

CLEARFIELD CITY
CONSTRUCTION AND DEVELOPMENT
STANDARDS,
TECHNICAL SPECIFICATIONS,
AND DRAWINGS



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CONSTRUCTION AND DEVELOPMENT STANDARDS,
TECHNICAL SPECIFICATIONS, AND
DRAWINGS
FOR
CLEARFIELD CITY, UTAH

Adopted by the Clearfield City Council

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PART I TECHNICAL SPECIFICATIONS
PART II DRAWINGS

PART I TECHNICAL SPECIFICATIONS

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SECTION 1 - GENERAL IMPROVEMENT REQUIREMENTS

A. **Scope.** This section defines the general requirements for improvements to be built.

The improvements shall include all street improvements in front of all lots and along all dedicated streets to a connection with existing improvements of the same kind or to the boundary of the subdivision nearest existing improvements. Layout must provide for future extension to adjacent development and to be compatible with the contour of the ground for proper drainage. All water lines, sewer lines, and any other buried conduit shall be installed to the boundary lines of the subdivision.

B. **Construction Drawings.** Complete and detailed construction plans and drawings of improvements shall be submitted to the City Engineer prior to commencing construction. No construction shall be started until plans have been checked and approved by an authorized City Representative.

C. **Standard for Construction Drawings.** The following instructions are for the purpose of standardizing the preparation of drawings to obtain uniformity in appearance, clarity, size, and style.

The construction plans shall be submitted in the current required amount with two (2) sets to be retained by the City Engineer and one (1) set returned to the subdivider with approval signature of the City Engineer. This approved set shall be kept available at the construction site.

The construction plans and designs shall meet the standards defined in the specifications and drawings hereinafter outlined. The minimum information required on drawings for improvements are as follows:

All drawings and/or prints shall be clear and legible and conform to good engineering and drafting practice drawn in waterproof black ink on mylar. The size of drawings shall be twenty-four (24) by thirty-six (36) inches (trim line) with one-half (1/2) inch border on top, bottom and right sides, also one and one-half (1-1/2) inch on the left side.

(1) In general, the following shall be included on drawings:

- a. North arrow (plan).
- b. Scale and elevations above sea level referenced to USGS datum.
- c. Stationing and elevations for profiles.
- d. Title block, located in lower right corner of sheet to include:
 - i. Name of city.
 - ii. Project title (subdivision, etc.).
 - iii. Specific type and location of work.
 - iv. Space for approval signature of City Engineer and date.
 - v. Name of engineer or firm preparing drawings with license number.

- (2) Curb and gutter, storm drain lines, and drainage structures, sidewalks, and street surfacing shall show:
 - a. Scale: 1"=20' to 1"=50' horizontal; 1"=5' to 1"=10' vertical.
 - b. Both plan view and profiles must be shown. In development along steep cross slopes, profiles each side of the street should be shown.
 - c. Stationing and top of curb elevations with curve data must be shown for all curb returns.
 - d. Flow direction and type of cross drainage structures at intersections with adequate flow line elevations.
 - e. B.M. location and elevation above sea level (use USGS datum).
 - f. Typical street cross-section with all distances shown.
 - g. Street survey monument locations.
- (3) Sewer drawings shall show:
 - a. Scale: 1"=20' to 1"=50' horizontal; 1"=5' to 1"=10' vertical.
 - b. Location, size and slope of mains.
 - c. Manhole size, location, and flow line elevations.
 - d. Type of pipe materials.
 - e. B.M. location and elevation above sea level (use USGS datum).
- (4) Culinary water drawings shall show:
 - a. Scale: 1"=20' to 1"=50'.
 - b. Size and location of water mains, valves, and hydrants.
 - c. Type of pipe materials.
 - d. Minimum cover indicated.
 - e. All structures.
- (5) Each set of plans shall be accompanied by a separate sheet of details for structures which are to be constructed. All structures shall be designed in accordance with minimum requirements established by the Clearfield City Public Works specifications and drawings.

D. **Preconstruction Conference.** A preconstruction conference may be held before any excavation or other work is begun, if deemed necessary by the City. The meeting will be held in the City offices and will include the following:

- (1) City Engineer, Public Works Director, other City Officials as required
- (2) Developer
- (3) Design Engineer and or Surveyor
- (4) All contractors and or subcontractors, as required.
- (5) Representatives of all local utility companies

Items pertaining to the construction and inspection of the subdivision improvements will be discussed.

E. **Inspection.** All construction work involving the installation of improvements in subdivisions shall be subject to inspection by the city. Certain types of construction shall have continuous inspection while others may have only periodic inspections (City reserves the right to require continuous inspection).

(1) Continuous inspection involves all work to be done under direct observation of a City Inspector and shall be required on the following types of work:

- a. Placement of street surfacing.
- b. Placing of concrete curb and gutter, sidewalks, and other structures.
- c. Laying of sewer pipe, drainage pipe, water pipe, valves, hydrants, and testing.

(2) Periodic inspections involves observation by a City Inspector on a periodical basis and shall be required on the following:

- a. Street grading and gravel base.
- b. Excavations for curb, gutter, and sidewalks.
- c. Trenches for laying pipe.
- d. Forms for curb, gutter, sidewalks, and structures.

On construction requiring continuous inspection, no work shall be done except in the presence of an Authorized City Representative or his designed representative.

F. **Requests for Inspection.** Requests for inspections shall be made to the city by the person responsible for the construction. Requests for inspection of work requiring continuous inspection shall be made three (3) days prior to the commencing of the work. Notice shall also be given one (1) day in advance of the starting of work requiring periodic inspection.

G. Construction Completion Inspection. An inspection shall be made by an Authorized City Representative after all construction work is completed. Any faulty or defective work shall be corrected by the persons responsible for the work no longer than ten (10) days of the date of City Engineer's Inspection Report defining the faulty or defective work.

H. Guarantee of Work. The developer shall warrant and guarantee (and post bond or other security) that the improvements provided for hereunder, and every part thereof, will remain in good condition for a period of one (1) year, after the date of the Construction Completion Inspection Report by the City Engineer, and agrees to make all repairs to and maintain the improvements and every part thereof in good condition during the time with no cost to the city.

It is further agreed and understood that the determination for the necessity of repairs and maintenance of the work rests with an Authorized City Representative. His decision upon the matter shall be final and binding upon the developer. The guarantee hereby stipulated shall extend to and include, but shall not be limited to the entire street base, all pipes, joints, valves, backfill and compaction; as well as, the working surface, curbs, gutters, sidewalks, and other accessories that are, or may be affected by the construction operations. Whenever in the judgment of the City Engineer said work shall be in need of repairs, maintenance, or rebuilding, he shall cause a written notice to be served to the developer; and thereupon the developer shall undertake and complete such repairs, maintenance, or rebuilding. If the developer fails to do so within ten (10) days from the date of the service of such notice, City Officials shall have such repairs made, and the cost of such repairs shall be paid by the developer together with 25% in addition thereto as and for stipulated damages for such failure on the part of the developer to make the repairs.

Note: If the Public Works Director sees that an emergency exists, He will make the necessary repairs and those costs may be billed by the City to the developer.

SECTION 2 - EARTHWORK

- A. **General.** This section defines the requirements for excavating and backfilling for structures; construction requirements for embankments and fills; subgrade preparation for pavements and other surface improvements.
- B. **Excavation for Structures.** All structures shall be built on undisturbed original subsoil or engineered compacted fills. All unauthorized excavation below the specified structure subgrade shall be replaced with a concrete monolithic slab or with coarse gravel compacted into place.

Subgrade soil for all concrete structures, regardless of the type of location, shall be firm, dense, thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen engaged in subgrade surfacing, laying reinforcing steel, and depositing concrete. 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.

- C. **Backfill Around Structures.** Backfill around structures shall be placed to the lines shown on the approved drawings, or as directed. After completion of foundation footings, 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. Material for backfilling shall consist of excavated material or borrow of sand, gravel, or other suitable material, and shall be placed in layers not exceeding twelve (12) inches in uncompacted thickness. 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 ASSHTO T-99.
- D. **Construction of Embankments and Fills.** Unsuitable materials that occur in the foundations for embankments and fills shall be removed by clearing, stripping and/or grubbing. Where suitable materials occur, after stripping, the foundation shall be scarified to depth of not less than six (6) inches, and the loosened material shall be moistened and compacted as hereinafter specified for each layer. All materials in embankments and fills shall be placed, moistened, and compacted as provided in the following paragraphs.

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

The materials used for embankment and fill construction shall be free from sod, grass, trash, rocks larger than six (6) inches in diameter and all other material unsuitable for construction of compacted fills.

Grading of completed embankments and fills shall bring the surfaces to a smooth, uniform condition with final grades being within 0.10 feet of design grade.

- E. **Compacting Earth Materials.** The material shall be deposited in horizontal layers having a thickness of not more than twelve (12) inches after being compacted as hereinafter specified; provided, that when mechanical equipment is used for placing and compacting the material on a sloping foundation, the layers may be placed parallel to the foundations. The distribution of materials shall be such that the compacted material will be homogeneous and free from lenses, pockets, of other imperfections.

Prior to and during compaction operations, the material shall have the optimum moisture content required for the purpose of compaction and the moisture content shall be uniform throughout the layers, insofar as practicable. Moistening of the material shall be performed at the site of excavation, but such moistening shall be supplemented, as required by sprinkling at the site of construction. If the moisture content is less or greater than optimum form compaction, the compaction operations shall be delayed until such time as the material has been conditioned as herein before specified, the backfill or embankment shall be compacted as follows.

- (1) **Under roadways** and extending one (1) foot beyond the proposed right-of-way line or embankment, material shall be compacted to a density equal to, but not less than 95% of maximum dry density as measured by AASHTO T-99.
- (2) **Under sidewalks and driveways** the fill or embankment, material (to at least one (1) foot each side of the edge of the slab) shall be compacted to a density equal to, but not less than 95% of maximum dry density as measured by AASHTO T-99.
- (3) **Structures.** Other fills and embankments not listed above shall be compacted to a density equal to, but not less than 95% percent of maximum dry density as measured by AASHTO T-99.

