

TECHNICAL SPECIFICATIONS

for

CITY OF ROCKAWAY BEACH

April 2002

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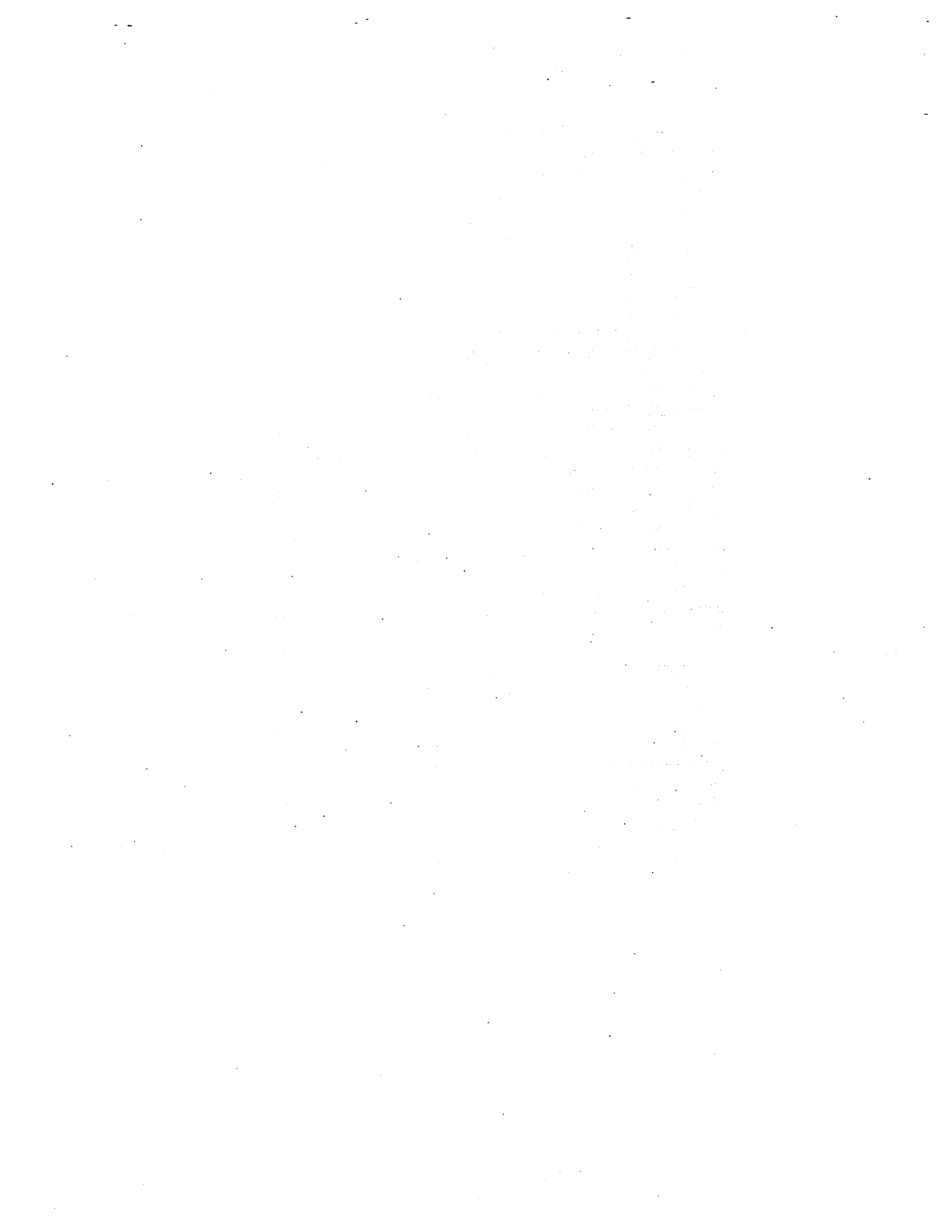
CITY OF ROCKAWAY BEACH TECHNICAL SPECIFICATION

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205 DEMOLITION**205.1 DESCRIPTION:**

This item includes all work necessary for the demolition, removal and disposal of all pavement, curbs, driveways and sidewalks within the designated limits and to preserve from injury or damage such objects and structures as are designated to remain in place.

This item also includes the disposal of unsuitable and excess excavated material within the designated limits.

205.2 MATERIAL:

No disposal sites will be provided by the City. The Developer or the Developer's Contractor shall be responsible for providing a suitable disposal site for all demolition material.

205.3 CONSTRUCTION:

205.3.01 Public streets used by the Contractor between the project site and all disposal sites shall be kept free and clear of any and all debris resulting from the Contractor's demolition activity.

205.3.02 Concrete surfaces designated to remain and which will abut new concrete surfaces shall be sawcut to a neat and straight edge.

205.3.03 Asphalt surfaces designated to remain and which will abut new asphalt surfaces shall be sawcut to a neat and straight edge. The asphalt shall be cut before removal of asphalt begins.

210 CLEARING, GRUBBING, AND ROUGH GRADING**210.1 DESCRIPTION:**

This item includes all work necessary to clear, remove and dispose of all debris and vegetation such as stumps, trees, logs, roots and brush within the designated limits, and to rough grade the areas to the profiles as shown on the plans so as to leave the areas that have been disturbed with a neat and finished appearance free from vegetative debris.

210.1.01 Clearing is defined as the cutting and removal of trees, snags, high stumps, brush and branches, and the removal of down trees, logs and loose brush and debris at or above the surface of the ground.

210.1.02 Grubbing is defined as the removal of wood items remaining at or below the ground surface following the clearing operation to a depth of 1 foot below the existing grade. All stumps and roots thereof shall be completely removed.

210.1.03 Rough grading is defined as the excavation and grading of all clearing limit areas to conform with the lines, grades and dimensions shown on the plans, and to leave such areas with a neat and finished appearance.

210.2 MATERIALS:

210.2.01 A disposal site shall be provided by the Developer or the Developer's Contractor. The Contractor shall obtain the necessary permits and approvals for this disposal site.

210.3 CONSTRUCTION:

210.3.01 Areas to be Cleared and Grubbed - The areas on which clearing and grubbing is to be performed shall be the areas indicated by the clearing limit areas shown on the plans and as staked by the Project Engineer.

210.3.02 Ownership and Disposal of Materials - Clearing and grubbing material shall become the property of the Contractor and shall be disposed of by the Contractor in compliance with all federal, state, and local laws, regulations, rules, and ordinances and in conformance to the provisions herein set forth as follows:

210.3.02A Burnable material may be burned within the clearing limit areas in street rights-of-way on the project where the burning will not injure or endanger adjacent properties or trees. No burning will be allowed on easement areas. A City burning permit must be obtained before any material is burned.

210.3.02B - The Contractor may deposit material in the designated disposal site. No material may be deposited in the designated disposal area within 10 feet of the water's edge of any existing creek or wetlands.

210.3.02C - All material, other than such as is covered herein under A and B above shall be removed from the project and disposed of by the Contractor in a manner satisfactory to the City. Written permission to place material on private property or on land not owned or controlled by the Contractor shall be obtained by the Contractor from the property Owner or other responsible party prior to placing the material thereon, and evidence of such permission shall be furnished to the City. The permit shall be in writing and shall be so phrased as to absolve the City from any and all responsibility in connection with the placing of material on said property.

210.3.03 Rough Grading - After the completion of clearing and grubbing operations, the Contractor shall rough grade all clearing limit areas so as to provide a suitable grade and work area for sewer construction. It is not the intent of this provision to provide a finished road subgrade. The Contractor shall fill all stump holes with suitable material from adjacent street right-of-way areas. In those areas designated on the plans as rough grading embankment and

rough grading excavation, the Contractor shall move material from the excavation areas to the embankment areas. Any material, irrespective of nature, character or conditions encountered, shall be considered rough grading.

211 SOD STRIPPING

211.1 DESCRIPTION:

This item includes all work necessary for the stripping, removal and disposal of sod material within the designated limits of those areas which are to receive the roadway base rock as shown on the plans.

211.2 MATERIALS:

211.2.01 Disposal of Material - Excavated material resulting from the sod stripping shall be smoothly graded and compacted onto the road right-of-way in those areas not a part of the roadway surface or drainage ditches.

211.3 CONSTRUCTION:

211.3.01 Sod and roots shall be completely removed from all areas that are to receive the roadway base rock. The work shall be performed in such manner as to remove all evidence of their presence from the surface of the areas involved, and shall be inclusive of grasses, weeds and growing crops.

220 EARTHWORK

220.1 DESCRIPTION:

This item includes all work necessary for excavating and grading all roadways, curb, sidewalk, driveway areas, parking areas, planting areas, cuts, embankments, slopes, roadway ditches, lot grading and all other earth-moving work required in the construction of the project including disposal of all surplus material.

All excavation covered in this item shall be unclassified excavation regardless of the type, nature or condition of the materials encountered. The Contractor shall assume full responsibility to estimate the kind and extent of the various materials to be encountered in order to accomplish the work.

220.2 MATERIALS:

220.2.01 Disposal of Unsuitable and Excess Material - The Contractor shall dispose of all unsuitable and excess material not required elsewhere on the project according to Section 210.

220.3 CONSTRUCTION:

220.3.01 Embankments and fills shall be placed in approximately horizontal layers of a maximum of 8 inches in thickness, each layer being separately and thoroughly compacted.

220.3.02 Excavation and grading shall be to the lines and grades as shown on the plans and as staked by the Project Engineer. The Contractor shall trim all roadbeds, parking areas, ditches and other excavations and embankments to the established lines and grades. All surfaces shall be left in a neat and well-finished condition prior to the time the project is completed and accepted. Immediately prior to completion of the earthwork, the Contractor shall clean the entire roadway right-of-way area of debris and foreign matter of all kinds and dispose of as directed.

220.3.03 Roadway subgrade shall be excavated and shaped to line, grade, and cross-section as shown on the plans and as staked by the Project Engineer. The Contractor shall remove all soft or otherwise unsuitable material as directed and replace with suitable material from the excavation.

220.3.04 Compaction - The Contractor shall proof-roll or mechanically compact the subgrade within 6 inches of established subgrade elevation to a minimum density of 92 percent of the optimum density. Soil density will be determined by AASHTO T-99.

223 SUBGRADE

223.1 DESCRIPTION:

This work consists of the preparation of the subgrade. Subgrade is defined as the area of new or existing roads, streets, alleys, driveways, sidewalks, or other public place upon which additional materials are to be placed as a part of work covered in other Sections or by future work. Subgrade is classified as untreated or treated.

223.1.01 Untreated Subgrade - The top 1 foot of material placed in embankments or unmoved from cuts in the normal grading of the roadbed and which is brought to true line and grade, shaped and compacted to provide a foundation for the pavement structure constitutes untreated subgrade.

223.1.02 Treated Subgrade - Subgrade which is improved by the addition of stabilizers and prepared as in untreated subgrade constitutes treated subgrade.

223.2 MATERIALS:

223.2.01 Soil stabilizing materials shall conform to the following requirements:

MATERIAL	TYPE	GRADE
Hydrated Lime	AASHTO M 216, Type 1	Grade A
Granular Quicklime (CaO)	AASHTO T 27 and T 219 for grading and hydroxide content, with min. 85% Calcium Hydroxide	100 percent passing 3.8 inch sieve, max. 15% passing 100 sieve
Calcium Chloride	AASHTO M 144, sampling and testing in accordance with AASHTO T 143	
Sodium Chloride	AASHTO M 143	
Portland Cement	AASHTO M 85	Conform to Portland Cement in Section 212

Storage of materials shall conform to the requirements of Section 106.

223.2.02 Water shall conform to the requirements of Section 205.

223.3 CONSTRUCTION:

223.3.01 Preparation - Prior to starting subgrade work, including backfill, all underground work contemplated in the area of the subgrade shall be completed. This requirement includes work by the Contractor, by the Owner, or by others. The Contractor shall drain all depressions or ruts which contain water.

223.3.02 Untreated Subgrade - The Contractor shall remove unsuitable material as directed and replace with approved material. The subgrade shall be excavated and shaped to line, grade, and cross section and compacted to the specified density. Compaction shall extend to a line 1 foot beyond the edge of the paving curbs, or forms.

Subgrade areas which are too wet to be compacted to specified density, but which in the judgement of the Project Engineer otherwise meet the requirements, shall be scarified and aerated to provide optimum moisture content.

223.3.03 Treated Subgrade:

223.3.03A General - The Contractor shall blade, disc, harrow or scarify and thoroughly break up the surface of areas to be treated or aerated to the full depth and width as shown. Cemented soil clods shall be reduced to the size specified and soil brought to the required moisture content. Subgrade material shall be shaped and sized to pass through the mixing machine.

Stabilizing materials shall be applied only when the temperature is above freezing and when wind and other weather conditions are not detrimental to the work or to the public. The Contractor shall take all precautions necessary to prevent injury to persons, livestock or property. Any material that is spilled or deposited at places other than on areas designated to be treated shall be immediately picked up, buried or made harmless at no expense to the City.

223.3.03B Addition of Stabilizing Material: - The Contractor shall apply stabilizing materials at a uniform rate as specified, using equipment and methods that will insure uniformity of distribution. The use of blade graders to distribute lime will not be permitted. Only equipment that is used for watering and for applying and mixing the stabilizing material shall be permitted to pass over the materials until after it is mixed into the soil. If necessary, water should be added during mixing operations to provide optimum moisture content.

223.3.03C Mixing - The Contractor shall perform mixing operations until the treated subgrade material is uniform and free of streaks or pockets, and all material other than stones will pass a 1-inch sieve.

223.3.03D Finishing - Immediately after mixing of a treated subgrade, the Contractor shall grade the mixture to specified line, grade and cross section and compact the mixture to the specified density.

223.3.03E Curing - The Contractor shall limit traffic over treated subgrade to wheel loads which do not cause any damage to the subgrade and which do not visibly deflect, ravel or wear the surface. The Contractor shall keep the finished surface moist and protected from rutting, spalling, displacement and disfiguration for a period of 7 days or until a subsequent course of material is placed which will prevent drying of the mixture by evaporation or absorption.

223.3.04 Tolerances - The Contractor shall rework areas found to be deficient in thickness by more than 0.04 foot, except that fresh stabilizing material shall be added in an amount equal to one half of the original amount.

The finished surface of treated and untreated subgrade shall not vary more than 0.04 foot from established grade and cross section at any point. The finished surface, when tested with a 12 foot straightedge, shall not vary from the testing edge by more than 0.04 feet at any point.

223.3.05 Compaction - The required density of treated and untreated subgrade materials shall be not less than 92 percent of optimum density as determined by AASHTO T-99. Testing methods used for determining in-place density shall be according to AASHTO T191, T205 and T238.

If the specified compaction is not obtained, the Contractor shall notify the City and the Project Engineer. The Contractor may be required to use a modified compaction procedure or apply additional compactive effort. If approved materials meeting the specifications can not be

compacted to the required density regardless of compactive effort or method, the City may reduce the required density or direct that alternate materials be used. In no case shall finishing and compaction of the subgrade proceed until the Contractor is able to compact the material to the satisfaction of the City.

