placed on the Utah Department of Environmental Quality, Division of Water Quality's inventory list. Application and a fee are required.

Sub-Section B. BEST MANAGEMENT PRACTICES (BMP's):

Best Management Practices or BMP's are the control measures that eliminate contaminants such as sediment from traveling to offsite storm water facilities, rivers, streams and lakes. Best Management Practices typically fall into the following categories: Perimeter Control, Erosion Controls, Sediment Control, Materials Handling and Spill Prevention, Waste Management, and Good Housekeeping. The application of some BMPs are discussed below. They include, but are not limited to: Oil Separators, Inlet Protection, Tracking pads, Street Sweeping, Concrete Washout, and Silt Fences.

1. Oil Separators: Oil Separators shall be required on sites anticipating oily discharge from mechanic shops, manufacturing facilities, or large parking lots. Oil separators must be capable of removing particulates down to 150 microns and meet the approval of the City Engineer.

   Where oil separators are required, sizing and design of Oil Separators must be reviewed by the City Engineer prior to installation. Consideration must be given to frequency and ease of maintenance of the structure. Private basins shall have contracts in place with a local sewer company to periodically clean the Separator (at least annually).

   Manufacturers recommendations for sizing must be followed with calculations submitted to the city. The separator may either be installed upstream or downstream of the basin keeping in mind that flows on the outlet of the basin would be smaller.

2. Inlet Protection: Straw bales, silt fences or curb snakes (after asphalt is placed) are acceptable to protect contaminants from entering storm drain boxes, pipes and ditches. Filter fabric under grates shall not be permitted since drainage is greatly inhibited.

3. Tracking Pads: Sites must have a tracking pad to eliminate mud from being tracked onto the adjacent street. If mud is tracked, the contractor shall be responsible to sweep the streets as necessary.

4. Street Sweeping: If mud is tracked onto the street, the developer or owner shall be responsible for sweeping the street.

5. Concrete Washout: A place must be located within the subdivision or on the site for concrete washout. No washout will be permitted on the street which would then continue to the Storm Drain. The washout area may need to be maintained and temporarily excavated until the building foundations and driveways are constructed, or some other arrangement made.

6. Silt Fences: Silt Fences must be installed to prohibit the flow of sediments from the site in accordance with manufacturers recommendations and as directed by the City.

7. Portable Toilets: Portable Toilets must be provided for workers for as long as workers are on site. The quantity and location must be such that workers have reasonable access while working.

PART II – STANDARD DRAWINGS