F. **Road Subgrade Preparation.** In both cut and fill areas, the paving subgrade shall be scarified to a depth of eight (8) inches and compacted to the equivalent of 95% of maximum dry density as measured by AASHTO T-99. No rocks larger than two (2) inches in diameter, organic material, soft clay, spongy material, or other deleterious material will be permitted in this scarified subgrade layer. Rough subgrades shall be shaped and graded to within a tolerance of 0.15 feet of design grade and drainage shall be maintained at all times.

During the rolling operation moisture content of the subgrade layer shall be maintained at not less than 97% or more than 105% of optimum moisture content. Rolling shall be continued until the entire road bed, (the edge of the right-of-way) is compacted to the specified density to a minimum depth of eight (8) inches.

G. **Density Testing.** All in-place soil densities shall be tested in the presence of an Authorized City Representative by a qualified testing company. If densities do not comply with the required values, the contractor shall be required to correct any deficiencies as directed by the City Engineer. All costs associated with density testing as well as costs associated with obtaining the necessary soil proctors shall be the responsibility of the subdivider/developer. Testing shall be at the height and location per the Authorized City Representative and/or as required.

SECTION 3 - ASPHALT PAVING

A. **General.** This section covers the requirements for bituminous surface paving on roads. All streets shall be surfaced in accordance with the following:

- (1) Eight (8) inch or ten (10) inch minimum crushed gravel base course over prepared subgrade.
(Ten (10) inch for collector or arterial roads).
- (2) Three (3) inch minimum compacted thickness plant mix asphalt surfacing on all streets.
- (3) Bituminous and aggregate seal coat.

B. **Base Course.** Base for all streets shall consist of select material, either natural or crushed, and shall be graded as follows:

Percent Passing Sieves

<u>Sieve Size</u>	<u>1" Maximum</u>	<u>3/4" Maximum</u>
1"	100	
1/2"	79-91	100
3/8"	-	78-92
No. 4	49-61	55-67
No. 16	27-35	28-38
No. 200	7-11	7-11

Each layer shall be compacted for the full width and depth by rolling with a pneumatic roller. 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 95% maximum dry density as determined by AASHTO T-180. Surfaces shall be true to the established grade with a thickness being not less than one fourth (1/4) inch from the required layer thickness and with the surface elevation varying not more than three-eighths (3/8) inch in ten (10) feet from the true profile and cross-section.

C. **Bituminous Surface Course.** Over the dry, dust-free compacted base course, the contractor shall place and compact a bituminous surface course. The surface course shall consist of a mixture of mineral aggregate and binder. Gradation of aggregate shall conform to one of the following as required by the City Engineer:

Percent Passing Sieves

<u>Sieve Size</u>	<u>3/4" Maximum</u>	<u>1/2" Maximum</u>
3/4"	100	
3/8"	69-91	100
No. 4	42-58	55-85
No. 16	17-31	24-38
No. 50	9-21	9-21
No. 200	4-8	4-8

The contractor shall establish a mix gradation and the amount of bituminous material shall be subject to the approval of the City Engineer and shall meet the requirements of the gradation selected.

Regardless of the bituminous content there shall not be more than three (3) percent voids in the aggregate.

The bituminous material for the surface course shall be AC-10 asphalt cement conforming to the requirements of AASHTO M-226.

The bituminous surface course shall be mixed at a mixing plant and spread and compacted on the prepared base in conformance with the lines and dimensions shown on the plans and in accordance with these specifications.

D. Construction Methods and Equipment. The methods employed in performing the work, all equipment, tools, machinery and other appliances used in handling the materials and executing the work shall be the responsibility of the contractor. The contractor shall make such changes in the methods employed and in the equipment used as are necessary whenever the bituminous surface course being produced does not meet the specifications herein established.

E. Spreading and Compaction. The bituminous mixtures shall be spread with self-propelled mechanical spreading and conditioning equipment capable of distributing at least a twelve (12) foot width. The mixture shall be spread and struck off in such a manner that the finished surface shall result in a uniform smooth surface. The longitudinal joints in succeeding courses shall be off-set at least twelve (12) inches transversely to avoid a vertical joint through more than one (1) course.

The temperature of the bituminous mix shall be between 250 degrees Fahrenheit and 325 degrees Fahrenheit when placing.

After the mixture has been spread, the surface shall be rolled in longitudinal direction commencing at the outside edge or lower side and preceding to the higher side. Each pass of the roller shall overlap the preceding pass at least one-half (1/2) the width of the roller. Rolling shall continue until 95% of the laboratory density as determined in accordance with ASTM Designation D-1559 for the bituminous mixture being used has been obtained.

Rolling operations shall be conducted in such a manner that shoving or distortion will not develop beneath the roller.

The surface of the pavement, after compaction, shall be uniform and true to the established crown and grade. When tested with a ten (10) foot straight edge placed parallel to the center line of the pavement the surface of the pavement at any point shall not deviate from the lower edge of the straight edge by more than one-eighth of an inch.

All high and low spots shall be remedied immediately by removing the wearing course material over the affected areas and replacing it with fresh, hot wearing course and surface finish material and immediately compacting it to conform with surrounding area.

All traffic shall be kept off the completed surface for a minimum period of 24 hours.

- F. **Bituminous Chip Seal and Bituminous Fog Coat.** The contractor shall not perform this item of work unless the air temperature is 70 degrees Fahrenheit or higher as approved by the City Engineer.

All materials and workmanship shall conform to Section 405 of the Utah Department of Highways Standard Specifications. Cover material shall be Type "A."

Bituminous chip seal and fog coat shall not be placed within ten (10) calendar days of the placement of the new bituminous surface course material.

- G. **Plant Mix Bituminous Seal Coat.** All materials and workmanship shall conform to Section 406 of the Utah Department of Highways Standard Specification.

- H. **Weather Limitations.** No bituminous surface course shall be placed when the temperature of the air or road bed is 50 degrees Fahrenheit or below, during rainy weather, when the base is wet or during other unfavorable weather conditions as approved by the City Engineer. The air temperature shall be measured in the shade.

Seal coats shall be applied only between June 1 and September 15.

- I. **Testing.** All in-place road base and asphalt pavement density testing shall be performed in the presence of the City Engineer by a qualified testing company. If densities do not comply with the required values, the contractor shall be required to correct any deficiencies as directed by the City Engineer. All costs associated with testing, obtaining marshall densities, and/or asphalt extraction testing, shall be the responsibility of the subdivider/developer.

SECTION 4 - PORTLAND CEMENT CONCRETE

A. **Scope.** This section of the specifications define materials to be used in all Portland Cement concrete work and requirements for mixing, placing, finishing, and curing.

B. **Materials.** Materials used in Portland Cement concrete and reinforcing of Portland Cement concrete shall meet the following requirements:

- (1) **Cement.** Portland Cement shall be Type II and shall comply with the Standard Specification for Portland Cement, ASTM C-150.
- (2) **Aggregates.** Concrete aggregates shall conform to Tentative Specification for Concrete aggregate, ASTM C-33.
- (3) **Water.** Water used in mixing concrete shall be clean and free from oil, acid, salt, injurious amounts of alkali, organic matter, or other deleterious substances.
- (4) **Entraining Agent.** An air-entraining agent shall be used in all concrete exposed to the weather. The agent shall conform to ASTM Designations C-175 and C-260.
- (5) **Admixtures.** No admixture (except calcium chloride) will be permitted to be used in Portland Cement unless such use is specifically authorized by the City Engineer. Calcium chloride shall conform to ASTM Standard Specification D-98 and shall be incorporated into the mix only with the approval of the City Engineer.
- (6) **Reinforcing Steel.** All bar material used for reinforcement of concrete shall be intermediate grade steel conforming to the requirements of ASTM Designation A-615 and shall be deformed in accordance with ASTM Designation A-305.
- (7) **Welded Wire Fabric.** Welded wire fabric for concrete reinforcement shall conform to the requirements of ASTM A-185.

C. **Concrete Mix.** For the purpose of practical identification concrete has been divided into three classes; Class A, B and C. Basic requirements and use for each class are as defined below:

<u>Class</u>	<u>Minimum Cement (Sacks/c.y)</u>	<u>Minimum 28-day Comp. Strength PSI</u>	<u>Primary Use</u>
A	6-1/2	4000	Reinforced structural concrete
B	6	3500	Sidewalks, curbs and gutters, cross gutters, pavements, and nonreinforced footings, and foundations
C	5-1/2	3000	Thrust blocks, anchors, mass concrete

All concrete shall also comply with the following requirements:

- (1) **Aggregates.** The maximum size of the aggregate 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. From nonreinforced concrete slabs the maximum size of aggregates shall not be larger than one-fourth (1/4) the slab thickness.
- (2) **Water.** Sufficient water shall be added to the mix during production at the batch plant to produce concrete with the minimum practicable slump. The slump of mechanically vibrated concrete shall not exceed four (4) inches. No concrete shall be placed with a slump in excess of five (5) inches.

The maximum permissible water-cement ratio (including free moisture on aggregates) shall be 5 and 5-3/4 gallons per bag of cement respectively for Class A and B air entrained concrete.

- (3) **Air Entraining.** Air content for air-entrained concrete shall comply with following:

Course Aggregate	
<u>Size (in.)</u>	<u>Air Content(%)</u>
1 1/2 to 2 1/2	5 ± 1
3/4 or 1	6 ± 1
3/4 or 1/2	7 ± 1

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

- (4) **Calcium Chloride.** Calcium Chloride may be added as an accelerator during cold weather with the maximum amount being two (2) pounds per sack of cement upon prior authorization by the City Engineer.

D. **Forms.** Forms shall be substantially built and adequately braced so as to withstand the liquid weight of concrete. All linings, studding, walling, and bracing shall be such as to prevent bulging, spreading, or loss of true alignment while pouring and displacement of concrete while setting. All concrete forms are to be inspected by an Authorized City Representative and approval given prior to the placement of any concrete.