224 AGGREGATE BASES

224.1 DESCRIPTION:

This item includes all work necessary to furnish, place and compact one or more courses of aggregate base, sub-base, or leveling courses on a prepared subgrade within the designated limits.

224.2 MATERIALS:

224.2.01 Base Course Aggregate shall be crushed rock as a requirement, reasonably well graded from coarse to fine. The grading shall be such that the maximum size shall not exceed 2 inches. The aggregate fraction passing a 1/4-inch sieve shall constitute not less than 10 percent nor more than 50 percent of the whole, by weight, and not more than 8 percent of the total aggregate shall pass a No. 200 sieve. Within the above limits, the aggregate shall be so graded that the materials will be dense and firm when compacted.

The Contractor shall obtain the approval of the City for both the pit selected to supply the material and the material as delivered to the job site. The City may reject any material that, in the opinion of the City, is unsuitable.

224.2.02 Leveling Course Material shall be of the designated size 3/4 inch-0 and shall meet the requirements of ODOT Standard Specifications subsection 703.07.

224.2.03 Acceptance will be based on periodic samples of the material in place prior to compaction.

224.3 CONSTRUCTION:

224.3.01 Preparation of Foundation - All surfaces on which a base is to be constructed shall be firm at the time aggregate is placed thereon. No materials shall be placed on a soft, muddy or frozen subgrade.

224.3.02 Thickness of Base Course - If the required compacted depth of the base course exceeds 9 inches, it shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 9 inches. Each layer shall be placed in spreads as wide as practicable and to the full width of the course before a succeeding layer is placed.

224.3.03 Placing - The Contractor shall haul, deposit, and blade mix the material so as to provide a homogeneous mixture of unsegregated and uniformly dispersed materials as placed in position for compacting. The Contractor shall spread and strike off the material to the designated line, grade and transverse slope with surface texture of uniform appearance without segregation or fracture of material.

224.3.04 Compaction equipment used to compact aggregate bases shall be self-propelled steel wheel rollers. Rollers shall be capable of compacting materials to a firm, even surface. Steel wheel rollers shall be capable of providing a weight of not less than 200 pounds per inch width of the compression roll. In small areas and around obstructions, where compaction by rollers is not feasible, the Contractor shall compact aggregate bases with mechanical vibrators or impact tampers. All compaction equipment shall provide compaction of demonstrated equivalency to that of prescribed steel wheel rollers. Loaded dump trucks are not considered acceptable compaction equipment.

224.3.05 Density Requirements - The Contractor shall begin compaction of each layer as soon as practicable after the material is spread and continue until a density of not less than 92 percent of the maximum density has been achieved. Maximum density will be 92 percent determined by AASHTO T-99. Testing will be required at the discretion of the City.

224.3.06 Surface Finish - The aggregate base surface shall be within 0.04 feet of the required grade, and when tested with a 12-foot straightedge shall not vary from the testing edge by more than 0.04 foot at any point. Following construction of each layer, the Contractor shall do such work as the City determines necessary to prevent or repair segregation, raveling or rutting and to maintain the layer to specified condition until it is covered with a following layer, or until all contract work is completed and accepted.

226 EMBANKMENTS

226.1 DESCRIPTION:

This item includes all work necessary to furnish and place select fill material embankments on a prepared subgrade within the designated limits as shown on the plans.

226.2 MATERIALS:

226.2.01 Select fill material shall be provided by the Contractor and shall be pit run rock, maximum aggregate size of 4 inches, with sufficient fine material to act as binder but no excess earth. The Contractor shall obtain the approval of the City for both the pit selected to supply the material and the material as delivered to the job site. The City may reject any material that, in the opinion of the City, is unsuitable.

226.2.02 Acceptance will be based on periodic samples of the material in place prior to compaction.

226.3 CONSTRUCTION:

226.3.01 Preparation of Foundation - All surfaces on which a base is to be constructed shall be firm at the time select fill material is placed thereon. No materials shall be placed on a soft, muddy or frozen subgrade. Prior to placement of select fill material, all vegetation shall be removed from the area. All organic topsoil shall also be removed.

226.3.02 Select fill material embankments shall be constructed in close conformity with the lines, grades and cross sections as shown on the plans and staked by the Project Engineer. The embankments shall be constructed in maximum 8-inch lifts.

226.3.03 Placing - The Contractor shall haul, and deposit the select fill material so as to provide a homogeneous mixture of unsegregated and uniformly dispersed materials as placed in position of each lift for compacting. The Contractor shall spread and strike off the material to the designated line, grade and transverse slope with surface texture of uniform appearance without segregation of material.

226.3.04 Compaction equipment used to compact select fill material embankments shall be steel wheeled rollers, mechanical vibrators or impact tampers. Rollers shall be capable of compacting materials to a firm, even surface. Steel wheel rollers shall be capable of providing a weight of not less than 200 pounds per inch width of the compression roll. In small areas and around obstructions, where compaction by rollers is not feasible, the Contractor shall compact aggregate bases with mechanical vibrators or impact tampers. All compaction equipment shall provide compaction of demonstrated equivalency to that of a standard steel wheel tire rollers.

227 EROSION CONTROL227.01 DESCRIPTION:

The Contractor shall construct temporary erosion control structures as shown on the plans and specified herein. The Contractor shall maintain these structures throughout the course of construction as set forth in these specifications.

227.02 SUBMITTALS:

The Contractor shall submit manufacturer's data on the silt fence system to the City prior to ordering materials.

227.03 MATERIAL:

227.03.01 Silt fence system shall be the "Envirofence" silt fence system manufactured by Mirafi, Inc., or equal. The height of a silt fence shall not exceed 36 inches (higher fences may impound volumes of water sufficient to cause failure of the structure).

227.03.02 Bio bags shall be natural fiber mesh bags filled with clean wood chips. Bags and contents shall be 100 percent biodegradable with no weed seeds.

227.03.03 Hold down stakes shall be 24-inch long steel rods (1/2 inch diameter), or rebars (#4).

227.04 CONSTRUCTION:

227.04.01 - All erosion control products and materials shall be installed in accordance with the manufacturer's recommendations and as shown on the plans.

227.04.02 - All erosion control measures shall be left in place until all reseeding efforts are completed and vegetation has taken root, or as directed by the Project Engineer.

227.04.03 Bio Bag Protection For Culvert Outlets - Bags shall be placed lengthwise in a single row as shown on the drawings, with the ends of adjacent bags pressed together. Each bag shall be securely anchored to the ground and held in place by at least two stakes, fence posts, steel rods (2-inch diameter), or rebars (#4). The stakes shall be driven 18 inches into the ground. The barrier shall be extended to such a length that the bottoms of the end bags are higher in elevation than the top of the lowest middle bag to assure that sediment-laden runoff will flow either through or over the barrier but not around it.

227.04.04 Silt Fences - The filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. Where joints are necessary, filter cloth shall be spliced together only at a support post, with a minimum 6-inch overlap, and securely sealed. Posts shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground (minimum of 24 inches). A trench shall be excavated approximately 12 inches (wide) x 12 inches (deep) along the line of posts and upslope from the barrier. The trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently seeded and stabilized.

227.04.05 Optional Site Assembled Silt Fences - When standard strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least 1 inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of 2 inches and shall not extend more than 30 inches above the original ground surface. The standard strength filter fabric shall be stapled or wired to the fence, and 6 inches of the fabric shall be extended into the trench. The fabric shall not extend more than 36 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

227.04.06 Maintenance of Bio Bags - Bio bags barriers shall be inspected immediately after each rainfall of 2-inch or more and at least daily during prolonged rainfall by the Contractor. Close attention shall be paid to the repair of damaged bags, end runs and undercutting beneath bags. Necessary repairs to barriers or replacement of bags shall be accomplished promptly by the Contractor. Sediment deposits should be removed after each rainfall, and when the level of

deposition reaches approximately half the height of the barrier. Any sediment deposits remaining in place after the bio bag barrier is no longer required shall be dressed to conform to the existing grade, prepared and seeded.

227.04.07 Maintenance of Silt Fences - Silt fences and filter barriers shall be inspected immediately after each rainfall of 1/2 inch or more and at least daily during prolonged rainfall by the Contractor. Any required repairs shall be made immediately by the Contractor. Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly. Sediment deposits should be removed after each storm event and when deposits reach approximately half the height of the barrier.

227.04.08 Removal of Erosion Control Structures - Any material remaining in place after the fence or barrier is no longer required shall be graded to conform to the existing grade and reseeded.

228 RIPRAP

228.1 DESCRIPTION:

This item includes all work necessary to furnish and place erosion-resistant and protective materials at locations shown on the plans or designated by the Project Engineer. The work shall be done in reasonably close conformity to the lines and grades shown on the plans or established by the Project Engineer.

228.1.01 Loose riprap is defined as classes of stone placed on a filter blanket or prepared slope.

228.1.02 Filter blanket is defined as one or more layers of graded materials placed on a prepared area prior to placing the riprap thereon to prevent underlying material from passing through the riprap.

228.1.03 Riprap fabric is defined as geotextile fabric placed on a prepared area prior to placing the riprap thereon to prevent underlying material from contaminating the riprap.

228.2 MATERIALS:

228.2.01 General - Stone used for loose riprap shall be hard, durable, angular in shape, resistant to weathering and shall meet the gradation requirements for the class specified. Neither breadth nor thickness of a single stone should be less than 1/3 its length. Rounded stone or boulders will not be accepted unless authorized by the City. Shale or stone with shale seams is not acceptable.

The sources from which the stone is obtained shall be selected well in advance of the time when the materials will be required in the work. The acceptability of the stone will be determined by previous use of records or by tests as the Project Engineer determines to be appropriate. If testing

is required, suitable samples of stone shall be furnished by the Contractor and taken in the presence of the Project Engineer at least 25 days in advance of the time when the placing of riprap is expected to begin. The approval of some riprap from a particular source shall not be construed as constituting the approval of all riprap taken from that source.

228.2.02 Physical Requirements - In the absence of satisfactory previous use records, the stone shall conform to the following requirements:

Apparent Specific Gravity (AASHTO T85)	2.50 min.
Percent Absorption (AASHTO T85)	6.00 max.
Degradation (ODOT TM 208A) Passing No. 20 Sieve Sediment Height	35% max. 8" max.
Soundness (ODOT TM 206) Average Loss of 2 1/2"- 1 1/2" and 1 1/2" - 3/4" Fraction After Five Alterations	16%

The riprap shall be free from overburden, spoil, shale and organic material.

228.2.03 Grading and Size:

228.2.03A Grading of loose riprap by class and size of stone shall conform to the following:

Class/6000 weight, lb.	Approximate Size	Percent (by weight)
6000# - 4000#	46" - 40"	30
4000 - 2000	40" - 32"	40
2000 - 200	32" - 15"	20
<200	<15"	10

Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified.

228.2.04 Control of gradation will be by visual inspection as herein set forth. The Contractor shall provide, at a location satisfactory to the City and in close proximity to the project, a mass of rock sample of at least 5 tons meeting the gradation for the class specified. This sample will be used as a frequent reference for judging the gradation of the riprap supplied. Any difference of opinion between the City and the Contractor shall be resolved by dumping and checking the gradation of 2 random truck loads of stone. Mechanical equipment, a sorting site and labor needed to assist in checking gradation shall be provided by the Contractor at no additional cost to the Owner.

228.2.05 Filter blanket material shall be clean rock or gravel, crushed or uncrushed, or combinations thereof the gradation shall meet the requirements of ODOT Standard Specifications subsection 703.07 for 2 inch-0 crushed rock.

228.3 CONSTRUCTION:

228.3.01 Preparation - Slopes to be protected by riprap shall be free of brush, trees, stumps and other organic material and be dressed to a smooth surface. All soft or spongy material shall be removed to the depth shown on the plans or as directed by the Project Engineer and replaced with approved material. Filled areas shall be compacted as specified in Section 223. A toe trench shall be dug when and as shown on the plans, and maintained until the riprap is placed.

Protection for structure foundations shall be provided as early as the foundation construction permits. The area to be protected shall be cleaned of waste materials and the surfaces to be protected prepared as shown on the plans.

228.3.02 Loose riprap shall be placed on the prepared area in a manner which will produce a reasonably well graded uniform mass of stone. Riprap protection shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing or riprap protection by methods likely to cause segregation will not be permitted.

The larger stones shall be well destructed and the entire mass of stone shall conform approximately to the gradation specified. All material going into riprap protection shall be so placed and distributed that there will be no large accumulations of either the larger or smaller sizes of stone.

It is the intent of these specifications to produce a compact riprap protection in which all sizes of material are placed in their proper proportions and with a reasonably smooth finished surface having a pleasing appearance. Hand placing, rearranging of individual stones by mechanical equipment, slapping the surface of the material with armor plating or some other approved means may be required to the extent necessary to secure the results specified.

228.3.03 Filter Blanket - When required, a filter blanket shall be placed on the prepared area to the full specified thickness of each layer in one operation, using methods which will not cause segregation of particle sizes within the layer. The surface of the finished layer should be reasonably even and free from mounds or windrows. Additional layers of filter material, when required, shall be placed in the same manner, using methods which will not cause mixture of the material in the different layers.

228.3.04 Riprap Fabric - When required, a manufactured geotextile fabric shall be placed on the prepared area shown on the plans or directed by the Project Engineer. The riprap fabric shall be installed as shown on the plans.

250 ASPHALT CONCRETE PAVEMENT

250.1 DESCRIPTION:

This item includes all work necessary for the construction of hot mix asphalt concrete pavements upon prepared foundations or base surfaces.

250.2 MATERIALS:

250.2.01 Asphalt cement shall be either PBA 5 or PBA 2. The use of silicones as an additive to asphalt cement will not be permitted.

250.2.02 Aggregates shall meet the requirements of Subsection 268, Standard Specifications for Highway Construction, ODOT, current edition.

250.2.03 Mineral filler shall conform to the requirements of AASHTO M17. Collector dust may be used as mineral filler, in whole or in part, provided the dust or the resultant mineral filler mixture conforms to the above requirements.

250.2.04 Additives and admixtures may be used to prevent stripping or separation of bituminous coatings from aggregates, and to aid in the mixing or use of bituminous mixes or for experimental purposes. Admixtures and additives shall be standard recognized products of known value for the intended purpose and shall be approved by the City on the basis of laboratory tests prior to their use in the work. They shall have no deleterious effect on the bituminous material and shall be completely miscible.

250.2.05 Classes of Concrete and Proportions of Materials - The asphalt concrete mixture shall be of the class as shown on the plans and shall conform to the following requirements:

Sieve Size	Class "B"	Class "C"
Percentages of Total Aggregate (by weight)		
1"		
3/4"	95-100	100
1/2"		95-100
1/4"	52-72	65-85
No. 10	21-41	30-45
No. 40	8-24	8-26
No. 200	3-7	3-7
Asphalt Cement*	4-8	4-8

- * The asphalt cement content (percent of total mix, by weight) shall conform to the current approved mix design on file with ODOT for the source to be used, within a tolerance of +/- 0.5 percent. The Contractor shall furnish the City with a copy of this mix design. If there is no current mix design, the asphalt cement content for the mixture shall be not less than 6 percent. The mixture shall be accepted by such testing as the City deems necessary to assure that the mixture is suitable for the purpose intended.

250.2.06 Prime coat asphalt shall be emulsified asphalt and shall be RS-1 grade.

250.2.07 Tack coat asphalt shall be emulsified asphalt and shall be RS-1 grade.

250.3 CONSTRUCTION:

250.3.01 Foundation Preparation - All bases and foundations shall be constructed to the condition prescribed under the applicable specification. Broken or ragged edges of existing Portland cement concrete or bituminous surfaces underlying or abutting the new pavement shall be trimmed back to firm material. Contact surfaces of structures in the paving area shall be treated with an asphalt tack coat prior to placing the asphalt concrete. Underlying surfaces of Portland cement concrete and designated areas of asphalt-deficient, fine-cracked or spalled bituminous material shall be treated with an asphalt tack coat prior to placing the asphalt concrete.

250.3.02 Existing Pavement Surfaces - Existing pavement surfaces shall be cleaned of all loose material, dirt and dust by brooming, by flushing with water or by other approved methods. All vegetation on existing asphalt surfaces shall be removed by first burning with a torch followed by careful removal of the burned vegetation by scraping and brooming.

250.3.03 Weather Limitations - Asphalt concrete mixtures shall be placed on dry prepared surfaces when the air temperature in the shade and the surface temperature is 50 degrees F and warmer. However, the City may permit the Contractor to begin paving work if the temperature is 45 degrees F or above and rising, and in the judgement of the Public Works Superintendent will be 50 degrees F in a reasonable period of time. Placing any mixture during rain, freezing, or other adverse weather conditions will not be permitted, except that mix in transit at the time these adverse conditions occur may be laid if the following conditions are met:

- a. Mix is at proper temperature.
- b. Mix is covered during transit.
- c. Mix is placed on a foundation free of standing or flowing water.
- d. Mix is placed on unfrozen foundation.

250.3.04 Prime coat asphalt shall be applied to cleaned potholes and to aggregate base pavement edges which have been shaped and compacted prior to paving. Prime coat asphalt shall be applied at a rate of 0.3 to 0.4 gallons per square yard of surface. Distributor spraying temperature shall be a minimum of 120 degrees F and a maximum of 160 degrees F. Asphalt shall not be applied on wet surfaces or when the air temperature is below 50 degrees F.

250.3.05 Tack coat asphalt shall be applied to existing bituminous and Portland cement concrete surfaces prior to placing asphalt concrete. The application rate shall normally be within a range of 0.06 to 0.10 gallons per square yard of surface. Asphalt shall not be applied to any wet surfaces or when the air temperature is less than 50 degrees F. The asphalt shall be applied by pressure-spray equipment capable of providing a uniform application at the prescribed rate. It shall be applied only so far in advance of the asphalt concrete paving operations as is necessary in order to provide a tacky surface upon which to place the asphalt concrete.

250.3.06 Placing - Asphalt concrete shall be at a temperature of between 250 and 300 degrees F at the time it is placed. Asphalt Concrete shall be placed in panels of such width as to hold to a practical minimum the number of longitudinal joints required. The longitudinal joints in any panel shall offset those joints in underneath panels by not less than 6 inches. Special care shall be taken at longitudinal joints to provide the required bond and density. The placing of asphalt concrete shall be a continuous operation as nearly as practicable. If the capacity of the paving machine exceeds the capacity of the hauling vehicles, the paving machine shall be operated at a reduced uniform speed so as to maintain a continuous operation. Overlay paving shall be applied in a minimum of two lifts. The first lift shall be a leveling course, followed by a cover course.

250.3.07 Compaction - Longitudinal joints shall be rolled directly behind the paving machine. The first panel shall have vertical edges, and the abutting panel shall be tightly crowded against its edge. Material from the second panel shall be pushed over the surface of the first panel so as to develop an overlap of from 3 inches to 6 inches. Breakdown rolling shall immediately follow the rolling of the longitudinal joints and edges. Rollers shall be operated as close to the paving machine as necessary to obtain adequate density without causing undue displacement. The breakdown roller shall be operated with the drive roll or wheels nearest the paving machine. Exceptions may be made when working on steep slopes or superelevated curves. Breakdown rolling and the rolling of longitudinal joints shall be performed with steel wheeled rollers having a minimum weight of 10 tons. Compaction rolling, consisting of at least 6 coverages with a steel wheel roller, having a minimum weight of 10 tons, or of at least 4 coverages with a vibratory roller, capable of imparting a dynamic force of at least 21,000 pounds, shall follow the breakdown rolling as closely as possible and while the material is at a temperature that will result in good compaction being achieved. This rolling shall continue until roller wheel marks are no longer discernible. Roller wheels shall be kept moist with only enough water to avoid picking up the material. Rollers shall move at a uniform speed not to exceed 3 mph for steel wheeled rollers. Rollers shall be in good condition and capable of being reversed without backlash. The line of rolling shall not be suddenly changed nor the direction of rolling suddenly reversed. Any pronounced change in direction of the roller shall be made on stable material. If rolling causes displacement of the material, the affected areas shall be loosened and restored to the original grade with loose material before being rerolled. Heavy equipment, including rollers, shall not be permitted to stand on finished surface before it has thoroughly cooled or set. The finished surface shall be true to line and grade, free of irregularities and roller wheel tracks. For asphalt concrete with a thickness of 1 1/2 inches or greater placed on materials placed under the contract, the mixture shall be compacted to at least 92 percent of the theoretical optimum density as determined by ODOT TM 306 (Rice Density).

252. CONCRETE CURBS

252.1 DESCRIPTION:

This item includes all work necessary for the construction of concrete curbs.

252.2 MATERIALS:

252.2.01 Concrete shall conform to the requirements of ASTM C94 and of Section 330. Compressive field strength of Portland cement concrete shall be not less than 3,000 p.s.i. at 28 days.

252.2.02 Preformed expansion joint fillers for concrete shall conform to the requirements of AASHTO M153 or AASHTO M213 except that those furnished under AASHTO M213 shall be tested in conformance to ASTM D1751. Fillers conforming to AASHTO M213, except the binder if other than bituminous material, may also be used provided that they otherwise meet this specification and provided further that they have been demonstrated to be rot and vermin proof for a period of at least 5 years.

252.2.03 Curing materials shall be liquid membrane-forming compounds for curing concrete conforming to the requirements of AASHTO M148.

252.3 CONSTRUCTION:

252.3.01 Aggregate Foundation and Bedding - All bases upon which new concrete curbs are to be constructed shall be firm and free of all extraneous matter. Foundation courses and bedding materials shall be constructed in conformance with the applicable requirements of Section 224. The Contractor shall thoroughly dampen surfaces upon which new concrete is to be placed prior to placement of the concrete.

252.3.02 Line and Grade - The top and face of finished curb shall be true and straight and the top surface of curbs shall be of uniform width, free from humps, sags, honeycombs, or other irregularities. When a straightedge 10 feet long is laid on the top or face of the curb the surface shall not vary more than 0.02 foot from the edge of the straightedge, except at grade changes or vertical curves. The Contractor shall construct all curbs within 0.02 foot of true line, within 0.02 foot of established surface grade, cross section and slope, and within 0.02 foot of specified thickness.

252.3.03 Placing - Concrete curbs may be placed either by mechanical extrusion methods or between suitable forms, as the Contractor may elect.

252.3.03A Extrusion Method - If concrete is to be placed by mechanical extrusion methods, the slump shall be between 1 and 2 inches. Concrete shall be fed into the extruding machine at a uniform rate and the machine shall be operated under sufficient

restraint to forward motion to produce a well-compacted mass of concrete. Maximum size of aggregate shall be 1/2 inch.

252.3.03B Forms - If forms are used, the concrete slump shall be between 2 inches to 4 inches. Maximum size of aggregate shall be 3/4 inch. Placing of concrete shall conform to the requirements of Subsection 330.3.01. Forms shall be removed from formed structures after the concrete has taken its initial set and while the concrete is still green.

252.3.04 Finishing - Minor defects shall be repaired with mortar containing one part Portland cement and two parts sand. Plastering will not be permitted on exposed surfaces. Honeycombed and other structurally defective concrete shall be removed and replaced at no expense to the City. While the concrete is still green, the exposed surfaces shall be finished as required to provide a uniform texture and smooth surface.

252.3.05 Transverse expansion joints shall be constructed opposite abutting expansion joints, at each point of tangency, and at connections to existing curbs, driveways and walks. Additional transverse expansion joints shall be provided at other evenly spaced locations as required to confine the expansion joint spacing to a maximum distance shown on the plans. The width of joints and thickness of filler shall match those of the joints in abutting concrete; elsewhere the filler thickness shall be not less than 1/2 inch. Each expansion joint shall be at right angles to the alignment, vertical to the top surface, and shall provide complete separation of the concrete. The joint in the old concrete that abuts the new concrete shall be made with a saw cut.

252.3.06 Curing - After the concrete has been placed and finished, it shall be cured by application of a white pigmented liquid membrane-forming compound applied uniformly to the damp concrete by pressure spray methods, or by keeping the concrete protected and moist, by approved methods, for at least 72 hours. The concrete shall be protected from contact, strain, and vehicular traffic for at least 7 days.

253 CONCRETE DRIVEWAYS & WALKS

253.1 DESCRIPTION:

This item includes all work necessary for the construction of concrete driveways, walks, ramps, and miscellaneous surfaces.

253.2 MATERIALS:

253.2.01 Concrete shall conform to the requirements of ASTM C94 and of Section 330. Compressive field strength of Portland Cement concrete shall be not less than 3,000 p.s.i. at 28 days. Maximum size of aggregate shall be 3/4 inch. Concrete slump shall be between 2 inches and 4 inches.

253.2.02 Reinforcement shall conform to the applicable requirements of Section 320.

253.2.03 Preformed expansion joint fillers shall conform to the requirements of Subsection 252.2.02.

253.2.04 Curing materials shall be liquid membrane-forming compounds for curing concrete conforming to the requirements of AASHTO M148.

253.3 CONSTRUCTION:

253.3.01 Aggregate Foundation and Bedding - All bases upon which new concrete surfaces are to be constructed shall be firm and free of all extraneous matter. Foundation courses and bedding materials shall be constructed in conformance with the applicable requirements of Section 224. The Contractor shall thoroughly dampen surfaces upon which new concrete is to be placed prior to placement of the concrete.

253.3.02 Surface Line and Grade - Construct slabs and similar surfaces to drain with true, uniform slopes. Finished surfaces shall be free from humps, sags, or other irregularities. The surface shall not vary more than 0.02 foot from a 10-foot straightedge, except at grade changes or vertical curves. All work shall be within 0.02 foot of true line, within 0.02 foot of established surface grade, cross section and slope, and within 0.02 foot of specified thickness.

253.3.03 Reinforcement shall be provided as shown on the plans. The placement of reinforcement shall conform to the requirements of Subsection 320.3.

253.3.04 Placing of concrete shall conform to the requirements of Subsection 330.3.01.

253.3.05 Finishing - Concrete surfaces shall have a broomed surface unless otherwise specified. Brooming shall be transverse to the direction of traffic. The surface shall be lightly grooved or marked into squares or other shapes to match other such markings on similar existing surfaces in the vicinity, or as designated by the Project Engineer. Edges shall be tooled with 3-inch radius edger.

253.3.06 Transverse expansion joints shall conform to the requirements of Subsection 252.3.05.

253.3.07 Transverse contraction joints of the weakened plane or dummy type shall be constructed at such locations as are required to confine the contraction joint spacing to a maximum of 18 feet. The joints shall be formed to a depth of 1/3 of the thickness of concrete and to a width of about 1/8 inch. Joint edges shall be tooled.

253.3.08 Curing shall conform to the requirements of Subsection 252.3.06.

257 CONSTRUCTION FABRIC

257.1 DESCRIPTION:

This item includes all materials and work necessary for the placement of construction fabric required on a prepared subgrade at the locations shown on the plans.

257.2 MATERIALS:

257.2.01 Construction fabric shall be ground stabilization fabric woven from monofilaments of isotactic polypropylene, Amoco 2006, or approved equal. Fabric shall have the following properties:

- Weight 7 oz./sq. yd.
- Grab Strength.....200 lbs.
- Trapezoidal Tear Strength5 lbs.
- Mullen Burst Strength.....400 psi

257.3 CONSTRUCTION:

257.3.01 No standing water shall be present at the excavated subgrade when fabric is placed. Roll fabric onto the subgrade, keeping it as taut and free of wrinkles as possible. Some stretching stakes may be required. Overlap joints a minimum of 24 inches between sections of fabric.

257.3.02 Aggregate base and fill should be placed on the fabric without any construction equipment operating on the uncovered fabric.

257.3.03 Proofroll the base or fill to tension the fabric and identify soft spots in the subgrade. If a soft spot is encountered, mound base rock into the subgrade at the soft area.

257.3.04 Construct base per specification Section 224.

258 PAVEMENT MARKING

258.1 DESCRIPTION:

This item includes all work necessary for furnishing and installing striping and pavement markings.

258.2 MATERIALS:

258.2.01 Striping paint shall be the alkyd resin type, ready mixed white, Type I, conforming to the requirements of AASHTO M248.

258.3 CONSTRUCTION:

258.3.01 General - The Project Engineer will be responsible for preliminary spotting of the lines and markings to be painted and approval of the City must be obtained before pavement marking may begin. The area to be painted shall be dry, clean and free of loose particles. The paint machine shall be of the spray type capable of satisfactorily applying the paint under pressure with a uniformity of feed through nozzles spraying directly upon the pavement.

258.3.02 Striping paint shall be thoroughly mixed prior to application and shall be applied when the air temperature is above 40 degrees F. The rate of application for striping paint shall not exceed 80 square feet per gallon (approximately 20 mils wet thickness). This rate is effectively 20 gallons of paint per mile of 4-inch width solid stripes. For narrower or wider striping or other marking, paint shall be applied at a proportional rate with the 4-inch stripes.

266 STORM DRAINAGE PIPE & FITTINGS266.1 DESCRIPTION:

This item includes all work necessary for the construction of drainage pipe culverts.

266.2 MATERIALS:

266.2.01 General - Storm drainage pipe and fittings shall be as hereinafter specified for the particular kind of pipe and fittings required, as designated on the plans. Joints for all fittings shall be the same as the joints used on the pipe. No pipe and fittings that are not hereinafter specified will be allowed on the project, and no substitution of approved pipe materials will be allowed other than the pipe materials shown on the plans.

No used or rejected material, "seconds", shall be used without written approval of the city.

266.2.02 Storm Drainage Pipe:

266.2.02A Corrugated High Density Polyethylene Smooth Interior (HDPE) pipe and fittings shall conform to the requirements of ASTM D1248, Type III, Category 4 or 5, Grade P33 or P34, Class C. Stiffness of HDPE pipe and fittings shall conform to the requirements of ASTM D-2412.

266.2.02B Corrugated Polyethylene (PE) tubing shall conform to the requirements of ASTM F405 (Heavy Duty) for 3-inch through 6-inch diameters and shall conform to the requirements of ASTM F667 for 8-inch through 15-inch diameters.

266.2.02C Polyvinyl Chloride (PVC) pipe shall conform to the requirements of ASTM D3034 and D2729.