Metal forms and/or automated equipment shall be used for curb and gutter work. All edge forms for sidewalk pavements, curbs and gutters shall be of sufficient rigidity and adequately braced to accurately maintain line and grade.

Forms or equipment used 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 appreciably from the arc of the curve. Exposed vertical and horizontal edges of the concrete in structures shall be chamfered by the placing of moldings in the forms.

E. **Joints.** Joints shall be provided for sidewalk, curb and gutter as follows:

- (1) **Sidewalks** shall have scribed joints at intervals of four (4) feet which joints shall be approximately three-sixteenth ($3/16$) inches wide and be approximately one-third ($1/3$) of the total slab thickness. In addition, one-half ($1/2$) inch expansion joints shall be provided at forty (40) foot intervals and at locations where sidewalks adjoin curbs or existing sidewalks. Slabs shall be ruled at four (4) foot intervals.
- (2) **Curb and Gutter** shall be cut into lengths of ten (10) feet by the use of one-eighth ($1/8$) inch steel division plates of the exact cross-section of the curb and gutter. Curb and gutter that is constructed using automated equipment shall also be cut into lengths of ten (10) feet by a three-eighth ($3/8$) inch wide scribed joint. Expansion joints (one-half ($1/2$) inch wide) shall be provided at curb and gutter radii, or where a solid object is abutted against, unless otherwise specified by the City Engineer.
- (3) Material for one-half ($1/2$) inch expansion joints shall be as defined in ASSHTO M-33, and shall be installed with its top approximately one-fourth ($1/4$) inch below the concrete surface.

F. **Reinforcement and Embedded Items.** Reinforcing steel shall be clean and free from rust, scale, paint, grease, or other foreign matter which might impair the bond. It shall be accurately bent and shall be tied to prevent displacement when concrete is poured. Reinforcing steel shall be held in place by only metal or concrete ties, braces, and supports. No steel shall extend for or be visible on any finished surface. Steel shall be placed per the current Building Code adopted by the City.

The contractor shall use concrete chairs for holding the steel away from the subgrade, and spreader or other type bars for securing the steel in place. The spreader bars shall be not less than three-eighth ($3/8$) inch in diameter.

G. **Preparations.** Before batching and placing concrete, all equipment for mixing and transporting the concrete shall be cleaned, all debris and ice shall be removed from places that are occupied by the concrete. Forms shall be thoroughly wet (except in freezing weather), or oiled, and masonry filler units that will be in contact with concrete shall be well drenched (except in freezing weather), and the reinforcement shall be thoroughly cleaned of ice or other coatings. Ponding water shall be removed from spaces to receive concrete.

When placing concrete on earth surfaces, the surfaces shall be free from frost, ice, mud, and water. When the subgrade surface is dry soil and previous material, it shall be sprayed with water immediately before placing of concrete or shall be covered with water-proof sheathing paper or a plastic membrane. No concrete shall be placed until the surfaces have been inspected and approved by the City Engineer.

H. **Concrete Mixing.** Ready mixed concrete shall be mixed and delivered in accordance with the requirements set forth in Tentative Specifications for Ready-Mixed concrete (ASTM C-95). Concrete shall be delivered and deposited in its final position within 60-minutes after adding the cement and water to the mixture. All concrete placed in the city right-of-way shall be ready-mixed plant concrete.

I. **Depositing.** Concrete shall be deposited as neatly and practical in its final position to avoid segregation due to rehandling or flowing. The concrete placing shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the corners of forms and reinforcing bars. No concrete that has partially hardened or been contaminated by foreign material shall be deposited in the work, nor shall retempered concrete be used. No concrete shall be dropped more than three (3) feet.

All concrete in structures shall be vibrator compacted during the operation of placing, and shall be thoroughly worked around reinforcement and embedded fixtures and into the corners of the forms.

- J. **Placing Concrete in Cold Weather.** No concrete shall be poured where the air temperature is lower than 35 degrees Fahrenheit, at location where the concrete cannot be covered or protected from the surrounding air. When concrete is poured below a temperature of 40 degrees Fahrenheit, the ingredients of the concrete shall be heated so that the temperature of the mixture shall not be less than 50 degrees or more than 100 degrees Fahrenheit. Before mixing, the heated aggregates shall not exceed 125 degrees Fahrenheit and the temperature of the heated water shall not exceed 175 degrees Fahrenheit.

Cement shall not be added while the temperature of the mixed aggregates and water is greater than 100 degrees Fahrenheit. When there is likelihood of freezing during the curing period, the concrete shall be protected by means of an insulating covering and/or heat for a period of not less than seven (7) days after placing. Concrete shall not be placed on frozen soil.

Equipment for protecting concrete from freezing shall be available at the job site prior to placing concrete. Particular care shall be exercised to protect edges and exposed corners from freezing. In the event heating is employed, care shall be taken to insure that no part of the concrete becomes dried out or is heated temperatures above 90 degrees Fahrenheit.

- K. **Finishing.** After the concrete for slabs have been brought to the established grade, it shall be worked with a magnesium float and then given a light broom finish only or as approved. 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 one-half (1/2) inch.

After concrete has been poured in curb and gutter forms, it shall be spaded so as to insure a thorough mixture, eliminate air pockets, and create uniform and smooth sides. Before the concrete has thoroughly set and while the concrete is still green, the forms shall be removed and the front and top side shall be finished with a float or steel trowel to make a uniform finished surface. Wherever corners are to be rounded, special steel trowels shall be used while the concrete is workable and the corners constructed to the dimensions specified.

The top and face of the curb and also the top of the apron on combined curb and gutter must be finished true to line and grade without any irregularities of surface noticeable to the eye. The gutter shall not hold water to a depth of more than one-fourth (1/4) of an inch, nor shall any portion of the surface or face of the curb or gutter depart more than one-fourth (1/4) of an inch from a straight edge ten (10) feet in length, placed on the curb parallel to the center line of the street nor shall any part of the exposed surface present a wavy appearance.

- L. **Curing and Protection.** As soon as the concrete has hardened sufficiently to prevent damage, all finished surfaces shall be treated with a chemical curing agent applied in accordance with the manufacturers specification.

The concrete surface must not be damaged or pitted by rain. The contractor shall provide and use, when necessary, sufficient tarpaulins to completely cover all sections that have been placed within the preceding twelve (12) hours.

The contractor shall erect and maintain suitable barriers to protect the finished surface. Any section damaged from traffic or other causes occurring prior to its official acceptance, shall be repaired or replaced by the contractor at his own expense in a manner satisfactory to the Engineer.

M. **Testing.** The contractor shall furnish to the City Engineer upon request the concrete mix design to be used prior to placement of concrete. The mix design may be modified if the City Engineer deems it necessary.

The contractor shall be responsible for testing costs associated with compressive strength and compliance testing ordered by an Authorized City Representative. Testing shall be in accordance with AASHTO T-22 and T-23.

SECTION 5 - EXCAVATION AND BACKFILL FOR PIPELINES

- A. **General.** This section covers the requirements for trenching and backfilling for underground pipelines and appurtenances.
- B. **Control of Ground Water.** All trenches shall be kept free from water during excavation, fine grading, pipe laying, jointing, and embedment operations. Where the trench bottom is mucky or otherwise unstable because of the presence of ground water, and in cases where the static ground water elevation is above the bottom of any trench or bell-hole excavation, such ground water 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.
- C. **Excavation for Pipelines.** Excavation for pipelines shall follow lines parallel to and equidistant from the location of the pipe center line. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:
- (1) Except in ledge rock, cobblestone, stones or water-saturated earth, mechanical excavation of trenches shall not extend below an elevation of four (4) inches 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. Excavation shall not be carried below the grade shown on the approved drawings. Any unauthorized excavation made below grade for any reason shall be backfilled in accordance with these specifications.
 - (2) Excavation for trenches in ledge rock, cobblestone, stones, mud or other material unsatisfactory for pipe foundation, shall extend to a depth of at least six (6) inches below the bottom of the pipe. A bedding of special material shall be placed and thoroughly compacted with pneumatic tampers in six (6) inch lifts to provide a smooth, stable foundation. Special foundation material shall consist of suitable earth materials free from roots, sod, or vegetable matter. Trench bottoms shall be hand shaped as specified in paragraph 1 above.

Where unstable earth or muck is encountered in the excavation at the grade of the pipe, a minimum of twelve (12) inches below grade will be removed and backfilled with crushed rock or gravel to provide a stable subgrade.
 - (3) The maximum width of trench measured at the top of the pipe shall be as narrow as possible, but not wider than the pipe outside diameter plus eighteen (18) inches, unless approved otherwise by the City Engineer.
 - (4) The trench wall slope and all other trench safety requirements must comply with Utah State Industrial Commission and Federal OSHA regulations.
- D. **Gravel Foundation for Pipe.** Wherever the subgrade material does not afford a sufficiently solid foundation, as determined by the City Engineer, to support the pipe and superimposed load, and where water must be drained to maintain a dry bottom for pipe installation and at other locations as previously defined, the subgrade shall be excavated to the specified depth and replaced with crushed rock or gravel.

Gravel for pipe foundations shall be clean crushed rock or gravel conforming to the following gradation:

<u>Screen</u>	<u>% Passing</u>
1"	100
1/2"	5

The gravel material shall be deposited over the entire trench width in six (6) inch maximum layers. Each layer shall be compacted by tamping, rolling, vibrating, spading, slicing, rodding, or by a combination of one or more of these methods. In addition, the material shall be graded to produce a uniform and continuous support the installed pipe.

- E. **Blasting.** Blasting will not be allowed except by permission from the City Engineer. The contractor shall comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage and use of explosives and protection of life and property. He shall be fully responsible for all damage attributable to his blasting operations. Excessive blasting or over-shooting will not be permitted. Any material outside the authorized cross-section which may be shattered or loosened by blasting shall be removed by the contractor.
- F. **Sheeting, Bracing and Shoring of Excavations.** Excavation shall be sheeted, braced, and shored as required to support the walls of the excavations to eliminate sliding and settling; and as may be required to protect the workmen, the work in progress, and existing utilities and improvements. All such sheeting, bracing, and shoring shall comply with the requirements of the Utah State Industrial Commission and Federal OSHA Requirements.