266.2.02D Non-reinforced Concrete Pipe shall conform to the requirements of ASTM C14, Class 3.

266.2.02E Reinforced concrete pipe (RCP) shall conform to the requirements of ASTM C-76, Class III.

266.2.03 Jointing Materials: All joints shall be water tight.

266.2.03A Concrete pipe joints shall be standard tongue-and-groove type joints with rubber gaskets.

266.2.03B Corrugated PE joints shall be made with standard polyethylene fittings designed for use with corrugated PE tubing.

266.2.03C PVC pipe gaskets shall conform to the requirements of ASTM D3212.

266.2.04 Fittings:

266.2.04A Concrete pipe fittings on 18 inches and smaller concrete pipe shall be shop fabricated. Fittings on pipe 21 inches and larger may be field or shop fabricated. Fittings fabricated by inserting a stub into a hole cut in the pipe shall be grouted with a non-shrinking grout. Surfaces to receive grout shall be coated with an epoxy bonding agent prior to grouting. Fitting stubs shall not protrude inside the sewer pipe.

266.2.04B Corrugated PE pipe fittings shall conform to the applicable portions of ASTM F405 and ASTM F667.

266.2.04C PVC pipe fittings shall conform to the applicable portions of the following specifications: ASTM D1785, ASTM D2729, ASTM D2466, ASTM D2467, and ASTM D3034.

266.2.05 Native pipe bedding and trench backfill material shall consist of native material being earth, sand, gravel, rock or combination thereof, free of humus, organic matter, vegetative matter, frozen material, clods, sticks and debris and containing no stone having a dimension greater than 1 1/2 inches. The materials shall predominate in the fine sizes and in place, shall present no isolated points or areas or larger stones which would cause fracture or denting of the structure or subject it to undue stress. When, in the opinion of the City, the native material is unsuitable for pipe bedding and trench backfill, select material shall be used. All pipe bedding and trench backfill materials shall be submitted for the City's approval prior to utilization.

266.2.06 Select pipe bedding and initial backfill material shall be clean crushed rock with a maximum size of 3/4 inch, uniformly graded from coarse to fine. The maximum size of select pipe bedding material used shall be as directed by the Project Engineer for the particular conditions encountered in the culvert trench. The select pipe bedding depth shall be as specified on the plans.

266.2.07 Drain rock shall be rounded river rock, washed to remove all fines, with a maximum size of 2 inches.

266.3 CONSTRUCTION:

266.3.01 Trench Excavation:

266.3.01A Trench Width - It is the intent of these specifications that the trench width at the surface of the ground be kept to a minimum necessary to install the pipe in a safe manner. In all cases, trenches must be of sufficient width to allow for shoring, as required, and permit proper joining of the pipe and backfilling of material along the sides of the pipe. The minimum trench width, in the pipe zone, shall be 12 inches larger than the outside diameter of the pipe, or as specified on the plans.

266.3.01B Grade - The Contractor shall excavate the trench to the lines and grade shown or established by the Project Engineer, with proper allowance for pipe diameter and pipe bedding depth.

266.3.01C Disposal of Excess Material - The Contractor shall dispose of all excess material not required elsewhere on the project, make arrangements for disposal and bear all cost related thereto.

266.3.02 Pipe Bedding consists of leveling the bottom of the trench and placing bedding material to the depth as specified on the plans. Bedding material shall be as specified hereinbefore. The Contractor shall spread the bedding smoothly to proper grade so that the pipe is uniformly supported along the barrel. Bedding under the pipe shall provide a firm, unyielding support along the entire pipe length. The Contractor shall place subsequent lifts of not more than 6 inches in thickness up to the required depth, bring lifts up together on both sides of the pipe and carefully work under the pipe haunches by slicing with a shovel, tamping or other approved procedure. Particular attention must be given to the area from the flow line to the horizontal centerline of the pipe or top of bedding to insure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone. Pipe bedding shall be placed the full width of the trench.

266.3.03 Initial Backfill - The Contractor shall place the specified initial backfill material carefully around the pipe in 6-inch layers and thoroughly hand tamp with approved tamping sticks supplemented by "Walking In" and slicing with a shovel. The Contractor shall prevent pipe from movement either horizontally or vertically during placement and compaction of pipe zone material. Mechanical compactors shall not be utilized in placement of the material. The material shall be placed to a depth of 12 inches above the top of the pipe.

266.3.04 Trench Backfill - The Project Engineer will sample excavated material to determine the suitability of the native material for backfill use. If the native backfill is found to be compactable and within the tolerance range of the moisture content, the Contractor will be allowed to use it for

trench backfill. The Contractor shall take reasonable precautions to prevent excavated material from becoming saturated beyond the critical moisture limits and replace any saturated native material with other approved native material at no expense to the City. When, in the opinion of the Project Engineer, the excavated material is unsuitable for trench backfill by reason of pre-existing moisture content or other undesirable physical characteristics, the Contractor shall use select trench backfill material at the direction of the Project Engineer. The Contractor shall backfill and compact the trench above the pipe zone in lifts not to exceed 8-inch loose depth. Any subsequent settlement of the trench during the one-year warranty period shall be considered to be the result of improper compaction and shall be promptly corrected.

266.3.05 Pipe Cover — Minimum cover over HDPE and PVC pipes shall be 12 inches. Greater cover will be used when recommended by manufacturer.

267 CATCH BASINS

267.1 DESCRIPTION:

This item includes all work necessary for the construction of catch basins of the types and sizes shown on the plans.

267.2 MATERIALS:

267.2.01 Concrete shall conform to the requirements of ASTM C94. Compressive strength for poured in place concrete shall be not less than 3,000 p.s.i. at 28 days. Maximum size of aggregate shall be 3/4 inch. Slump shall be between 2 inches and 4 inches.

267.2.02 Formwork shall conform to the requirements of Section 310.

267.2.03 Welded frames and grates shall be fabricated of steel meeting or exceeding the requirements for "Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality", ASTM A283. Welding shall conform to the standard requirements of the American Welding Society.

267.2.04 Precast concrete units may be substituted for cast-in-place units, at the option of the Contractor. Precast units shall be Pipe, Inc. Salem Type 1, or equal.

267.2.05 Precast concrete and cast iron frames and grates may be substituted for welded frames and grates, at the option of the Contractor. Cast iron frames and grates shall conform to the requirements of AASHTO M105, Class 30B.

267.3 CONSTRUCTION:

267.3.01 Excavation and backfill shall be in accordance with applicable portions of Section 266.

267.3.02 Pre-cast concrete catch basins shall be installed according to the plans. The units shall be placed on a prepared bedding of 8 inches compacted thickness of 3/4 inch-minus crushed rock. Precast concrete units shall be set plumb and level. Riser sections shall be installed as needed with a full bed of mortar between all sections and the catch basin. The Contractor shall set the top unit in a full bed of mortar and shall adjust the top unit as needed to match the slope of the adjacent grade.

267.3.03 Cast-in-place units may be used, at the option of the Contractor, provided that the Project Engineer, prior to construction, approves all details of construction. Cast-in-place units shall be constructed according to the plans. The units shall be placed on a prepared bedding of 8 inches compacted thickness of 3/4 inch-minus crushed rock. Forms shall be tight and well braced. The concrete shall be consolidated by mechanical vibration, hand spading, rodding, or tamping. Screed the top surface of exposed surfaces to a smooth even surface. Finish exposed edges with a steel edging tool followed by broom finish. All details of concrete work shall conform to applicable portions of Section 330.

267.3.04 Pipe connections shall be smoothly finished with the inside surface of the catch basin wall, and shall not project into the catch basin opening.

267.3.05 Existing Catch Basins - Where shown on the plans, existing catch basins shall be retrofitted with new cast iron frames and slotted inlet grates in accordance with the plans. The contractor shall remove existing lids and tops and make all necessary adjustments to retrofit the new tops to receive the new frames and grates. Pipe connections shall be smoothly finished with the inside surface of the catch basin wall, and shall not project into the catch basin opening.

269 DRAINAGE DITCHES

269.1 DESCRIPTION:

This item includes all work necessary for the construction of drainage ditches as shown on the plans.

269.2 MATERIALS:

None required.

269.3 CONSTRUCTION:

269.3.01 Drainage Ditches shall be constructed in close conformity with the lines, grades and cross sections as shown on the plans and staked by the Project Engineer.

269.3.02 Disposal of Excavated Material - The Contractor shall dispose of all excess material not required elsewhere on the project according to Subsection 210.

275 WORK ON EXISTING STORM DRAINAGE STRUCTURES**275.1 DESCRIPTION:**

This item includes all work necessary for the adjustment of existing storm drainage structures.

275.2 MATERIALS:

275.2.01 Concrete shall conform to the requirements of ASTM C94. Compressive field strength shall be not less than 3,000 p.s.i. at 28 days. Maximum size of aggregate shall be 3/4 inch. Slump shall be between 2 inches to 4 inches.

275.2.02 Formwork shall conform to the requirements of Section 310.

275.2.03 Mortar shall conform to the requirements of ASTM C387, or be proportioned 1 part Portland cement to 2 parts clean, well graded sand which will pass a 1/8 inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5percent. Consistency of mortar shall be such that it will readily adhere to the precast concrete. Mortar mixed longer than 30 minutes shall not be used.

275.2.04 Welded frames and grates shall be fabricated of steel meeting or exceeding the requirements for "Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality", ASTM A283. Welding shall conform to the standard requirements of the American Welding Society.

275.2.05 Precast concrete and cast iron frames and grates may be substituted for welded frames and grates, at the option of the Contractor. Cast iron frames and grates shall conform to the requirements of AASHTO M105, Class 30B.

275.2.06 Precast concrete riser sections shall conform to the requirements of ASTM C478.

275.3 CONSTRUCTION:

275.3.01 Storm drainage structure adjustment - Storm drainage structures shall be raised by removing the existing frames, grates or covers and adjusting the height as necessary to correspond to grade. Storm drainage structures may be extended by the use of precast riser sections and mortar or by reconstructing the frame.

275.3.02 Existing frames, grates or covers shall be reset in fresh mortar and brought to proper grade following storm drainage structure adjustment.

275.3.03 New grates shall be installed to fit existing frames as shown on the plans.

284 PARKING BUMPERS**284.1 DESCRIPTION:**

This item includes all work necessary for the furnishing and installing of precast concrete parking bumpers.

284.2 MATERIALS:

284.2.01 Precast concrete parking bumpers shall be 5" (high) x 9" (wide) x 7' (long), with 2-inch chamfer on all top edges, and two 1-inch diameter holes for staking bars. Minimum reinforcement shall be one #6 bar, or an equivalent area of smaller diameter bars. Portland cement concrete in precast units shall attain a compressive strength of not less than 4,000 p.s.i. at 28 days. The proportions of sand, gravel and cement, the type of forms used, and the method of compacting the concrete in the forms shall all be such that a dense, smooth and uniform surface is obtained on the finished units.

284.2.02 Staking bars shall be metal reinforcing bars, #6 bar, 24 inches long, conforming to the applicable requirements of Section 320.

284.3 CONSTRUCTION:

284.3.01 Precast concrete parking bumpers shall be installed as shown on the plans or as staked by the Project Engineer. Each unit shall be staked with two staking bars driven flush with the top surface of the unit.

285 PERMANENT SIGNS**285.1 DESCRIPTION:**

This item includes all work necessary for the removal of existing street signs and the installation of new street signs consistent and compatible with City standards.

285.2 MATERIAL:

285.2.1 Regulatory signs shall be constructed of extruded aluminum panels with an Engineering grade reflective sheeting. All signs shall be rectangular with a minimum dimension of 24 inches, unless otherwise noted. Signs shall have a white reflective background with a black non-reflective legend, unless otherwise noted.

285.2.1.1 STOP signs shall be octagonal shaped with a minimum dimension of 24 inches across. Signs shall have a red reflective background with a white reflective legend. Product number GR-158 as manufactured by "Traffic Safety Supply Co." of Portland, Oregon, or an approved equal.

285.2.1.2 YIELD signs shall be triangular with a minimum dimension shall be 30 inches. Signs shall have a red and white reflective background with a red reflective legend. Product number GR-199 as manufactured by "Traffic Safety Supply Co." of Portland, Oregon, or an approved equal.

285.2.2 Warning signs shall be constructed of extruded aluminum panels with an Engineering grade reflective sheeting finish. The minimum dimension shall be 24 inches. Signs shall have a yellow reflective background with a black non-reflective legend.

285.2.3 Parking signs shall be constructed of extruded aluminum panels with a baked enamel finish. The minimum dimension shall be 12 inches. Signs shall have a white background with a green legend.

285.2.4 Street signs shall be constructed of extruded wood blades with a alidine finish. The signs shall have a non-reflective green background with white reflective legend. The legend shall be 4-inch standard alphabet C series. The prefix and standard abbreviations shall be 2-inch alphabet C series.

285.2.5 Sign posts shall be 4 x 4 or 4 x 6 Douglas Fir or Cedar, pressure treated in accordance with U.B.C. Standards No. 25-12 and A.W.P.A Standards, C2 and C18. Minimum net retention of waterborne preservatives (ACZA or CCA) shall be 0.06 pounds per cubic foot. All sign posts shall be 14 feet long. All hardware shall be smooth-finished die-cast high strength aluminum alloy or stainless steel.

285.3 CONSTRUCTION:

285.3.1 Existing signs that interfere with the construction shall be removed. Those signs that are judged by the City to be in good condition may be reused at the Contractors discretion.

285.3.2 Sign Posts shall be installed between 5 feet and 10 feet from the edge of the traveled way. Embed sign post to a depth of 3 feet in a 12-inch diameter by 3'-6" deep hole. Install a 6-inch layer of railroad ballast bedding in hole prior to post installation. Backfill post with compacted 3/4 inch-minus crushed rock.

285.3.3 Street signs shall be mounted to the post with the assembly hardware per the manufacturer's instructions.

285.3.4 Other signs shall be mounted to the post such that the bottom of the sign is at least 7 feet above finish ground elevation. The sign shall be mounted to the post at the top and bottom per the manufacturer's instructions.

285.3.5 Sign Locations shall be as determined by the Traffic Practices Handbook For Local Roads And Streets In Oregon prepared by Oregon Department of Transportation.

286 GUARD RAILS

286.1 DESCRIPTION:

This work consists of constructing metal guard rail to the lines and grades shown or established and includes the assembly and erection of all components, parts, and materials complete at the locations shown or directed.

286.2 MATERIALS:

286.2.01 Concrete in anchors shall meet the requirements of the ODOT Standard Specifications for Highway Construction, current edition.

286.2.02 Anchor Hardware - Cables and fittings for guardrail anchors shall conform to the requirements of AASHTO M 30, Class C, for Type II cable. All fittings shall be galvanized according to AASHTO M 111.

For steel anchors, the steel dubbing shall meet the requirements of ASTM A 500, Grade B; ASTM A 501; or ASTM A 618. The soil plate shall meet the requirements of ASTM A 36. Both tubing and plate shall be galvanized according to AASHTO M 111.

286.2.03 Metal Beam Rail - The metal beam rail shall be formed from galvanized steel. The effective length of rail members shall be 12'-6". Galvanized steel beam rail shall conform to the requirements of AASHTO M 180, for Class A rail. The zinc coating shall conform to the requirements for Type 2, AASHTO M 180, applied after fabrication and subject to the single spot test. Backup plates will be accepted with un-galvanized edges and bolt holes, provided these areas are field coated with an approved galvanizing substitute.