All damage resulting from lack of adequate sheeting, bracing, and shoring shall be the responsibility of the contractor, and the contractor shall make all necessary repairs or reconstruction resulting from such damage.

- G. **Bedding/Backfilling.** Backfill shall be carefully placed around and over pipes and shall not be permitted to fall directly on a pipe from such a height, or in such a manner as to cause damage. In these specifications the process of preparing the trench bottom to receive the pipe and the backfilling on each side of the pipe to a level over the top of the pipe is defined as bedding. Bedding requirements are defined in the specifications for each specific pipe material per the manufacturer's requirements.

Trench backfilling above the level of the pipe bedding shall normally be accomplished with native excavated materials and shall be free from rocks larger than four (4) inches in diameter.

The backfill in all utility trenches shall be either compacted or consolidated according to the requirements of the materials being placed under the direction of the City Engineer. Under pavements or other surface improvements, the in-place density shall be a minimum of 95% of laboratory standard maximum dry density as determined by AASHTO T-99. In shoulders and other areas the in-place density shall be a minimum of 90% of the maximum dry density as determined by the same laboratory method.

- H. **Consolidation of Backfill.** 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 City Engineer. All consolidation of backfill which uses water shall be approved by the City Engineer.

Authorization by the City 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 (4) foot intervals (staggered) throughout the length of the backfilled area and shall be slowly forced down to the bottom of the trench or the top of the previously jetted lift and held until the trench backfill is completely saturated with water. Depth of jetted lift shall not exceed three (3) feet.

The minimum size of hose and equipment shall be such as to provide a minimum pressure of thirty-five (35) pounds per square inch at the discharge. The jet shall be a rigid iron pipe with a minimum diameter of one (1) inch.

After the water-settled trench has set for a minimum of seven (7) days, any depression in the trench shall be filled, and mounded over with the fill material and recompacted.

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 allowance of the use of consolidation methods shall not be construed as guaranteeing or implying that the use of such methods will 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, or improvements, or utilities, either on the surface of the ground or underground.

- I. **Compaction of Backfill.** Backfill shall be compacted by means of sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers of a size and type approved by the City Engineer. All backfill methods shall be performed in strict compliance with the pipe manufacture requirements.

Where mechanical compaction methods are used, the material shall be placed at a moisture content such that after compaction the required relative densities will be produced. The material shall also be placed in lifts which, prior to the compaction, shall not exceed twelve (12) inches.

Prior to compaction each layer shall be evenly spread, moistened, and worked by disk harrowing, or other means approved by the City Engineer.

If the required relative density is not attained, test sections will be required to determine any adjustments in compacting 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 contractor of the responsibility for attaining the specified minimum relative densities. The contractor in planning his work shall allow sufficient time to perform the work connected with test sections, and to permit the City Engineer to make tests for relative densities.

All relative density tests shall be made by the contractor at no expense to the City and in the presence of the City Engineer.

- J. **Imported Backfill Material.** In the event the native excavated material is not satisfactory for backfilling, the contractor shall provide imported granular material. This granular material shall pass a three (3) inch square sieve and shall not contain more than 15% of material passing a 200-mesh sieve, and shall be free from sod, vegetation and other organic or deleterious materials.

- K. **Disposal of Excess Materials.** All excess materials shall be hauled away from the construction site and disposed of by the contractor unless otherwise approved by the City Engineer.

- L. **Soil Testing.** All in-place density testing of backfill shall be performed in the presence of the City Engineer by a qualified testing company. If densities do not comply with the required values, the contractor shall be required to correct any deficiencies as directed by the City Engineer. All costs associated with density testing and obtaining soil "proctors" shall be the responsibility of the subdivider/ developer.

SECTION 6 - CONCRETE PIPE

A. **General.** This section covers the requirements for concrete pipe materials and installation in sanitary sewer, storm drain, and land drain construction.

B. **Pipe.** Pipe used in sewer line, storm drain, and land drain shall be either non-reinforced concrete sewer pipe manufactured to meet ASTM C-14, or reinforced concrete pipe as manufactured according to ASTM C-76 as follows:

- (1) Non-reinforced concrete pipe shall be used for all sanitary sewers and storm drains up to and including twelve (12) inch size on the approved drawings. Pipe shall be Class 3 as shown on Table 1 of the latest revision of ASTM C-14. The joint shall consist of a bell or groove on one end of the pipe and a spigot or tongue on the adjacent end of the pipe. All surfaces of the joint upon which the rubber gasket may bear shall be smooth and free of chips, spalls, fractures, and imperfections that would adversely affect the performance of the joint.

Pipe joints shall be designed as to provide for self-centering and when assembled to compress the gasket to form a water tight seal. The joint shall meet the requirements of ASTM C-443.

- (2) Reinforced concrete pipe shall be used for all sanitary sewers and storm drains of a size larger than twelve (12) inches and/or all sanitary sewers and drain lines of a smaller size where installation does not provide a cover of at least three (3) feet over the top of the pipe. Reinforced concrete pipe shall conform to the requirements of ASTM C-76 and shall be Class III, IV, or V as designated on the plans. Joints shall be either rubber gasket conforming to ASTM C-443 or tongue and groove as indicated on the plans.

C. **Pipe Laying.** All concrete pipe installation shall proceed upgrade on a stable foundation with joints closely and accurately fitted. 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 rejointed 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 to the specific requirements of the pipe manufacturer.

D. **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 foundation material shall be as defined in Section 5 - paragraph D, of these specifications.

- E. **Installation Requirements for Line and Grade.** All pipe shall be installed accurately to the defined line and grade within the following limits:

Variance from established line and grade shall not be greater than one thirty-second ($1/32$) of an inch per inch of pipe diameter in eight (8) feet and not to exceed one-half ($1/2$) inch in eight (8) 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 ($1/2$) inch maximum.

- F. **Pipe Bedding.** All piping 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 an elevation twelve (12) inches above the top of the pipe shall be deposited and compacted in layers not to exceed six (6) inches 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 two (2) inches in 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 (12) inches above the top of the pipe. Modified bedding material shall be graded as follows: 100% passing a one (1) inch screen and 5% passing a No. 4 sieve.

- G. **Tests.** Tests for both displacement and leakage shall be conducted on the installed piping system. House service laterals shall be considered part of the main line and shall be tested with the mainline pipe. The contractor may choose test 3, 4, or 5 below, unless otherwise directed by the Engineer.

- (1) **Inspection of Sewer Lines.** All sewer lines will be recorded with a video camera to ensure quality of pipe.
- (2) **Displacement Test.** The displacement test conducted shall be conducted by the City Engineer and shall consist of the following: 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 flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe shows broken, a misaligned or displaced pipe, or other defects, the defects discovered by the City Engineer shall be remedied at the contractor's expense.

- (3) **Exfiltration Test.** This test is allowed only where groundwater does not exist. The contractor shall test all sanitary sewer pipe by means of an exfiltration test. Length of the line tested at one time shall be limited to the length between adjacent manholes.

Each section of the pipe shall be tested between successive manholes by closing the lower end of the pipe to be tested and the inlet pipe of the upper manhole with stoppers. The pipe and manhole shall be filled with water to a point approximately four (4) feet above the invert of the pipe at the center of the upper manhole.

The allowable leakage will be computed by the formula:

$$E = 0.25 D \text{ divided by } H$$

Where: E is the allowable leakage in gallons per minute per 1000 feet of pipe tested.

D is the internal diameter of the pipe in inches.

H is the difference in elevation in the water surface in the upper manhole and the invert of the pipe at the lower manhole (feet).

If the leakage for the pipe as shown by the test exceeds that allowed by the formula the contractor shall make the necessary corrections to reduce the exfiltration to within permissible limits.

Where the difference in elevation between inverts of adjacent manholes exceeds ten (10) feet, the exfiltration leakage test will be modified as directed by the City Engineer.

- (4) **Infiltration Test.** The contractor shall furnish all labor, equipment and materials, including pumps. In the presence of the City Engineer, infiltration tests of the completed pipe shall be conducted before it can be placed into service. The contractor shall furnish and install the measuring weirs or other measuring devices.

The length of line to be tested at any time and shall be subject to the approval of the City Engineer. The maximum allowable infiltration shall not exceed 50 gallons per mile per 24 hours for all installed sanitary sewer pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the City Engineer at the expense of the contractor.

(5) **Low Pressure Air Testing.** The contractor or a qualified firm or individual approved by the City Engineer shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform in the presence of the City Engineer, air tests of the completed pipe before it can be placed in service. (As covered under ASTM C-924-84; standard practice for testing.) Each section of sanitary sewer pipe between manholes shall be tested after all the four (4) inch service laterals have been installed. For the purpose of stabilizing the air pressure in each test section, the 4.0 psi pressure shall be maintained for a two (2) minute period. After the air pressure has stabilized for at least two (2) minutes, air introduction into the pipe should be stopped. After disconnection of the air supply, the pressure shall gradually decrease. When the air pressure decreases to 3.5 psi, start a stopwatch. The time for the pressure to decrease 2.5 should be noted in minutes and seconds with the stopwatch. The time noted for this pressure drop should not be less than the time shown on the following table:

<u>TEST TIME (min:sec)</u>							
<u>LENGTH</u>	<u>4"</u>	<u>6"</u>	<u>8"</u>	<u>10"</u>	<u>12"</u>	<u>15"</u>	
25	0:04	0:10	0:17	0:22	0:26	0:31	
50	0:09	0:20	0:35	0:44	0:53	1:02	
75	0:13	0:30	0:53	1:06	1:20	1:33	
100	0:17	0:40	1:11	1:28	1:46	2:05	
125	0:22	0:50	1:28	1:51	2:13	2:36	
150	0:26	1:00	1:46	2:13	2:40	3:07	
175	0:31	1:10	2:04	2:35	3:06	3:38	
200	0:35	1:20	2:22	2:57	3:33	4:09	
225	0:40	1:30	2:40	3:19	3:59	4:41	
250	0:44	1:40	2:57	3:42	4:26	5:12	
275	0:49	1:50	3:15	4:04	4:53	5:43	
300	0:53	2:00	3:33	4:26	5:19	6:14	
325	0:57	2:10	3:51	4:48	5:46	6:46	
350	1:02	2:20	4:08	5:10	6:13	7:17	
375	1:06	2:30	4:26	5:33	6:39	7:48	
400	1:11	2:40	4:44	5:55	7:06	8:19	
425	1:15	2:50	5:02	6:17	7:33	8:50	

The test section of piping and laterals shall be accepted if the time noted on the stopwatch is greater than the time required on the above table.