286.2.04 Guard Rail Posts - Guard rail posts shall be either Douglas Fir or Hem Fir conforming to the requirements of the ODOT Standard Specifications for Highway Construction, current edition.

286.2.05 Guard Rail Blocks - Guard rail blocks shall be Douglas Fir, Hem Fir, or Pine conforming to the requirements of the ODOT Standard Specifications for Highway Construction, current edition.

286.3 CONSTRUCTION:

286.3.01 Excavation and backfill shall be made to the lines, grades, and depths shown or established. All cuts shall be made with an auger or other means which will prevent undue disturbance of the abutting areas. Any materials which become fouled as a result of post excavation shall be replaced with new materials.

Posts shall be backfilled with 3/4 inch-minus crushed rock, placed and compacted in maximum 6-inch lifts. Backfill shall be compacted to 90 percent of maximum density.

286.3.02 Installation of Posts and Anchors - Posts may be set in excavated holes or they may be driven in place, at the option of the Contractor. Contractor shall repair all damage resulting from excavation and/or post driving. Posts shall be firmly set at proper line, grade and spacing within a tolerance of 2 inch. Anchors and terminals shall be rigidly attached as shown.

286.3.03 Rails and Other Components - All fabrication of metal beam rail members and other components shall be done in the shop or by the manufacturer. Field cutting, drilling, and other field fabrication shall be kept to a minimum and be performed in a manner that will not impair the appearance or structural quality of the material. Burning of new holes in metal beam rail members will not be allowed.

Blocks shall be toe nailed to posts with two 10d galvanized nails to prevent rotation. All bolts, except adjustment bolts, shall be drawn tight. Bolts shall be of sufficient length to extend slightly beyond the nuts.

All surface finishes and protections which are damaged before or during construction shall be restored. All cut ends of bolts, rail members, back-up plates, and any holes drilled or punched after galvanizing shall be restored according to Technical Specification 02420.10(d) of the ODOT Standard Specifications for Highway Construction, current edition, except that 1 1/2 ounces of leafing aluminum powder shall be added to each quart of high zinc dust content paint.

292 GRASS RESEEDING

292.1 DESCRIPTION:

This item includes all work necessary to restore and reshape the existing grass surface within the clearing and grubbing limits.

292.2 MATERIALS:

292.2.01 Native topsoil shall be the existing native topsoil material excavated from the surrounding vicinity consisting of fertile, loamy, natural surface soil consisting of sands, silts, clays and organic matter in combination and free from substances toxic to plant growth, noxious weeds, roots, refuse, sticks and lumps. Sticks and roots greater than 2 inches in diameter shall be removed from the topsoil.

292.2.02 Seed shall be from blue tag stock and from the latest crop available. Each variety shall be from tested seed and shall be delivered in standard sealed containers labeled in accordance with Oregon State laws and U.S. Department of Agriculture rules and regulations. The percentage of purity, germination and maximum weed content shall be as set forth in the General Seed Certification Standard by Oregon State University Certification Board or as specified. The label shall show the variety of seed, the percentage of germination, purity and weed content, and the

date of test. The seed shall have been tested within 9 months of date of delivery and shall not be moldy, or show evidence of having been wet or otherwise damaged.

Each lot of seed shall be subject to inspection, sampling and testing on delivery to the project. Seed not meeting the requirements of these specifications or not labeled as specified, will be rejected and shall be replaced with seed conforming to the specifications. Grass seed may be delivered to the project as a mixture providing each variety of grass seed in the mixture is identified and labeled as specified or a certification from the supplier is attached giving the percentage of each variety of grass seed in the mixture and the percentage of purity, germination, and weed content.

Seed mixture shall be as follows:

Annual, perennial or hybrid rye grass.....	6% - 12%
Tall fescue.....	44% - 58%
Creeping red fescue	20% - 28%
Big trefoil.....	9% - 15%
Bentgrass	1% - 5%

292.2.03 Fertilizer shall be furnished in moisture proof bags. Each bag shall be marked with the weight and with the manufacturer's analysis of the contents showing the percentage for each ingredient contained therein. Fertilizer shall be furnished in a dry condition free from lumps and caking, in granular or pelletized form. Fertilizer shall be standard commercial grade and shall conform to all State and Federal regulations, and to the standards of the Association of Official Agricultural Chemists. Inorganic fertilizer shall consist of a co-granulated ammonium phosphate and magnesium potassium phosphate, controlled-release compound having a minimum analysis expressed as percent of total weight as follows:

16-20-0	
Nitrogen	16%
Available Phosphoric Acid	20%
Soluble Potash	0%

The chemical composition shall be as specified.

292.3 CONSTRUCTION:

292.3.01 Preparation of Areas - Seeding areas shall be in a loose, friable, condition for a minimum depth of 6 inches and suitable for fine grading. Seeding areas shall be made substantially free of vegetative matter, stones, clods, roots, sticks debris and other matter detrimental or toxic to the germination and growth of grass seed. Seeding areas shall be at the established grades and shall be finished to provide good drainage and left approximately 1 inch below the grades of adjacent

paved areas. Soil amendments and fertilizers shall be spread evenly over the seedbed at the rates specified in the special provisions and then thoroughly incorporated into the upper 6 inches of the soil. The surface shall then be graded to a fine-textured, smooth and firm condition.

292.3.02 Seeding - Seed, as a mixture, shall be sown uniformly on the prepared areas at the rate of 2 pounds per 1,000 square feet, using such methods as the Contractor may select. Seed shall then be worked into the soil to a depth not exceeding 4 inches. Upon completion of the seeding, the ground surface shall be made free of ruts, footprints or other irregularities and uniformly covered with a light application of clean, aged sawdust, peat moss, organic mulch pellets or wood cellulose. Areas that settle and collect water shall be brought to grade and reseeded as originally specified.

292.3.03 Fertilizing shall be applied uniformly in three separate applications as follows:

- a. Once during seed bed construction prior to seeding
- b. Twice, at equal intervals, during the establishment period.

292.3.04 Establishment Period - The seeded lawn construction work includes establishing all seeded lawn to a uniform, thick and healthy weed-free growth of grass.

292.3.05 Water shall be applied, when required, according to good horticultural practice under the prevailing conditions, as required to promote a healthy stand of grass.

293 HYDRO-SEEDING

293.1 DESCRIPTION:

This work shall consist of furnishing and applying a mixture of seed, fertilizer, fiber and water, mixing stabilizing emulsion, fiber, and water and applying said mixtures with hydro-seeding equipment in two separate applications.

293.2 MATERIALS:

293.2.01 Commercial fertilizer shall be in pellet or granular form and shall have a minimum guaranteed chemical analysis of 16 percent nitrogen and 20 percent phosphoric acid. The fertilizer for erosion control work need not contain water soluble potash.

293.2.02 Seed shall be from blue tag stock and from the latest crop available. Each variety shall be from tested seed and shall have been tested within 9 months of date of delivery and shall not be moldy, or show evidence of having been wet or otherwise damaged. The percentage of purity, germination and maximum weed content shall be as set forth in the General Seed Certification Standard by Oregon State University Certification Board or as specified. The seed grass seed may be delivered to the project as a mixture providing each variety of grass seed in the mixture is identified and labeled as specified or a certification from the supplier is attached giving the

percentage of each variety of grass seed in the mixture and the percentage of purity, germination and weed content.

Seed mixture shall be as follows:

Annual, perennial or hybrid rye grass.....	6 - 12%
Tall fescue.....	44 - 58%
Creeping red fescue	20 - 28%
Bent grass	1 - 5%
Big trefoil.....	9 - 15%

293.2.03 Stabilizing emulsion shall be a concentrated liquid chemical that forms a plastic film upon drying and allows water and air to penetrate. The film shall be nonflammable and shall have an effective life of at least 1 year.

293.2.04 Fiber shall be produced from wood chips or similar wood materials and shall not be produced from sawdust or from paper, cardboard, or other such materials. Fiber shall be of such character that the fiber will disperse into a uniform slurry when mixed with water. Water content of the fiber before mixing into a slurry shall not exceed 15 percent of the dry weight of the fiber marked on the package. Fiber shall be colored green, and shall be nontoxic to plant or animal life, and shall not strain concrete or painted surfaces.

293.3 CONSTRUCTION:

293.3.01 Preparation of areas shall be in a loose, friable, condition for a minimum depth of 6 inches and suitable for fine grading. Seeding areas shall be made substantially free of vegetative matter, stones, clods, roots, sticks, debris and other matter detrimental or toxic to the germination and growth of grass seed.

293.3.02 Hydro-seeding shall consist of mixing and applying seed, commercial fertilizer and stabilizing emulsion, or any combination thereof, with fiber and water. Seed shall be applied at a rate of 2 pounds per 1,000 square feet.

The quantity of water shall be as needed for application, except that ration of stabilization emulsion to water shall be as recommended by the manufacturer of the emulsion, but shall not exceed 6 gallons of water for each 5 pounds of stabilizing emulsion solids specified.

Mixing of materials for application with hydro-seeding equipment shall be performed in a tank with a built-in continuous agitation system of sufficient operating capacity to produce a homogenous mixture and a discharge system which will apply the mixture at a continuous and uniform rate. The tank shall have a minimum capacity of 1,000 gallons. The Project Engineer may authorize use of equipment of smaller capacity if it is demonstrated that such equipment is capable of performing all operations satisfactorily.

A dispersing agent may be added to the mixture provided the Contractor furnishes evidence that the additive is not harmful. Any material considered harmful, as determined by the Project Engineer, shall not be used.

Any mixture containing stabilizing emulsion shall not be applied during rainy weather or when soil temperatures are below 40 degrees F. Pedestrians or equipment shall not be permitted to enter areas where mixtures containing stabilizing emulsion have been applied.

DIVISION THREE

CONCRETE

310 CONCRETE FORMWORK310.1 DESCRIPTION:

This item includes all work necessary to do all of the concrete formwork required to complete this project. Concrete formwork engineering, design and construction shall be the responsibility of the Contractor.

310.2 MATERIALS:

310.2.01 General - Concrete formwork shall conform to ACI 347-68 unless otherwise noted. The Contractor shall be responsible for adequate strength and safety of all formwork including false work, bracing and shoring.

310.2.02 Plywood forms shall be DFPA exterior "Plyform", or approved, Class I or Class II as required by concrete placement rate.

310.2.03 Form ties shall be plastic cone type, Burke, Bowman, Richmond, Dayton, JEF, or approved equal.

310.2.04 Form coating shall be stainless, non-grain raising, form sealer, Madden "N", or approved equal.

310.3 CONSTRUCTION:

310.3.01 General - Forms shall be constructed to the required lines, grades, dimensions and surfaces, all according to ACI 347-68.

310.3.02 Embedded items such as sleeves, inserts, anchors, conduits, etc. shall be properly located and placed. All embedded items required by other trades shall be coordinated with those trades.

310.3.03 Form Removal - The Contractor shall not remove formwork until concrete has sufficient strength to permit safe removal and adequate support of its own weight and imposed loads.

320 CONCRETE REINFORCEMENT320.1 DESCRIPTION:

This item includes all work necessary for the furnishing and placement of all materials for the reinforcing steel work for all concrete as shown on the plans.

320.2 MATERIALS:

320.2.01 Reinforcing bars shall be deformed as defined in ASTM specifications. All reinforcing bars shall be Grade 40, ASTM A615. Metal reinforcement at the time concrete is placed shall be free from mud, oil, loose mill scale, loose rust, or other coatings that adversely affect bonding capacity in the opinion of the Project Engineer.

320.3 INSTALLATION:

320.3.01 General - All requirements of concrete reinforcement not covered in these specifications or on the plans shall be in accordance with "Manual of Standard Practice", as published by the Concrete Reinforcing Steel Institute (CRSI). All hooks shall conform to bend dimensions defined as "Standard Hooks" in "Manual of Standard Practice", as published by CRSI. Reinforcing bars shall not be bent or straightened in a manner that will injure the material.

320.3.02 Placing - Reinforcing bars shall be accurately placed and shall be firmly and securely held in position by wiring at intersections with black annealed No. 16 gage wire and by using precast mortar blocks or metal chairs, spacers, metal hangers, supporting wires and other approved devices of sufficient strength to resist crushing under full load. Metal supports which extend to the surface of the concrete, except where shown on the plans, and wooden supports shall not be used. Placing bars on layers of fresh concrete as the work progresses and adjusting bars during this placing of concrete will not be permitted. Clearance between reinforcement and embedded pipe, etc., shall not be less than 1 1/2 times the maximum aggregate size. Minimum lap splices shall be 12 inches.

330 CAST-IN-PLACE CONCRETE330.1 DESCRIPTION:

This item includes the furnishing of all labor, materials and tools necessary to do all the plain and reinforced concrete work, including finishing as shown on the plans.

330.2 MATERIALS:

330.2.01 Concrete shall be 6-sack transit-mixed concrete in accordance with ASTM C94. In no case will the use of concrete be permitted which has been mixed with water for more than 90 minutes prior to placing. Water content shall be controlled such that maximum slump by standard slump cone test, ASTM C143, shall not exceed 3 1/2 inches.

330.3 CONSTRUCTION:

330.3.01 Placing - Concrete shall be placed in such a manner as to prevent segregation. Concrete shall be consolidated to the maximum practicable density, free from pockets of coarse aggregate and entrapped air, and closed snugly against all surfaces of forms and embedded materials.

Consolidation of concrete in structures shall be by electric or pneumatic drive, immersion-type vibrators. Consolidation of all other concrete shall be by vibration, hand spading, rodding, or tamping. Mechanical vibration shall not be used to transport concrete. Place all concrete within 90 minutes after batching and mixing. No concrete shall be placed when the air temperature is below 35 °F.

330.3.02 Finishing of Slabs - After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. All high and low spots shall be leveled during this operation to produce a true plane surface within 1/4 inch in 10 feet, as determined by a 10 foot straightedge placed anywhere on the surface. Immediately after the concrete has received a float finish, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

330.3.03 Form tie holes and minor defects which are exposed to final view shall be filled with patching mortar mixed as dry as feasible, packed solid, and neatly finished to match adjoining surfaces.

330.3.04 Curing - Concrete shall be protected from premature drying, freezing, wash by drainage rains, snow, and from traffic and mechanical injury. Concrete shall be protected from freezing if the air temperature is expected to drop below 35 degrees F during the first 5 days after placing. Formed concrete surfaces shall be cured by leaving the forms in place for at least 7 days after placing. Flat concrete surfaces shall be water cured by spraying lightly with water as soon as the concrete has hardened enough to prevent damage from spraying, then covered completely with a plastic waterproof membrane. A curing compound approved by the Project Engineer and applied in accordance with manufacturer's instructions may be used in lieu of water curing. Precast concrete slabs shall not be moved for at least 28 days after casting.

330.4 QUALITY ASSURANCE:

330.4.01 Inspection of formwork and reinforcement by the Project Engineer will be required prior to concrete placing. The Contractor shall notify the Project Engineer 24 hours before each expected concrete pour.