Failure of the contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and retested until the minimum air testing requirements have been met, at the expense of the contractor.

(6) **Sewer Lateral Connections.** All sewer lateral connections into new sewer mains shall be through preformed wyes. All connections into existing sewer line shall be done with a sewer tapping machine and as shown on the drawings. All connections to be stainless steel band connectors.

SECTION 7 - PVC PLASTIC SEWER PIPE

A. **General.** This section covers the requirements for PVC plastic sewer pipe to be used in sewer mains and sewer laterals.

B. **Pipe.** PVC plastic sewer pipe shall be made of compound conforming to ASTM D-1784 with a cell classification of 12454-A 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 for diameters four (4) inch to fifteen (15) inch and ASTM F-679 for eighteen (18) inch and twenty-one (21) inch, and shall be supplied in twenty (20) foot laying lengths. Pipe shall carry the IAMPPO UPC Seal of Approval.

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

C. **Joints.** Joints for PVC plastic sewer pipe shall be of the rubber gasket bell and spigot type, and the rubber gaskets shall conform to ASTM F-477.

D. **Fittings.** 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 and shall have gasket joints.

E. **Pipe Laying.** All pipe installation shall proceed upgrade on a stable foundation with joints closely and accurately fitted. Installation requirements of the manufacturer shall be rigidly adhered to.

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 jointing surfaces to facilitate easy positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavation 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 rejoined 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 to the specific requirements of the pipe manufacturer.

F. **Gravel Foundation.** Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, it shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place. Gravel foundation material for pipe shall be placed only when, and to the depth, requested by the City Engineer or specified on the drawings.

Gravel for PVC pipe foundations shall be clean crushed rock or gravel with 100% passing a one (1) inch screen and maximum of 5% passing a No. 4 sieve.

G. Installation Requirement for Line and Grade. All sewer 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 thirty-second (1/32) of an inch per inch of pipe diameter and not to exceed one-half (1/2) inch in eight (8) 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 (1/2) inch maximum.

H. Pipe Bedding. All pipe shall be protected from lateral displacement and possible damage resulting from impact of unbalanced loading during backfilling operations by being adequately bedded in suitable embedment material. The bottom of the trench shall be of stable materials. In general, coarse-grained soils, free of rocks and stones, such as grade crushed rock, gravel, sand and other granular materials are considered stable materials. A stable material shall be placed and compacted under the pipe haunches and up to the springline in uniform layers not exceeding twelve (12) inches in depth. When bedding is required, the same material should be used for both bedding and haunching. Stable material, free of rocks and stones, shall be used to backfill the trench from the springline of the pipe to a point at least twelve (12) inches above the top of the pipe. Each ten (10) inch layer of bedding, haunching and initial backfill shall be placed, then carefully and uniformly compacted to a 95% of AASHTO T-99 density. Extra-fine sand, clay, silt, or large soil lumps shall not be allowed as bedding, haunching, or initial backfill material. The remaining backfill over the top of the initial backfill shall be placed in accordance with Section 2.

No bedding material shall be used unless accepted by the City Engineer. Samples of the materials shall be submitted by the contractor a sufficient time in advance of intended use to enable its inspection and testing. Bedding material shall be one of the following, at the contractor's option:

(1) **Sand.** Sand bedding shall be a clean sand-gravel mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D-422:

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing by Weight</u>
3/4"	100
3/8"	70-100
#4	55-100
#10	35-95
#20	20-80
#40	10-55
#100	0-10
#200	0-3

(2) **Pea Gravel.** Pea gravel bedding shall be a clean mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D-422:

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing by Weight</u>
1-1/2"	100
3/4"	30-75
1/2"	15-55
1/4"	0-5

(3) **Gravel-Sand.**

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing by Weight</u>
1-1/2"	100
3/4"	30-75
1/2"	15-55
1/4"	0-40
#200	0-3

(4) **Crushed Rock.** Crushed rock bedding shall be a clean mixture free from organic material and conforming to the following gradation when tested in accordance with ASTM D-422:

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing by Weight</u>
5/8"	100
1/4"	50-65
#40	8-23
#200	0-10

- I. **Tests.** The contractor will be required to conduct an infiltration, exfiltration and/or air test and displacement tests in the presence of the City Engineer. If these tests prove to be inconclusive, repairs shall be performed by the contractor and any or all of the other required tests shall again be conducted in the presence of the City Engineer or his representative. Tests shall be performed as specified in Section 6, paragraph G.
- J. **Sewer Lateral Connections.** All sewer lateral connections into new sewer mains shall be through preformed wyes. All connections into existing sewer lines shall be done with a sewer tapping machine and all required fittings and materials. Connections shall be as shown in the drawings.

SECTION 8 - MANHOLES

A. **General.** The contractor shall furnish and install water-tight concrete manholes at the locations shown on the drawings approved by the City Engineer. Manholes shall be furnished complete with cast iron rings, covers, and polypropylene coated steel steps.

B. **Concrete Bases.** Manhole bases may be either monolithic precast or cast-in place unless otherwise specified. Precast manhole bases shall have pipe inverts, a neoprene boot with strap for each pipe connecting to the manhole, and a minimum of six (6) inches of compacted gravel base under the manhole.

Where pipe line 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 flows within the manholes shall be made with a smooth curve with as long of a radius as possible. The floor of the manhole outside the channels shall be smooth and slope toward the channel at not less than one-half (1/2) inch per foot.

The connecting boots shall be made of neoprene compound meeting ASTM C-443 specifications. The boot shall have a wall thickness of three-eighths (3/8) inch. 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 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 Engineer.

Manholes with three or more pipes entering the base or pipes larger than twenty-four (24) inches in diameter shall be sixty (60) inch inside diameter. All others shall be forty-eight (48) inch inside diameter concrete for manhole bases.

C. **Wall and Cone Sections.** All manhole sections shall be precast, sectional, reinforced concrete of either forty-eight (48) inch or sixty (60) inch, as specified. Both cylindrical and taper sections shall conform to all requirements of ASTM C-478 Designation.

- (1) The taper section shall be of eccentric conical design, three feet in height, and shall taper uniformly from forty-eight (48) inches or sixty (60) inches to thirty (30) inches inside diameter.
- (2) The pipe used in the wall section shall be furnished in section lengths of one (1), two (2), three (3), and four (4) feet as required.
- (3) Reinforcing steel shall be placed per ASTM C-478 designation.
- (4) The "D-Load" test will not be required.
- (5) In areas where the water table is high, rubber gasket joints shall be used between manhole sections.

All joints surfaces of precast sections and the face of the manhole base shall be thoroughly cleaned and wet prior to setting precast sections. Joints shall be set in mortar consisting of one part cement and one and one-half (1-1/2) parts sand with sufficient water added to bring the mixture to workable consistency.

Bituminous jointing material may be used in lieu of cement mortar and shall be installed in accordance with manufacturer's recommendations. All joints shall be watertight and free from appreciable irregularities in the interior wall surface.

- D. **Iron Castings.** All iron castings shall conform to the requirements of ASTM A-48 (Class 30) for grey iron castings.

Rings and covers shall be thirty (30) inch diameter as supplied by "D & L Supply" Model A-1181 or any approved equal. Each cover shall contain one pick hole and air vent holes. In addition to the foundry name and year of manufacture, the cover shall be marked "SEWER" or "STORM DRAIN," as appropriate.

- E. **Polypropylene Covered Steel Steps.** Steps shall be provided and installed at an interval of twelve (12) inches in both the base and cone sections. These steps shall be PSI-375, M.A. Industries, Inc. or an approved equal.

All manhole rings shall be carefully set to the grade shown on the approved drawings or as directed by the City Engineer.

- F. **Concrete collars.** All manhole lids to be raised within three-eighth (3/8) inches of the finish surface and have an eight (8) inch thick and twelve (12) inch wide concrete ring.

SECTION 9 - DUCTILE IRON PRESSURE PIPE (WATER LINES)

A. **General.** This section covers the requirements for ductile iron pressure pipe material and installation.

B. **Materials.** Ductile iron pipe shall conform to all requirements of ANSI A-21.51, "Ductile Iron Pipe, centrifugally Cast in Metal Molds or Sand Lined Molds, for Water or Other liquids." Minimum thickness shall be Class 52.

C. Joints.

- (1) **Mechanical Joints.** All mechanical joints shall meet requirements of ANSI A-21.6 and ANSI 21.11. All gasket surfaces shall be smooth and free from imperfections. Gaskets shall conform to tests in accordance with specifications and shall be new and less than one (1) year old.

Mechanical joint restraint fittings (e.g. megalug) shall be used on all valves, bends, caps & hydrants.

Bolts shall meet all requirements of the above specification, honoring all characteristics, tolerances, and tests.

- (2) **Push-on Joints.** All push-on joints shall meet the requirements of ANSI 21.11. Gaskets shall be free from defects and not over one (1) 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 21.11.

- (3) **Flanged Joints.** 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 threaded pipe. Flanges shall be faced and drilled and of proper dimensions for size and pressure required. All flanges shall meet requirements of ANSI A-21.10, "American Standard for Cast Iron Fittings."