205 PIPELINE DEMOLITION**205.1 DESCRIPTION:**

This item includes all work necessary for the demolition, removal and disposal of all abandoned pipelines designated to be removed and to preserve from injury or damage such objects, utilities and structures as are designated to remain in place.

This item also includes the disposal of unsuitable and excess excavated material within the designated limits.

205.2 MATERIALS:

205.2.01 Disposal of Removed Materials - The Contractor shall dispose of all removed pipelines and unsuitable and excess material not required elsewhere on the project.

205.3 CONSTRUCTION:

205.3.01 Public streets used by the Contractor between the project site and all disposal sites shall be kept free and clear of any and all debris resulting from the Contractor's demolition activity.

205.3.02 Asphalt surfaces designated to remain and which will abut new asphalt surfaces above the trench where pipelines are removed shall be sawcut to a neat and straight edge.

206 ASBESTOS CONTAINING PIPE DEMOLITION**206.1 DESCRIPTION**

This item includes all work necessary for the safe demolition, removal, and disposal of asbestos containing pipe in accordance with DEQ guidelines.

206.2 MATERIALS:

206.2.01 Non-Friable Asbestos: Non-friable asbestos is asbestos that is contained within a solid matrix that will not allow asbestos fibers to release easily. AC pipe that is in reasonably good condition is considered to be non-friable.

206.2.02 Friable Asbestos: Friable asbestos can easily be released into the air where it poses a serious threat to health. AC pipe that has been shattered, crushed, or pulverized will become friable. Removal of friable asbestos requires a DEQ licensed asbestos abatement contractor and is not covered in this specification.

206.2.03 Disposal Site: Any landfill that is permitted by the DEQ to accept demolition waste can also accept non-friable asbestos. Some landfills may have special restrictions on non-friable asbestos so the Contractor is encouraged to arrange for disposal in advance.

206.3 CONSTRUCTION

206.3.01 DEO Notification: At least 5 days prior to the removal of AC pipe, the Contractor shall file an ASN-6 Non-Friable Asbestos Removal Notification Form with the Oregon Department of Environmental Quality.

206.3.02 Excavation: The Contractor shall carefully expose the entire length of pipe to be removed. Pipe shall be exposed to the first joint past the designated work area. The Contractor shall take precautions not to damage the pipe during the excavation. The exposed pipe shall be thoroughly wetted by spraying with a garden hose or other suitable means.

206.3.03 Removal: Pipe shall be removed in whole sections wherever possible. Couplings shall be split using a hammer and chisel to aid in removal of whole sections. All AC pipe that is exposed must be removed. Some breakage will occur, however this should be kept to the absolute minimum. Broken pieces of pipe shall also be removed. All pipe parts shall be kept thoroughly wet during the removal process. Sawing, sanding, grinding, chipping or use of power tools on the pipe is not permitted.

206.3.04 Disposal: Pipe shall be disposed of at an authorized disposal site, as described above. Pipe shall be kept thoroughly wet and covered during transport between the project site and the disposal site.

206.3.05 Friable Asbestos: If the pipe is so badly damaged that it becomes friable, the Contractor shall notify the Project Engineer and stop work immediately. The Contractor shall then file a friable asbestos abatement notification as outlined in OAR 340-32-5630 and retain the services of a DEQ licensed asbestos abatement contractor to remove the friable asbestos.

221 TRENCH EXCAVATION, BEDDING AND BACKFILL

221.1 DESCRIPTION:

This item includes all work necessary for trench excavation, trench foundation, pipe bedding, pipe zone, trench backfill, and surface removal and replacement.

221.1.01 Trench excavation is defined as the removal of all material encountered in the trench to the depths as shown or as directed. Trench excavation shall be classified as common excavation.

221.1.02 Trench foundation is defined as the bottom of the trench on which the pipe bedding is to lay and is responsible for the support of the pipe.

221.1.03 Pipe bedding is defined as the furnishing and placing of specified materials on the trench foundation so as to uniformly support the barrel of the pipe. The total bedding depth shall extend from a point 6 inches below the barrel of the pipe to the horizontal centerline of the pipe.

221.1.04 The initial backfill is defined as the full width of the trench from the top of the bedding to a point 12 inches above the top outside surface of the barrel of the pipe.

221.1.05 Trench backfill is defined as the furnishing, placing and compacting of material in the trench between the top of the initial backfill material and the bottom of the pavement base rock, ground surface, or surface material as directed.

221.1.06 Surface removal and replacement is defined as the removal and/or replacement of surface material such as topsoil, sod, pavement, sidewalks, gravel, etc. which requires special consideration in order to accomplish and restore the trench excavation area as specified.

221.2 MATERIAL:

221.2.01 The trench foundation shall be undisturbed native material in all areas except where ground water or other conditions exist, and in the opinion of the Project Engineer, the native material is such that it cannot support the pipe. In those conditions, excavation shall be included to additional depths as required by the Project Engineer and backfilled with select trench foundation material that shall be 1 1/2 inch-minus crushed rock.

221.2.02 Pipe bedding material shall be required in all instances and shall be clean pea gravel or crushed rock with a maximum size of 3/4 inch, uniformly graded from coarse to fine. All pipe bedding materials shall be submitted for the Project Engineer's approval prior to utilization.

221.2.03 The initial backfill material shall be crushed rock with a maximum size of 3/4 inch, uniformly graded from coarse to fine. All initial backfill materials shall be subject to the Project Engineer's approval.

221.2.04 Trench backfill within the public right-of-way shall be crushed rock with a maximum size of 3/4 inch, uniformly graded from coarse to fine. Trench backfill outside of the public right-of-way may be native or common material that, in the opinion of the City, meets the desired characteristic required for the specific surface loading or other criteria of the backfill zone. When, in the opinion of the City, the native material is unsuitable for trench backfill, select trench backfill material shall be used which shall be as specified above for initial backfill. All trenches that are located within the public right-of-way shall be backfilled with select material.

221.2.05 Surface removal and replacement shall consist of any and all material encountered in the excavation that, in the opinion of the Project Engineer, is suitable for use in the restoration and replacement of the original surface. All surface removal and replacement materials shall be subject to the City's approval.

221.2.06 Controlled Density Backfill shall be used when the trench is located within the traveled way of Highway 101 or when cover is less than 30 inches. The backfill shall have a minimum strength of 100 psi at 28 days. The Contractor shall submit details of mix for approval prior to construction. Two approved mixes are as follows:

Option 1	3/4" - 1/4" Crushed Rock	1,900 lb/c.y.
	Sand	1,270 lb/c.y.
	Portland Cement	75 lb/c.y.
	MBVR (Air-Entraining Agent)	35 oz/c.y.
Option 2	Sand	2,700 lb/c.y.
	Portland Cement	200 lb/c.y.
	MBVR (Air Entraining Agent)	35 oz/c.y.

221.3 CONSTRUCTION:

221.3.01 Trench Excavation:

221.3.01A General - All trench excavation and backfill shall conform to any and all specifications of any controlling regulatory agency under which the work is being performed. Pipelines shall be constructed in continuous open trench except that, in special locations, short tunnels or the cut and tunnel method of excavation may be used under specific instructions of the Project Engineer. The Project Engineer may require the use of tunnels to pass obstructions or to minimize traffic interference.

221.3.01B Clearing the Right of Way - Where clearing of the right of way is necessary, it shall be completed prior to the start of the trenching. Trees and brush shall be cut as near to the surface of the ground as practicable and removed to a disposal site approved by the City. The Contractor shall observe all federal and state laws relating to fire permits and local regulations related to burning materials. Under no conditions shall excavated materials be permitted to cover brush prior to clearing and disposal of all brush.

221.3.01C Open Trench Limit - The length of open trench excavated shall always be kept to a minimum. The City shall be the judge of the amount of open trench allowed based upon work conditions of the area. In normal cases, the open trench length shall not exceed 100 feet. Related trench construction such as pavement, road gravel, concrete restoration, etc. shall normally be completed within 500 feet of the open trench limit unless otherwise approved by the City.

221.3.01D Trench Width - It is the intent of these specifications that the trench width at the surface of the ground be kept to a minimum necessary to install the pipe in a safe manner. In all cases, trenches must be of sufficient width to allow for shoring and permit proper joining of the pipe and backfilling of material along the sides of the pipe. The minimum trench width, in the pipe zone shall be 24 inches. No maximum width of trench at the top of the pipe will be specified herein. When required by design, it will be shown on the plans. If the maximum width shown is exceeded by the Contractor without written authorization, the Contractor will be required, to provide pipe of a higher strength designation, a higher class of bedding, or both, as approved. The Contractor shall confine

the top width of the trench to right of ways or easements. Special written agreements to extend the width may be made with the affected property or City, provided such agreement is first approved by the Project Engineer. The Contractor shall take all necessary precautions to avoid damage to properties, structures and utilities adjacent to the trench.

221.3.01E Grade - The Contractor shall excavate the trench to the lines and grades as shown or established by the Project Engineer, with proper allowance for pipe thickness, pipe bedding and foundation stabilization as required. The subgrade upon which the bedding is to be placed shall be firm, undisturbed and true to grade. If the trench is over-excavated, the Contractor shall restore to grade with material of the type specified for pipe bedding. The Contractor shall place the material over the full width of the trench in compacted layers not exceeding 6 inches deep to the established grade with allowance for the pipe bedding.

221.3.01F Disposal of Excess Material - The Contractor shall dispose of all excess material not required elsewhere on the project, make arrangements for disposal and bear all cost related thereto.

221.3.01G Shoring - Unless otherwise provided in the special provisions, the Contractor shall provide all materials, labor and equipment necessary to adequately shore trenches to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench. The method of shoring shall be according to the Contractor's design. The Contractor may elect to use a combination of shoring and overbreak, tunneling, boring, sliding trench shields or other methods of accomplishing the work, provided the method conforms with all applicable local, state and federal safety codes. Removal of any cribbing and sheeting from the trench shall be accomplished in such a manner as to fulfill the above requirements. Damages resulting from improper cribbing or from failure to crib shall be the sole responsibility of the Contractor. That portion of cribbing or sheeting extending below the springline of rigid pipe or below the crown elevation of flexible pipe shall be left in place unless satisfactory means of reconsolidating bedding or side support, disturbed by cribbing or sheeting removal, can be demonstrated. If a moveable box is used in lieu of cribbing or sheeting and the bottom cannot be kept above the springline of rigid pipe or the crown elevation of flexible pipe, the bedding or side support shall be carefully reconsolidated behind the movable box prior to placing backfill. The use of horizontal strutting below the barrel of pipe or the use of the pipe as support for trench bracing will not be permitted.

221.3.01H Location of Excavated Material - Excavated material shall be placed at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic, nor interfere with the function of existing drainage facilities.

221.3.01I Existing Abandoned Facilities - The Contractor shall remove and dispose of existing abandoned pipelines, structures, and other facilities necessary for trench excavation, or as designated on the plans.

221.3.02 Dewatering - The Contractor shall provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe and until the backfill at the pipe zone has been completed. The Contractor shall dispose of the water in a suitable manner without damage to adjacent property. Groundwater shall be controlled such that softening of the bottom of excavations or formation of "quick" conditions or "boils" during excavation shall be prevented. Where the native trench material is sand, the Contractor shall use appropriate trench dewatering methods, to include vacuum dewatering, such that running sand, moving sand and "quick" sand conditions are prevented at the bottom of the excavation. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils and so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

221.3.03 Trench Foundation - When, in the judgment of the Project Engineer, the existing material in the bottom of the trench is unsuitable for supporting the pipe, the Contractor shall excavate below the pipe, as directed by the Project Engineer. The Contractor shall backfill the trench to subgrade of the pipe bedding, with select trench foundation material over the full width of the trench and compact in layers not exceeding 6 inches deep to the required grade. Where the native trench material is sand, the Contractor shall stabilize the native sand trench foundation with adequately designed dewatering systems in accordance with Subsection 221.3.02.

221.3.04 Pipe Bedding consists of leveling the bottom of the trench or the top of the foundation material and placing bedding material to the horizontal centerline of the pipe. Bedding material shall be as specified hereinbefore and placed in at least two lifts. Place the first lift to provide the minimum 6-inch depth of bedding material as shown on the plan before the pipe is installed. The Contractor shall spread the bedding smoothly to proper grade so that the pipe is uniformly supported along the barrel and excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Bedding under the pipe shall provide a firm, unyielding support along the entire pipe length. The Contractor shall place subsequent lifts of not more than 6 inches in thickness up to the horizontal centerline of the pipe, bring lifts up together on both sides of the pipe and carefully work under the pipe haunches by slicing with a shovel, tamping or other approved procedure. Particular attention must be given to the area from the flow line to the horizontal centerline of the pipe or top of bedding to insure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone. Pipe bedding shall be placed the full width of the trench.

221.3.05 Initial Backfill - The Contractor shall place the specified initial backfill material carefully around the pipe in 6-inch layers and thoroughly hand tamp with approved tamping sticks supplemented by "Walking In" and slicing with a shovel. The Contractor shall prevent pipe from movement either horizontally or vertically during placement and compaction of initial backfill material. Mechanical compactors shall not be utilized in placement of the initial backfill material.

221.3.06 Trench Backfill - The Project Engineer will sample excavated material to determine the suitability of the native material for backfill use. If the native backfill is found to be compactible and within the tolerance range of the moisture content, the Contractor will be allowed to use it for trench backfill. The Contractor shall take reasonable precautions to prevent excavated material

from becoming saturated beyond the critical moisture limits and replace any saturated native material with other approved native material. When, in the opinion of the Project Engineer, the excavated material is unsuitable for trench backfill by reason of pre-existing moisture content or other undesirable physical characteristics, the Contractor shall use select trench backfill material at the direction of the Project Engineer. The Contractor shall backfill the trench above the pipe zone to the final surface grade, or as shown on the plans, in lifts not to exceed 8-inch loose depth. The Contractor shall compact each lift to a minimum of 92 percent of the maximum density as determined by AASHTO T-99. The Contractor shall then place the proper surface replacement as required. Any subsequent settlement of the trench during the warranty period shall be considered to be the result of improper compaction and shall be promptly corrected. The Contractor shall compact and rake the soil to match the ground surface adjacent to the trench and maintain the surface of the backfilled trench level with the existing grade until the entire project is accepted by the City. In paved or graveled areas the Contractor shall maintain the surface of the backfill trench level with the existing grade 3/4 inch-minus crushed aggregate material, or asphalt concrete, if directed, until final pavement replacement is completed on the entire project, and is accepted by the City. In paved or graveled areas, this maintenance shall include, but not be limited to, the addition of asphalt concrete or crushed aggregate material to keep the surface of the backfilled trenches reasonably smooth, free from ruts and potholes, and suitable for normal traffic flow. In areas where controlled density backfill is placed, it shall be poured into the trench from a distance not greater than a 36-inch vertical drop. It shall be tamped into place using a mechanical vibrator or hand shovel, so as to form a level surface.

221.3.07 Surface Removal and Restoration:

221.3.07A General - The intent of surface restoration is not to replace what was actually removed in kind, but rather, it is to effect a restoration compatible with the original surface and minimize raveling and maintenance problems.