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 three-eighth (3/8) inch less than one-eighth (1/8) inch extends past face of nut.

Gaskets shall be one-sixteenth (1/16) inch thick, made of best quality sheet gasket material or equal. A gasket for each flanged joint of proper size, ring type or full face as shown on the drawings.

- (4) **Compression Joints.** Compression joints shall be mechanical joint sleeve, Rockwell 441 or Flange adapter Rockwell 912 or approved equal.

D. Fittings.

- (1) **Mechanical Joint Fittings.** Mechanical joint fittings shall conform to ANSI/AWWA C-153, "American Standard for Cast Iron Fittings."

- (2) **Push-on fittings.** Push-on fittings shall conform to ANSI A 21.10 with bells, sockets, and plain ends per ANSI A-21.11.

- (3) **Flanged Fittings.** Flanged fittings shall conform to ANSI/AWWA C-110, "American Standard for Cast Iron Fittings."

All flanges shall be faced and drilled. When cap screws or stud bolts are needed, flanges shall be tapped to support cap screws or stud bolts.

- E. **Pipe Laying.** Cast iron pipe shall be laid as specified in AWWA Standard for "Installation of Cast Iron Water Mains" C-600, except as modified herein and in Special Conditions. Tee, elbows, crosses, and reducers shall be used for changes in direction and outlets, as shown on the drawings. Anchors and thrust blocks shall be placed at valves, elbows, tees, etc., as shown on the drawings and as directed by the City Engineer.

All ductile iron pipe installation shall proceed 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. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for new pipe. In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with adjoining pipe and to prevent sudden offsets to the flow line. As work progresses, the interior of the pipe shall be cleared of dirt and superfluous materials of every description. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after jointing has set, and pipe shall not be laid when condition of the trench or weather is unsuitable for such work. At all times when work is not in progress, all open ends of the pipe and fittings shall be securely closed to the satisfaction of the City Engineer so that no water, earth, or other substance will enter the pipe or fittings.

- F. **Gravel Foundation.** 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 and gravel compacted into place.

Gravel for ductile iron pipe foundations shall be clean crushed rock or gravel with 100% passing one and one-half (1-1/2) inch screen and 5% passing a No. 4 sieve.

- G. **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 material placed at any point below the midpoint of the pipe shall be deposited and compacted in layers not to exceed six (6) inches 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 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 (12) inches above the top of the pipe.

Modified bedding material shall be graded as follows: 100% passing a one (1) inch screen and 5% passing a No. 4 sieve.

H. **Polyethylene Wrapping.** Ductile iron pipe materials placed are required to be wrapped, with a polyethylene plastic wrap the entire length of the pipeline materials, including all fittings and valves, in accordance with the manufacturer's specifications as determined by the soil conditions and/or a geotechnical report. This shall be completed in order to provide the necessary cathodic protection.

Polyethylene encasement wrap shall consist of one (1) or more wraps of sheet polyethylene plastic to produce a minimum thickness of eight (8) mils over all surfaces. The wrap shall be sufficiently loose so that it will contact all surfaces without tension after backfilling. The wrap shall extend one (1) foot over adjacent surfaces. The overlap at edges of the plastic shall be a minimum of one (1) foot, and the laps shall be secured in place. Ends of the wrap shall be secured by circumferential bands on one (1) inch wide polyethylene plastic tape applied under light tension.

Where polyethylene wrap is specified, all compression couplings, mechanical joints, flanged joints and valves exposed to soil shall be wrapped with eight (8) mil thick polyethylene film adhesive tape equal to Polyken No. 900 or Scotchrap No. 50. The tape shall be installed to adhere securely to both the pipe and polyethylene. All threaded connections and/or bolts shall be encased with a APWA approved lubricant grease. Enough film shall be used to overlap the adjoining pipe a minimum of one foot.

Valves shall be wrapped by bringing the wrap on the adjacent pipe over the bells or flanges of the valve and sealing with the adhesive tape. The valve bodies are then wrapped with a flat sheet of the film passed under the valve bottom and brought up around the body to the stem and fastened in place with the adhesive tape.

All fittings that require concrete blocking should be completely wrapped prior to pouring the concrete thrust block.

Polyethylene wrap shall be protected from the sun and weathering prior to use. Care shall be exercised during backfilling of the protected areas to prevent puncturing the film. The bottom of the trench shall be shaped to give substantially uniform circumferential support of the lower third (1/3) of each pipe.

- I. **Pipe Sizes.** If the size of any piping is not clearly evident in the drawings, the contractor shall request instructions from the City Engineer as to the proper sizing. Any changes resulting from the contractor's failure to request clarification shall be at the contractor's expense.
- J. **Cleaning and Flushing.** The contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be thoroughly cleaned to remove rocks, dirt, and other foreign matter by washing, sweeping, scraping, or other method that will not harm the lining or pipe.

Water required for flushing shall be furnished by the contractor. All temporary connections for flushing and drainage shall be furnished, installed, and subsequently removed by the contractor.

All open ends of pipes shall be bulkheaded or plugged when workmen are not on the job or in the immediate area to prevent rocks or other foreign matter from entering the pipe.

- K. **Service Connections.** Service connections to ductile iron pressure pipe shall be through either tapped couplings (AWWA thread) with teflon tape to be spirally wrapped completely around the thread area prior to insertion of the corporation stop, or by bronze double strap service saddle. Reducing bushings shall be of nylon.

SECTION 10 - POLYVINYL CHLORIDE (C-900) PRESSURE PIPE (WATER LINES)

A. **General.** This specification cover polyvinyl chloride (C-900) pipe and fittings made in standard thermoplastic pipe dimension ratio (SDR) and pressure rated for the pressurized transmission and distributions of potable water for municipal service.

B. **Materials and Workmanship.** Pipe shall be extruded from clean, polyvinyl compounds (PVC 1120, PVC 1220, or CPVC 4120) conforming to ASTM Resin Specification D 1784. Pipe shall meet or exceed the requirements of ASTM D 2241, "Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)."

The pipe shall be homogeneous throughout; and free from visible cracks, holes, foreign inclusions, or other defects. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties. Pipe surfaces shall be free from nicks, scratches, gouges and other imperfections that might weaken the pipe wall or cause leakage at joints.

The PVC pipe shall bear the seal of approval of the National Sanitation Foundation for potable water service.

C. **Pressure Class.** Pressure class rated pipe shall provide not less than the following allowable working pressure, conforming to ASTM D 2241.

<u>Pressure Class</u>	<u>Allowable Working Pressure psi</u>	<u>Minimum DR ratio</u>
160	160	26
200	200	21

D. **Dimensions.** The dimensions and tolerances of the pipe barrel and bell ends shall conform to the applicable requirement of ASTM D 2241 for the pressure-class specified.

E. **Fittings.** All fittings and accessories shall be a manufactured or recommended by the pipe manufacturer, or accepted equal, and have bell and spigot configuration identical to that of the pipe. The pipe fittings may be manufactured from PVC, cast iron, ductile iron, or welded steel, and shall have strength equal to or greater than the pipe which they attach. Fittings shall be installed as specified by the manufacturer.

F. **Joints.** The pipe and fittings shall be furnished with integrally thickened bell and spigot ends; for joining with a solid, uniform cross-sectional elastomeric gasket as the sealing element. Couplings will not be permitted. The gasket shall not be required to support the weight of the pipe when two sections are joined; but shall serve only as a seal, and shall conform to ASTM D 3139.

The critical sealing dimensions of the bell, spigot, and gasket shall be in accordance with the manufacturer's standard dimensions and tolerances. The gasket shall provide an adequate compressive force against the sealing surfaces of the bell and spigot so as to effect a positive seal under all combinations of the joint tolerances. The gasket shall be the only element depended upon to make the joint flexible and watertight. Solvent welded joints will not be permitted unless written approval is obtained from the Engineer prior to welding the joint.

F. **Pipe Tests.** The pipe manufacturer shall perform the inspection and testing as specified in ASTM D 2241 on a representative sample of the manufacturer's product and shall furnish to the City a certificate affirming that their product meets the requirements of ASTM D 2241, and the additional requirements of these specification, including the drop impact test.

(1) Drop Impact Test. All sizes of the pipe and fittings shall be tested in accordance with ASTM D 2444; and shall with stand without failure. There shall be no visible evidence of shattering or splitting when the recommended energy is imposed.

(2) Field Tests. The Contractor shall perform the field tests required in Section of these specifications.

G. **Installing PVC Pipe.** The pipe manufacturer's written instructions and recommendations, and the requirements shall be followed in installing the pipe. The maximum width of the trench at the top of the pipe shall be as shown on the drawing "Trench Details".

I. **Special Requirements.**

(1) Certification. The pipe manufacturer shall furnish the City certificates of all test. The certificates and pipe shall be so marked that the test results can readily be identified with the pipe furnished. The "Certificates of Tests" shall be received by the City prior to the installation of any of the pipe covered by the certificate.

(2) Marking. Marking on the pipe shall include the nominal pipe size, ASTM D 2241, Class and dimension ration (DR), the NSF seal of approval, and the manufacturer's name or trademark. Marking intervals shall be not more than 5 feet.

(3) Polyethylene Wrap. Where directed by the City Engineer, ferrous fittings and valves shall be wrapped with 8-mil thick polyethylene film, tube or sheet. The film shall be held in pace by 2-inch wide plastic-backed adhesive tape equal to Polyken No. 900 or Scotchrap No. 50. The tape shall be installed to adhere securely to both the pipe and polyethylene. All threaded connections and/or bolts shall be encased with a APWA approved lubricant grease. Enough film shall be used to overlap the adjoining pipe an minimum of 1 foot.

Polyethylene wrap shall be protected from the sun and weathering prior to use. Care shall be exercised during backfilling of the protected areas to prevent puncturing the film.

SECTION 11 - WATER LINE WARNING TAPE

- A. **General.** This section covers requirements for waterline warning tape required with the construction of water lines and services as shown in the standard detail drawings.
- B. **Specifications.** A non-detectable acid and alkali-resistant safety warning tape for the protects. location and identification of underground water lines shall be installed. The tape shall consists of a nominal 4-mil overall thickness, inert 100% low density polyethylene plastic film formulated for extended use underground. The tape is to be supplied in accordance with the ARWA national color code and permanently imprinted with a black, environmentally safe ink with an appropriate legend to define the type of utility line it protects.

<u>Property</u>	Test Data	
	<u>Method</u>	<u>Value</u>
Thickness	ASTM D 2103	4-mils (nominal)
Tensile strength	ASTM D 882	10 lbs/in width
Elongation	ASTM D 882-88	600%
Printability	ASTM D 2578	>40 dynes/cm ²

SECTION 12 - VALVES, HYDRANTS, AND MISCELLANEOUS ITEMS

- A. **General.** This section covers requirements for gate valves, hydrants, and miscellaneous items required in the construction of water lines and services.
- B. **Gate Valves.** Gate valves shall conform to AWWA C-509 specifications. Valves shall be of iron body, resilient seat gate with modified wedge disc, non-rising stem design with O-ring seats. Unless otherwise shown or specified, valves shall be of mechanical joint connection design for buried service, and flanged connection design for installation in structures. Gate valves shall be "Mueller" resilient seat gate valves unless approved otherwise by the City Engineer. Buried valves shall have a two (2) inch operating nut; valves in structures shall have hand wheels.
- C. **Valve Boxes.** All buried gate valves shall be installed complete with a cast iron, two (2) piece, slip-type, 5-1/4" shaft valve box. Valve boxes shall be "Tyler" 6855 series unless approved otherwise by the City Engineer.
- D. **Fire Hydrants.** Hydrants shall be designed, manufactured, and tested in compliance with the latest edition of AWWA C-502 "Standard for Dry Barrel Fire Hydrants" and shall be "Mueller" A-423 Centurion or Clow Medallion Fire Hydrant unless approved otherwise by the City Engineer.

The hydrant main valve shall be a minimum diameter of 5-1/4" with two (2) 2/1/2" NST hose nozzles, and one 4-1/2" NST pumper nozzle. The hydrant shall be supplied complete with a flanged by mechanical joint end, auxiliary gate valve connected by flange at the main line tee complete with box next to the main line and installed per drawings.

- E. **Water Services.** Pipe for residential water services shall be three-fourth (3/4) inch type K soft copper tubing with flared or compression fittings conforming to ASTM B-88. (Service larger than three-fourth (3/4) inch shall be approved by the City Engineer). Connection of the water service to the main lines shall be through a corporation type stop equal to Mueller H-15000. (A horizontal gooseneck shall be formed with the copper tubing immediately adjacent the corporation stop). Copper is required for all services that are three (3) inch or less. The service line shall be stubbed from the meter box to the property line.
- F. **Water Meter Box, Ring and Cover.** Meter boxes shall be round eighteen (18) inch diameter pre-cast plastic or concrete box, thirty (30) inch in length, notched for service pipe. The ring and cover for the meter box shall be cast iron with a locking cover, operated by a pentagon head and shall have a twelve (12) inch minimum opening diameter. The meter shall also have an opening for an electronic meter system. The top of the meter box shall be level with finish grade.

SECTION 13 - TESTING AND DISINFECTION OF CULINARY WATER LINES

- A. **General.** All culinary water lines shall be tested, flushed, and disinfected as outlined in this section.
- B. **Testing.** Tests shall be made upon completion of system installation or any valved portion thereof. All tests shall be made by Clearfield City at the expense of the contractor and in the presence of the City Engineer or City Representative.

Lines shall be slowly filled with water venting off all air. If required, taps shall be provided at line high points, to bleed off air and after testing these shall be plugged. A minimum pressure 200 psi shall be maintained on the portion being tested for a minimum period of two hours. This pressure shall remain steady for a period of two (2) hours for water line approval.

- C. **Flushing.** After pressure testing, all pipelines shall be flushed. Flushing shall be accomplished through hydrants or, if a hydrant does not exist at the end of the line, the contractor shall install a tap sufficient size to provide for a 2.5 foot per second flushing velocity in the line. The following is the flow quantity required to provide a 2.5 foot per second flushing velocity:

Pipe Size <u>(in.)</u>	Flow <u>(gpm)</u>
4	100
6	220
8	390
10	610
12	880

- D. **Chlorination.** After pipeline flushing, all culinary water lines shall be disinfected by chlorination. Chlorination shall provide a minimum of thirty (30) ppm residual after twenty-four (24) hours contact in the pipeline. This may be expected with an application of fifty (50) ppm although some conditions may require more. Chlorine, in the form of a 1% slurry of high test calcium hypochlorite shall be fed into the pipeline in such a manner as to mix with the water flowing in the pipeline.

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

Pipe Size <u>(in.)</u>	Vol. of 100 Ft. <u>Length (gal.)</u>	Required Amount of <u>Slurry (gal.)</u>
4	65	0.47
6	147	1.05
8	261	1.87
10	408	2.92
12	588	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, and if necessary, rechlorinated until a satisfactory bacteriological test is obtained. Any chlorinated water waste shall not be discharged into Clearfield City storm water system unless neutralized nor discharged into the Clearfield City sanitary sewer system without approval.

- E. **Clear Water Test.** Following chlorination and flushing of the water line a clear water test shall be taken in the presence of the City Engineer. A maximum of one (1) ppm of chlorine will be allowed to be present in the pipeline. Should a higher residual of chlorine be present the contractor shall be required to re-flush the water line and retest.
- F. **Bacteriological Test.** Following completion of the clear water test, a water sample shall be taken to an approved laboratory. A bacteriological test, approved by the Utah Department of Environmental Quality, shall be performed. Upon successful completion of all noted tests listed above, along with the bacteriological test, the culinary water pipeline may then be connected and/or placed into service.

SECTION 14 - CONSTRUCTION AND PLACEMENT OF THRUST BLOCKS

- A. **Scope.** This section of the specifications defines the placement and the construction of thrust blocks here required. It also gives the concrete mix design requirements for the concrete required in the construction of the thrust blocks.
- B. **Placement.** Thrust blocks are required at points where the pipe changes direction such as: at all tees, elbows, wyes, caps, valves, hydrants, reducers, bends, etc. Thrust blocks should be constructed so that the bearing surface is in direct line with the major force created in the pipe or fitting. The earth bearing surface should be undisturbed. (See the drawings for typical thrust block details).
- C. **Concrete Mix Design.** The Portland Cement Concrete mixture is given in Section 4 paragraph C. The concrete mixture shall have a minimum twenty-eight (28) day compressive strength of 3,000 pounds per square inch.

SECTION 15 - RESTORATION OF SURFACE IMPROVEMENTS

- A. **General.** The 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 are not limited to, permanent surfacing, curbs, ditches, driveways, culverts, fences, landscaping and walls. All improvements shall be reconstructed to equal or better, in all respects, the existing damaged improvements removed and disposed properly.
- B. **Road Base Surface.** Where trenches are excavated through road base surfaced areas such as roads and driveways, etc., the road base surface shall be restored and maintained as follows:
- (1) The road base shall be placed deep enough to provide a minimum of eight (8) inches of material.
 - (2) The road base 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 satisfactory to the City Engineer. Excess material shall be removed from the premises immediately.
 - (3) Material for use on road base surfaces shall consist of select material, either natural or crushed, and shall be graded as per Section 3 paragraph B.
- C. **Bituminous Surface.** Where trenches are excavated through bituminous surfaced roads, driveways, or parking areas, the surface shall be restored and maintained as follows:
- (1) A temporary road base surface shall be placed and maintained as required in paragraph above, after the required backfill and compaction of the trench has been accomplished.
 - (2) The road base shall be placed to such depth as to provide a minimum of ten (10) inches below the pavement and shall be brought flush with the paved surface.
 - (3) The area over trenches to be resurfaced shall be graded and compacted. Mud or other soft or spongy material shall be removed and the space filled with gravel and rolled and compacted thoroughly in layers not exceeding twelve (12) inches in thickness. The edges of trenches which are broken during the preparation or installation of the subgrade shall be removed and trimmed straight before resurfacing.
 - (4) Before any permanent resurfacing is placed, the contractor shall trim or cut the existing paving to clean, straight lines as nearly parallel to the centerline of the trench as practicable. Said straight lines shall be thirty (30) feet minimum length and no deviations from such lines shall be made except as specifically permitted by the Engineer.
 - (5) Existing bituminous paving shall be cut back a minimum of six (6) 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 six (6) inches of undisturbed soil.
 - (6) As soon as is practical, weather permitting, the bituminous surface shall be restored by standard paving practices to a minimum thickness per the roadway classification, and/or existing depth of asphalt under the direction of an Authorized City Representative.

- (7) Pavement restoration shall include tacking of pavement edges and subbase with a bituminous material, and placing a hot plant mix bituminous material to the level of the adjacent pavement surfaces.

D. Concrete Surfaces. All concrete curbs, gutters, sidewalks, and driveways shall be removed and replaced to the next joint or scoring line beyond the actually damaged or broken sections; or in the event that joints or scoring lines do not exist or are three (3) or more feet from the removed or damaged section, the damaged portions shall be removed and reconstructed to neat, plane faces. All new concrete shall match, as nearly as possible, the appearance of adjacent concrete improvements. Where necessary, lampblack or other pigments shall be added to the new concrete to obtain the desired results.

All concrete work shall conform to the requirements of Section 4 of these specifications.

SECTION 16 - SUBSURFACE DRAIN PIPE MATERIALS

- A. **General.** Buried drain pipe with open joints or perforated pipe shall be provided for the drains in the locations shown on the drawings.
- B. **Material.** Drain pipe may be perforated PVC pipe (ASTM D-1784) non-perforated or concrete pipe. Corrugated polyethylene piping (ASTM F-405-77) may also be used if installed with direct burial laser grade control equipment.