221.3.07B Paved Surfaces - All bituminous pavement or oiled surface, regardless of thickness, shall be sawcut prior to excavation of trenches. Width of cut shall be two feet wider than the top width of the trench and shall follow lines parallel to the pipe centerline. The use of any machine or device that, during the course of operation, results in damage to adjacent pavement, existing utilities, adjacent structures or improvements shall not be permitted. When the trench has been backfilled to within 3 inches of the final surface grade, the Contractor shall place 3 inches of asphaltic concrete. Any pavement or roadway surfacing not immediately over or adjacent to the trench which is disturbed or damaged as a result of the operations of the Contractor shall be similarly repaired or replaced to the satisfaction of the Project Engineer.

221.3.07C Gravel Surfaces - The restoration shall be the same as for paved surfaces except that 3/4 inch-minus crushed rock shall be placed and compacted to the final surface grade.

221.3.07D Other Surfaces - The ground surface shall be left in a neatly dressed and finished condition wherever it has been disturbed by the operations of the Contractor. Previously planted areas shall be replanted with the same type vegetation. Portland cement concrete pavement, curbs and sidewalks shall be cut with a pavement saw.

Portland cement concrete surfaces shall be replaced and finished to match the depth and finish surface of the adjacent surface.

261 WATER PIPE AND FITTINGS

261.1 DESCRIPTION:

This item includes all work necessary for the installation of water pipe and fittings as shown on the plans for use in water distribution systems.

261.2 MATERIALS:

261.2.01 General - Materials and strength specifications shall be as hereinafter specified for the particular kind of pipe and fittings as shown on the plans. No pipe and fittings that are not hereinafter specified will be allowed on the project.

261.2.02 Water Main Pipe:

261.2.02A Ductile Iron pipe shall conform to the requirements of ANSI A21.51 (AWWA C151), with push-on joints, mechanical joints or restrained joints as shown on the plans. All pipe shall be cement lined and seal coated according to ANSI A21.4 (AWWA C104). The minimum thickness class shall be class 50.

261.2.02B Polyvinyl Chloride (PVC) pipe shall conform to ASTM D2241 for SDR 21, 200 p.s.i. pressure rating. Pipe shall have integral bell and spigot joints with elastomeric gaskets conforming to the requirements of ASTM D1869 and F477. Cast iron fittings shall be used with PVC pipe.

261.2.02C Polyvinyl Chloride (PVC) pipe shall conform to the requirements of AWWA C900. Pipe shall have integral bell and spigot joints with elastomeric gaskets conforming to the requirements of ASTM D1869 and F477. The pressure class shall be Class 200. Cast iron fittings shall be used with PVC pipe.

261.2.03 Water main pipe fittings shall be of a class and rating at least equal to the adjacent pipe unless specified otherwise. Joint materials shall be compatible with the adjacent pipe. All fittings shall be cast or ductile iron. Mechanical joint and push-on joint type coupling shall conform to ANSI A21.10 and A21.11 (AWWA C153), cement lined and seal coated according to ANSI A21.4 (AWWA C104). Other types of joints shall conform to FS WWP-421 b, Type II for push-on joints. Flanged couplings shall be drilled and faced in accordance with ANSI B-16.1 or B-16.2. Rubber gasket type shall be U.S. Pipe, Tyton or approved equal. Cast iron fittings for use with FS Type II and Type III cast iron water pipe shall conform to the same specifications except that joints shall be mechanical type and include cast iron glands, plain rubber gaskets and T-head cast iron bolts and nuts per ANSI A21.11 or an approved compression type with rubber gasket.

261.2.04 Valves:

261.2.04A Gate Valves - Two inches and larger in diameter shall conform to the requirements of AWWA C500 as to composition and quality of material and workmanship. Valves shall be iron body, bronze mounted, resilient seat type, with triple O-ring seals, non-rising stem, and 2-inch square operating nut. Gate valves shall be Clow, Dresser, M and H, Mueller, or approved equal. Valve ends shall be mechanical joint, flanged joint, or push-on joint, or a combination of the foregoing as called for in the plans.

261.2.04B Gate Valves - Smaller than two inches in diameter shall be NRS with operating handwheel, screw ended, and have a rated working pressure not less than 150 p.s.i. The valves shall conform to the requirements of FS WWB 54B, Class A, Type 1.

261.2.05 Valve Boxes - Cast iron valve boxes shall be furnished with all valves 2 inches and larger, and shall conform to the requirements of ASTM A48. Valve boxes shall be two piece sliding type with 5 1/2-inch diameter shaft. Extensions shall be used as required for varying installation conditions and shall be cast iron. PVC extensions may be used when approved by the City. Valve box covers shall be marked "WATER".

261.2.06 Flanged coupling adapters shall be by Uniflange Corp., Series 900-C, or approved equal.

261.2.07 Thrust blocks shall be constructed of Portland cement concrete conforming to the requirements of ASTM C94. Compressive field strength shall be not less than 2,000 p.s.i. at 28 days. Maximum size of aggregate shall be 1 1/2 inches. Restrained joints may be constructed in lieu of thrust blocks. Joint restraint fittings shall be Uniflange Series 1500 for PVC pipe and Uniflange Series 1400 for ductile iron pipe, or approved equal.

261.2.08 Water Service Assemblies for up to 1 Inch Pipe: The City will supply and install water meters.

261.2.08A Pipe shall be Polyethylene type II IPS water service pipe conforming to ASTM D2239, 200 p.s.i., SDR 7. All joints shall use Insta-tite fittings, MIP H-15426 or FIP H-15456, for IPS PE water service pipe.

261.2.08B Service saddles on PVC water lines shall be epoxy coated ductile iron with a stainless steel strap, Mueller DE 1 S, or approved equal.

261.2.08C Corporation stops on PVC water lines shall be Mueller type H-10013, or approved equal, with AWWA I.P. thread inlet and Insta-tite® connection, Mueller H-15456, for IPS PE water service pipe outlet.

261.2.08D Angle curb stops shall be Mueller B-24265 ball angle meter valve, with Insta-tite connection for IPS PE water service pipe inlet and meter spud thread outlet.

261.2.08E Straight curb stops shall be Mueller Mark II Oriseal B-24351 meter valve, with Insta-tite connection for IPS PE water service pipe inlet and meter spud thread outlet.

261.2.08F Couplers shall be Insta-tite fittings, Mueller MIP H-15426 or Mueller FIP H-15456, for IPS PE water service pipe.

261.2.08G Meter boxes shall be Brooks No. 36 concrete body with No. 36T cast iron cover, or approved equal.

261.2.09 Tracer wire shall be #12 multi strand copper wire with blue colored insulation.

261.2.10 Fire Hydrants shall be of the dry barrel type conforming to the requirements of AWAA C502. Each hydrant shall be equipped with two, 2 1/2-inch hose nozzles and one 4 1/2-inch threaded pumper nozzle. Main valve shall be 5 1/2-inch compression type with a 6-inch inlet and counter clockwise opening. Hydrants shall be furnished with factory lubricated o-ring sealed bonnet, safety flange construction, allowing for 360 degree rotation of nozzle section on stem. Hydrant assemblies shall include main line tees and connecting pieces with integrally cast joint restraint, Tyler mechanical joint swivel fittings or approved equal. Hydrants shall be Mueller Superior Centurion.

261.2.11 Air Release Valve shall be APCO No. 65, or approved equal.

261.2.12 Flushing Hydrants shall be USA Bluebook # 17585 hidden style, or approved equal. Hydrant shall be steel with 2-inch diameter inlet and 2 1/2-inch diameter outlet.

261.3 CONSTRUCTION:

261.3.01 Alignment and Grade - All pipe shall be laid to the required lines and grades. Fittings and valves shall be at the required locations with joints centered, spigots home, and valve and hydrant stems plumb.

Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, or other obstructions encountered in the process of the work shall be furnished by the Contractor. Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections, the obstructions shall be permanently supported, relocated, removed or reconstructed by the Contractor in full cooperation with the Owners of such utility structures, or the new water pipe shall be laid to an alignment and/or grade to miss the obstruction. No deviation shall be made from the required line or grade except with the written consent of the Project Engineer.

261.3.02 Depth of Trench - Watermains shall have a minimum cover of 2'-6" from finish grade to top of pipe. Water service lines shall be 24 inches below finish grade.

261.3.03 Curvature - PVC pipe shall not be laid on horizontal and vertical curves. The City may permit curves as long as the radius is no less than the following values:

- 8" pipe - 400 ft. radius (6" offset per 20' length)
- 6" pipe - 300 ft. radius (8" offset per 20' length)
- 4" pipe - 200 ft. radius (12" offset per 20' length)

Where the design alignment and grade call for greater curvature, appropriate angle fittings shall be used. Water service tubing may be laid on horizontal and vertical curves with a minimum radius of 1 foot.

261.3.04 Distribution and Handling - The Contractor shall not distribute material on the job faster than it can be used to good advantage. The Contractor shall unload pipe only by approved means. Pipe shall not be unloaded by dropping it to the ground. The Contractor shall inspect all pipe and fittings prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are used. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep it clean during laying and joining. The Contractor shall use approved implements, tools, and facilities for the safe and proper protection of the work. The Contractor shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. The Contractor shall remove all damaged pipe from the job site. Pipe shall not be dropped or dumped into trenches.

261.3.05 Pipe Distribution and Handling - The Contractor shall not distribute material on the job faster than it can be used to good advantage. The Contractor shall unload pipe only by approved means. Pipe will not be unloaded by dropping it to the ground. The Contractor shall inspect all pipe and fittings prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are used. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep it clean during laying and joining. The Contractor shall use approved implements, tools, and facilities for the safe and proper protection of the work. The Contractor shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. The Contractor shall remove all damaged pipe from the job site. Pipe shall not be dropped or dumped into trenches.

261.3.06 Installation - Trench excavation, bedding and backfill shall be in accordance with Section 221.

261.3.06A Push-on Joints - After a section of pipe has been lowered into the prepared trench, wipe clean the gasket and gasket seat inside the bell with a cloth. Place the gasket in the bell with the large round side of the gasket first. Using a cloth, wipe clean the plain end of the next pipe and insert into the bell just far enough to make contact with the gasket. Force "home" the plain end into the bell end by the use of a bar, fork tool or jack assembly. Align pipe for position and tamp into place.

261.3.06B Mechanical Joints - Before laying all pipe, valves, or fittings, remove all lumps, blisters, and excess coal-tar coating from the bell ends. Wire brush and wipe clean the inside of the bell and the outside of the spigot to remove all loose rust and

foreign material just prior to assembly. Swab the cleaned surfaces with soapy water just prior to slipping the gasket over the spigot end. Accurately center the spigot end in the bell before inserting the gasket. After the gasket is in place, assembly the gland and bell end with bolts by alternately tightening the bolts around the bell end maintaining approximately equal tension until the final tension is reached.

261.3.07 Pipe Restraint - The Contractor shall provide restrained joints at all tees, caps, plugs, and bends for the lengths shown on the plans adjoining such fittings. Joint restraint shall be mechanical joint with retainer glands, or push-on with approved locking gasket, U.S. Pipe Typ-Lok, or approved equal. All joint restraint method shall be submitted to the Project Engineer for review prior to such use.

261.3.08 Thrust Blocks - All tees, plugs, caps, bends, fire hydrants and offsets, as well as all other appurtenances which are subject to unbalanced thrust, shall be properly braced with lateral thrust blocks of concrete. The concrete shall be formed and placed so that the bolts and glands can be removed. The concrete shall bear against solid undisturbed earth at side and bottom of trench excavation. Lateral thrust block bearing areas shall be of the size as specified in APWA standard drawing #401, or as shown on the plans.

261.3.09 Pipe cutting shall be accomplished using proper pipe cutting tools designed specifically for that purpose. Cuts shall be made in accordance with the pipe manufacturer's recommendations.

261.3.10 Fire hydrants shall be installed as shown on the plans and in accordance with the hydrant manufacturer's recommendations. Install hydrant with proper depth of bury or use extension for height adjustment such that hydrant traffic flange shall be located above grade as shown on the plans. Hydrants shall be set true and plumb. Hydrants shall be repainted to the satisfaction of the City should the paint be scratched, chipped, faded or discolored.

261.4 TESTING:

261.4.01 General - A pressure test and a leakage test shall be made by the Contractor of every section of water main after the completion of the final trench backfill. All connections to existing mains shall be left uncovered for a period of 4 hours after normal operating pressure is applied, after which time the inspector shall inspect all such connections and joints, and any leaks which appear shall be repaired. The City Public Works staff shall be advised 24 hours in advance of any testing.

261.4.02 Pressure Test:

261.4.02A Pre-test - After each valved section of pipe has been laid and partially backfilled, the Contractor shall perform a hydrostatic pressure test as outlined below. The results shall be given to the Project Engineer prior to complete backfill of the pipe. If the test indicates materials or workmanship that does not meet design requirements, defective material and/or workmanship shall be corrected and the test re-run until specifications are fulfilled.

261.4.02B Pressure Test of Completed Waterline - All mains, hydrants and fittings shall be subjected to a pressure test in the presence of the inspector after all pre-testing has been completed. A separate test shall be made on each section of the project whenever any section of the work is installed in such a manner as to permit its segregation as a unit. Each section of pipe shall be completely filled with water and care shall be taken to insure that all air is expelled from the pipe line. The specified test pressure shall be applied by means of a pump connected to the main through a corporation stop and service tubing. The test pressure, measured at the point of lowest elevation, shall be 150 p.s.i. for mains to be subjected to a working pressure of 100 p.s.i. or less, and 250 p.s.i. for mains to be subjected to a working pressure over 100 p.s.i. The test pressure shall be held for 1 hour during which time, all exposed pipe, fittings, valves and couplings will be carefully examined for leaks. The portion of main being tested shall be considered "acceptable" for the purposes of this test if the pressure does not decrease more than 10 p.s.i. in 1 hour. All leaks shall be repaired. The test shall be repeated until satisfactory.