Non-perforated pipe shall be extra-strength non-reinforced concrete. The pipe may be furnished with either bell-and-spigot or tongue-and-groove joints. Laying lengths of the non-perforated pipe shall not exceed four (4) feet to insure open joints between lengths of pipe, spacer lugs approximately one-eighth (1/8) inch thick located on the one-third (1/3) or one-fourth (1/4) points around the perimeter shall be provided at each joint between lengths of drain pipe. The lugs may be cast on one (1) 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 may be corrugated polyethylene pipe with one-fourth (1/4) inch diameter perforations, extra strength non-reinforced concrete pipe, or reinforced concrete pipe, and may be furnished with bell-and-spigot or tongue-and-groove joints.

- C. **Laying Pipe.** Gravel backfill shall be placed under the pipe to the minimum depth as shown on the drawings. The pipe shall be laid carefully on the gravel in a workmanlike manner and to the lines and grade shown on the drawings or established by the City Engineer. The joints for non-perforated pipes shall be covered with an approved drainage fabric.

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 up grade. The water level in the trench area where the pipe is being laid shall be held to a minimum. The pipe shall not be covered with backfill until it has been inspected and approved by the City Engineer. After approval, the trench shall be backfilled as prescribed in Section 5.

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 piping, if a clear and unobstructed view of the pipe interior cannot be obtained by use of a light or sun reflector, a device approved by the City Engineer, having a diameter one (1) inch less than the drain pipe to be tested, shall be pulled through the pipe between manholes. Any obstruction found in the pipe 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 pipe, such as use of water pressure, shall be subject to the approval of the City Engineer.

- D. **Concrete Culvert Pipe.** Concrete culvert pipe (reinforced or non-reinforced) shall be furnished and installed as shown on the drawings. Concrete culvert pipe shall be in accordance with ASTM Designation C-76 (reinforced pipe), ASTM C-14 (non-reinforced). Joints shall be bell-and-spigot with gaskets required. The minimum diameter unless approved by the City Engineer shall be fifteen (15) inches.
- E. **Catch Basin Grates.** Grates for catch basins may be shop fabricated and galvanized from steel per ASTM A-36 or as shown on the drawings.

SECTION 17 - IRRIGATION WATER

- A. **Special Note.** Clearfield City does not have a City Irrigation System. This section provides a minimum standard for all private irrigation systems that are/or will be located in the City right-of-way.
- B. **Supply.** Each secondary water system shall originate from a reliable water source capable of delivering a minimum annual supply of three (3) acre-feet per acre of irrigatable property. In the case where the supply is provided by a local irrigation company or a water conservancy district, the developer shall obtain a written agreement from the irrigation company or water district committing themselves to providing the required supply. This agreement shall be reviewed and approved by the city prior to recording of the subdivision.
- C. **Distribution and Delivery.** Each secondary water system shall provide a complete pressure distribution system with minimum three-fourth (3/4) inch diameter service connections to the property line of each lot. Service connections larger than three-fourth (3/4) inches shall be required on service areas exceeding one-half (1/2) acre, as approved by the City Engineer. A pressure system shall be required, with pressure within the system ranging from 40 psi to 100 psi. All facilities including reservoirs, pump stations, distribution systems, and miscellaneous structures, shall be constructed in recorded easements, dedicated streets, or on property which has been conveyed to the water company or water district. The pressure distribution system shall be constructed at the standard location shown on the drawings. Distribution systems shall be complete with sufficient gate valves and drains.
- D. **Material.** Secondary water systems shall comply with the following minimum material specifications.
- (1) **Pipe.** The system may use any one of the following types of piping materials:
 - a. **Ductile Iron Pipe.** AWWA Spec. C-151-76 minimum thickness Class 50 with rubber gasket push-on joints.
 - b. **PVC PIPE.** ASTM D-2241-200 psi class with rubber gasket push-on joints.
 - c. **Polyethylene Pipe.** ASTM D-2239-SDR 7-PE 3408.
 - d. **C-900 Pipe:** AWWA C-900, Class 200, DR-14 with rubber gasket push-on joints.
 - (2) **Gate Valves.** Gate valves shall conform to AWWA Specification C-500. Valves shall be of cast iron body, resident seat with modified wedge disc, nonrising stem design, provided with O-ring packing. Valves shall be of flange or mechanical design and shall be of the nonrising stem design with a two (2) inch square operating nut.
 - (3) **Valve Boxes.** All buried valves shall be installed complete with two (2) piece, cast iron, slip type, 5- 1/4 inch shaft valve boxes.
 - (4) **Concrete.** All concrete used within the system shall conform to the requirements of Section 4.
 - (5) **Reinforcing Steel.** All reinforcing steel shall be deformed bars conforming to the requirements of ASTM A-615-68, Grade 40. Any welded wire fabric used shall conform to ASTM A-185. Bar chairs, spaces, and other supports as stipulated in ACI-315.

- (6) **Special Valves.** Air/vacuum release valves shall be provided at high points in the distribution system and at all pump stations in accordance with city approved construction drawings. Drainage valves must be provided in the system to prevent freezing. Drain piping shall be constructed in accordance with city approved construction drawings.
- (7) **Pump Stations.** Pump stations shall be constructed in accordance with city approved construction drawings and shall be capable of delivering sufficient flow and pressure to meet all peak demands on the system.
- E. **Installation, Cleaning, Flushing, and Pressure Testing.** These items shall be in accordance with preceding sections on culinary water systems under the same headings. (Except chlorination and bacteriological testing).
- F. **Approval and Acceptance.** Prior to construction of the secondary water system, all construction plans shall be approved by an Authorized City Representative. In the event that the secondary system will be an extension or a part of a local irrigation company or water district, the plans shall also be approved by these entities. The Secondary water system shall be considered as a required subdivision improvement and shall be under the same construction guarantees, release of funds procedures, and acceptance as the regular subdivision improvements. The city shall not release funds or grant formal acceptance until both the city and the irrigation company or water district have conducted final inspections and can certify that the completed system conforms to plans and specifications. Following final approval and acceptance, ownership, operation and maintenance of the completed system shall be the responsibility of the irrigation company or water district.

SECTION 18 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

A. **Abbreviations.** Abbreviations that are used in this section include the following:

- SWPPP - Storm Water Pollution Prevention Plan
- NOI - Notice of Intent
- NOT - Notice of Termination
- BMP - Best Management Practices

B. **General.** Each site will be responsible for preparing a Storm Water Pollution Prevention Plan. The type of SWPPP is dependent on the site.

- (1) Project site less than 5,000 square feet (5,000 ft²) (not located in a sensitive area or a demolition) will not be required to obtain an Clearfield City SWPPP permit.
 - a. These sites must still comply with Municipal, State, and Federal Storm Water Regulations.
 - b. The responsible party must sign and certify the SWPPP.
- (2) Project site greater than 5,000 square feet (5,000 ft²) but less than one acre shall be required to obtain a city SWPPP permit.
- (3) Projects one acre (1 acre) or larger, part of a common plan development, and/or projects involving sensitive areas:
 - a. Must file an NOI with the state of Utah Division of Water Quality (A few exceptions may apply for projects located in sensitive areas).
 - i. Fill out and complete a State SWPPP Booklet (or approved equal) if an NOI is filed.
 - ii. If an NOI is filed, then the responsible party must file an NOT to conclude the project and end inspection requirements.

C. **BMP's.** All Best Management Practices (BMPs) shall be properly selected, installed, and maintained in accordance with manufacturer specifications and good engineering practices.

D. **Stabilization.** Portions of the site where construction activity is temporarily or permanently ceased Must be stabilized within 14 days. Unless construction will resume within 21 days.

E. **Protection.** Litter, debris, and chemicals must be protected from exposure to storm water.

F. **SWPPP Permit Requirements.** The following will be required when submitting for a SWPPP permit:

- (1) General Site Plan shall include:
 - a. A description of the protocol for ensuring the following permit requirements will be met.
 - b. The identification of all potential sources of pollution which may affect the quality of storm water discharges from the project site.

- c. Each contractor must have a qualified trained Inspector to conduct SWPPP inspections. The Inspector must meet all requirements of and be recognized as an Inspector by the State of Utah.
- d. A list of all operators at the site in charge of meeting the permit requirements and the implementation of the SWPPP permit.

(2) Site Description shall include:

- a. A general location map.
- b. The total area of site to be disturbed.
 - i. Include amount of pervious and impervious surface.
- c. The runoff coefficient for pre-construction and post-construction.
- d. A map identifying discharge locations near the site.
- e. A description for measures to minimize off-site tracking of sediment.
 - i. Include control measures for the generation of dust.
- f. A description of construction materials to be stored on site.
 - i. List measures to limit exposure, spill prevention, and response practices for operators on site.
- g. Describe all measures/waste disposal practices which prevent discharge of solid material and building materials from entering Ogden City Storm Sewers, or any nearby body of water.
- h. Describe any post-construction storm water management controls being utilized on site.
 - i. Identify reasons for utilization of these methods.

(3) The Structural Practices shall include:

- a. Any technical explanations and practices utilized for the current project.
- b. A description of structures used on site.
- c. The controls used to minimize off-site tracking.
- d. A description of materials to be stored on site.
- e. A description of any post-construction controls.

- (4) Site Map shall be complete and to scale, of the entire site. The site map shall be included with the approved set of drawings submitted to Clearfield City. A copy of this plan needs to remain on site at all times and shall include:
 - a. A page showing the drainage patterns of the site.
 - i. Include approximate slopes after major grading activities.
 - b. Any areas of soil disturbance and areas not being disturbed.
 - c. The locations of control measures.
 - d. Any Storm Water discharge locations.
 - i. Show locations where storm water discharges from the site, and how it discharges.
- (5) Stabilization Practices shall include:
 - a. A description of any temporary and/or permanent stabilization practices to be used for the development.
 - i. The practices shall make known the responsible party for the each practice.
- (6) All Contractors must comply with the new construction State Permit effective July 1, 2014.
 - a. For a copy of the new construction state permit go to: waterquality.utah.gov

PART II

DRAWINGS

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