261.4.03 Leakage Test - A leakage test shall be conducted after the pressure test has been satisfactorily completed and shall consist of an examination of all exposed joints for leakage as well as overall leakage test of the completed section of pipe. The pressure to be maintained during the test shall be the same as for the pressure test and shall be measured at the low point of the system. The same procedure for filling the line and expelling air shall be used as for the pressure test. The duration of each leakage test shall be 1 hour. Any joint found where accumulated leakage of the joint exceeds the rate of leakage specified by the manufacturer of the pipe shall be rejected. The overall permissible leakage for the section of pipe tested shall not be greater than the number of gallons per hour as determined by the formula in which:

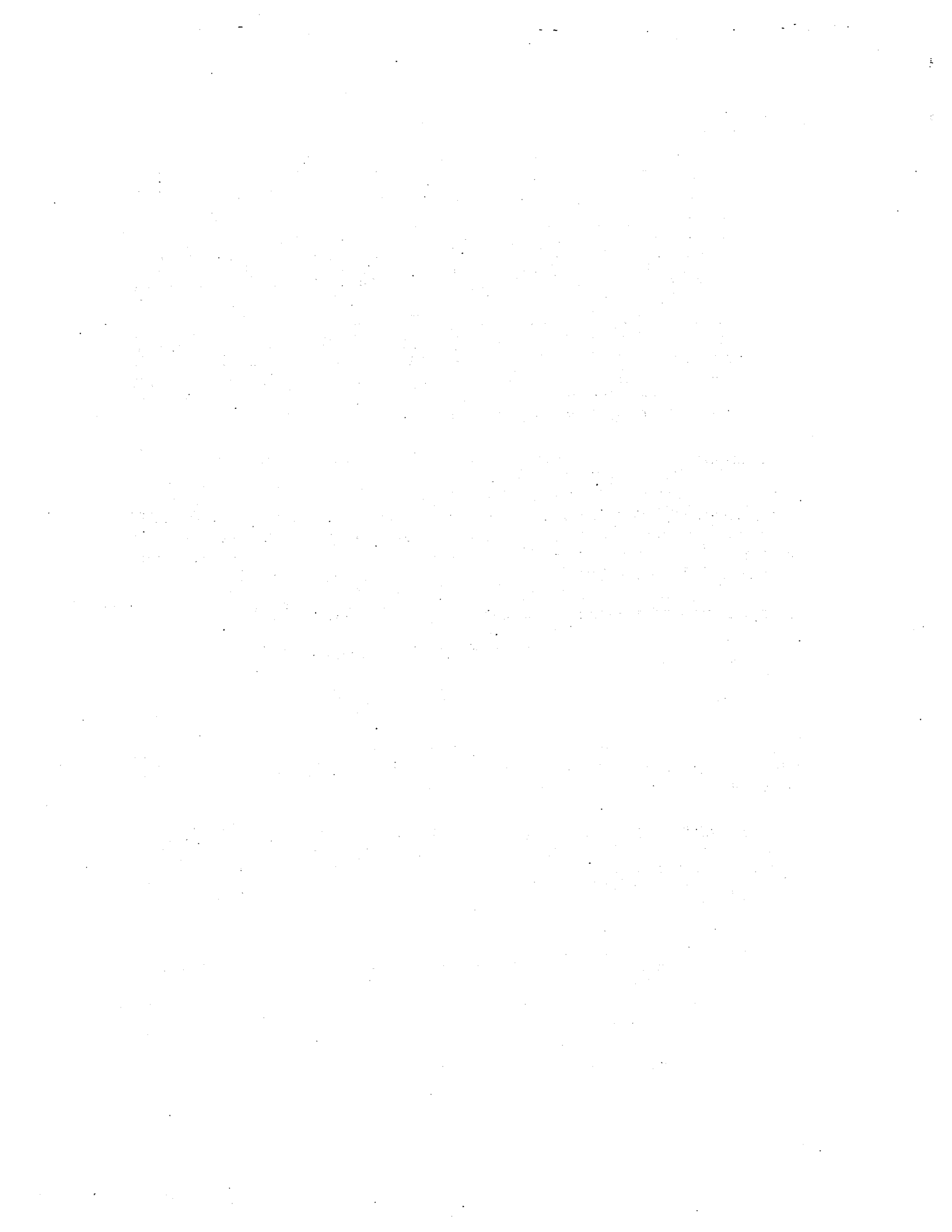
$$L = \frac{ND \times p^{1/2}}{6,054}$$

L = allowable leakage in gallons per hour
 N = Number joints in length of pipe tested
 D = Nominal diameter of pipe in inches
 p = average test pressure during test, in pounds per square inch

Should any test of a section of pipe line disclose joint leakage greater than that permitted, the Contractor shall locate and repair the defective joints until the leakage is within the permitted allowance.

261.4.04 Testing of Service Lines - Corporation stops, service lines, and curb stops shall be installed prior to the above described tests. Water service reconnections shall be tested up to the curb stop. Reconnected portions of water services beyond the last valve will not be subject to testing, but shall be approved by the inspector prior to covering, and any leaks that appear shall be repaired. Water service connections for future use shall be tested up to the last valve.

261.4.05 Disinfection and Flushing - Upon completion of the testing, water mains shall be disinfected in accordance with AWWA C601 and the latest Oregon State Health Division regulations. After disinfection, the chlorinated water shall be flushed from the water main until the replacement water tests are equal chemically and bacteriologically to those of the permanent source of supply. The chlorinated water shall be disposed of in a manner approved by the Oregon State Health Division and the Oregon State DEQ. The chlorinated water shall be discharged into a sanitary sewer system only after the written permission of the City is obtained.



205 PIPELINE DEMOLITION

205.1 DESCRIPTION:

This item includes all work necessary for the demolition, removal and disposal of all abandoned pipelines designated to be removed and to preserve from injury or damage such objects, utilities and structures as are designated to remain in place.

This item also includes the disposal of unsuitable and excess excavated material within the designated limits.

205.2 MATERIALS:

205.2.01 Disposal of Removed Materials - The Contractor shall dispose of all removed pipelines and unsuitable and excess material not required elsewhere on the project.

205.3 CONSTRUCTION:

205.3.01 Public streets used by the Contractor between the project site and all disposal sites shall be kept free and clear of any and all debris resulting from the Contractor's demolition activity.

205.3.02 Asphalt surfaces designated to remain and which will abut new asphalt surfaces above the trench where pipelines are removed shall be sawcut to a neat and straight edge.

206 ASBESTOS-CONTAINING PIPE DEMOLITION

206.1 DESCRIPTION

This item includes all work necessary for the safe demolition, removal, and disposal of asbestos containing pipe in accordance with DEQ guidelines.

206.2 MATERIALS:

206.2.01 Non-Friable Asbestos: Non-friable asbestos is asbestos which is contained within a solid matrix that will not allow asbestos fibers to release easily. AC pipe that is in reasonably good condition is considered to be non-friable.

206.2.02 Friable Asbestos: Friable asbestos can easily be released into the air where it poses a serious threat to health. AC pipe which has been shattered, crushed, or pulverized will become friable. Removal of friable asbestos requires a DEQ licensed asbestos abatement contractor and is not covered in this specification.

206.2.03 Disposal Site: Any landfill that is permitted by the DEQ to accept demolition waste can also accept non-friable asbestos. Some landfills may have special restrictions on non-friable asbestos so the Contractor is encouraged to arrange for disposal in advance.

206.3 CONSTRUCTION

206.3.01 DEQ Notification: At least 5 days prior to the removal of AC pipe, the Contractor shall file an ASN-6 Non-Friable Asbestos Removal Notification Form with the Oregon Department of Environmental Quality.

206.3.02 Excavation: The Contractor shall carefully expose the entire length of pipe to be removed. Pipe shall be exposed to the first joint past the designated work area. The Contractor shall take precautions not to damage the pipe during the excavation. The exposed pipe shall be thoroughly wetted by spraying with a garden hose or other suitable means.

206.3.03 Removal: Pipe shall be removed in whole sections wherever possible. Couplings shall be split using a hammer and chisel to aid in removal of whole sections. All AC pipe which is exposed must be removed. Some breakage will occur, however this should be kept to the absolute minimum. Broken pieces of pipe shall also be removed. All pipe parts shall be kept thoroughly wet during the removal process. Sawing, sanding, grinding, chipping or use of power tools on the pipe is not permitted.

206.3.04 Disposal: Pipe shall be disposed of at an authorized disposal site, as described above. Pipe shall be kept thoroughly wet and covered during transport between the project site and the disposal site.

206.3.05 Friable Asbestos: If the pipe is so badly damaged that it becomes friable, the Contractor shall notify the Project Engineer and stop work immediately. The Contractor shall then file a friable asbestos abatement notification as outlined in OAR 340-32-5630 and retain the services of a DEQ licensed asbestos abatement contractor to remove the friable asbestos.

221 TRENCH EXCAVATION, BEDDING AND BACKFILL

221.1 DESCRIPTION:

This item includes all work necessary for trench excavation, trench foundation, pipe bedding, pipe zone, trench backfill, and surface removal and replacement.

221.1.01 Trench excavation is defined as the removal of all material encountered in the trench to the depths as shown or as directed. Trench excavation shall be classified as common excavation.

221.1.02 Trench foundation is defined as the bottom of the trench on which the pipe bedding is to lay and is responsible for the support of the pipe.

221.1.03 Pipe bedding is defined as the furnishing and placing of specified materials on the trench foundation so as to uniformly support the barrel of the pipe. The total bedding depth shall extend from a point 6 inches below the barrel of the pipe to the horizontal centerline of the pipe.

221.1.04 The initial backfill is defined as the full width of the trench from the top of the bedding to a point 12 inches above the top outside surface of the barrel of the pipe.

221.1.05 Trench backfill is defined as the furnishing, placing, and compacting of material in the trench between the top of the initial backfill material and the bottom of the pavement base rock, ground surface, or surface material as directed.

221.1.06 Surface removal and replacement is defined as the removal and/or replacement of surface material such as topsoil, sod, pavement, sidewalks, gravel, etc. which requires special consideration in order to accomplish and restore the trench excavation area as specified.

221.2 MATERIAL:

221.2.01 The trench foundation shall be undisturbed native material in all areas except where ground water or other conditions exist, and in the opinion of the Project Engineer, the native material is such that it cannot support the pipe. In those conditions, excavation shall be included to additional depths as required by the Project Engineer and backfilled with select trench foundation material which shall be 1 1/2 inch-minus crushed rock.

221.2.02 Pipe bedding material shall be required in all instances and shall be crushed rock with a maximum size of 3/4 inch, uniformly graded from coarse to fine. Clean native sand may be substituted for gravel in trenches with no groundwater in the trench. All pipe bedding materials shall be submitted for the Project Engineer's approval prior to utilization.

221.2.03 The initial backfill material shall be crushed rock with a maximum size of 3/4 inch, uniformly graded from coarse to fine. Clean native sand may be substituted for gravel in trenches with no groundwater in the trench. All initial backfill materials shall be subject to the Project Engineer's approval.

221.2.04 Trench backfill within the public right-of-way shall be crushed rock with a maximum size of 3/4 inch, uniformly graded from coarse to fine. Trench backfill outside of the public right-of-way may be native or common material that, in the opinion of the City, meets the desired characteristic required for the specific surface loading or other criteria of the backfill zone. When, in the opinion of the City, the native material is unsuitable for trench backfill, select trench backfill material shall be used which shall be as specified above for initial backfill. All trenches that are located within the public right-of-way shall be backfilled with select material.

221.2.05 Surface removal and replacement shall consist of any and all material encountered in the excavation which, in the opinion of the Project Engineer, is suitable for use in the restoration and replacement of the original surface. All surface removal and replacement materials shall be subject to the City's approval.

221.2.06 Controlled Density Backfill shall be used when the trench is located within the traveled way of Highway 101 or when cover is less than 30 inches. The backfill shall have a minimum strength of 100 psi at 28 days. The Contractor shall submit details of mix for approval prior to construction. Two approved mixes are as follows:

Option 1	3/4" - 1/4" Crushed Rock	1,900 lb/c.y.
	Sand	1,270 lb/c.y.
	Portland Cement	75 lb/c.y.
	MBVR (Air Entraining Agent)	35 oz/c.y.
Option 2	Sand	2,700 lb/c.y.
	Portland Cement	200 lb/c.y.
	MBVR (Air Entraining Agent)	35 oz/c.y.

221.3 CONSTRUCTION:221.3.01 Trench Excavation:

221.3.01A General - All trench excavation and backfill shall conform to any and all specifications of any controlling regulatory agency under which the work is being performed. Pipelines shall be constructed in continuous open trench except that, in special locations, short tunnels or the cut and tunnel method of excavation may be used under specific instructions of the Project Engineer. The Project Engineer may require the use of tunnels to pass obstructions or to minimize traffic interference.

221.3.01B Clearing the Right of Way - Where clearing of the right of way is necessary, it shall be completed prior to the start of the trenching. Trees and brush shall be cut as near to the surface of the ground as practicable and removed to a disposal site approved by the City. The Contractor shall observe all federal and state laws relating to fire permits and local regulations related to burning materials. Under no conditions shall excavated materials be permitted to cover brush prior to clearing and disposal of all brush.

221.3.01C Open Trench Limit - The length of open trench excavated shall always be kept to a minimum. The City shall be the judge of the amount of open trench allowed based upon work conditions of the area. In normal cases, the open trench length shall not exceed 100 feet. Related trench construction such as pavement, road gravel, concrete restoration, etc. shall normally be completed within 500 feet of the open trench limit unless otherwise allowed by the City.

221.3.01D Trench Width - It is the intent of these specifications that the trench width at the surface of the ground be kept to a minimum necessary to install the pipe in a safe manner. In all cases, trenches must be of sufficient width to allow for shoring and permit proper joining of the pipe and backfilling of material along the sides of the pipe. The minimum trench width, in the pipe zone shall be 24 inches. No maximum width of trench at the top of the pipe will be specified herein. When required by design, it will be shown on the plans. If the maximum width shown is exceeded by the Contractor without written authorization, the Contractor will be required, at no expense to the City, to provide pipe of a higher strength designation, a higher class of bedding, or both, as approved. Excavation for manholes and other structures shall be wide enough to provide

a minimum of 12 inches between the structure surface and the sides of the excavation. The Contractor shall confine the top width of the trench to right of ways or easements. Special written agreements to extend the width may be made with the affected property or City. The Contractor shall take all necessary precautions to avoid damage to properties, structures and utilities adjacent to the trench.

221.3.01E Grade - The Contractor shall excavate the trench to the lines and grades as shown or established by the Engineer, with proper allowance for pipe thickness, pipe bedding and foundation stabilization as required. The subgrade upon which the bedding is to be placed shall be firm, undisturbed and true to grade. If the trench is over-excavated, the Contractor shall restore to grade with material of the type specified for pipe bedding and place the material over the full width of the trench in compacted layers not exceeding 6 inches deep to the established grade with allowance for the pipe bedding.

221.3.01F Disposal of Excess Material - The Contractor shall dispose of all excess material not required elsewhere on the project, make arrangements for disposal and bear all cost related thereto.

221.3.01G Shoring - Unless otherwise provided in the special provisions, the Contractor shall provide all materials, labor and equipment necessary to adequately shore trenches to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench. The method of shoring shall be according to the Contractor's design. The Contractor may elect to use a combination of shoring and overbreak, tunneling, boring, sliding trench shields or other methods of accomplishing the work, provided the method conforms with all applicable local, state and federal safety codes. Removal of any cribbing and sheeting from the trench shall be accomplished in such a manner as to fulfill the above requirements. Damages resulting from improper cribbing or from failure to crib shall be the sole responsibility of the Contractor. That portion of cribbing or sheeting extending below the springline of rigid pipe or below the crown elevation of flexible pipe shall be left in place unless satisfactory means of reconsolidating bedding or side support, disturbed by cribbing or sheeting removal, can be demonstrated. If a moveable box is used in lieu of cribbing or sheeting and the bottom cannot be kept above the springline of rigid pipe or the crown elevation of flexible pipe, the bedding or side support shall be carefully reconsolidated behind the movable box prior to placing backfill. The use of horizontal strutting below the barrel of pipe or the use of the pipe as support for trench bracing will not be permitted.

221.3.01H Location of Excavated Material - Excavated material shall be placed at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic, nor interfere with the function of existing drainage facilities.

221.3.01I Existing Abandoned Facilities - The Contractor shall remove and dispose of existing abandoned pipelines, structures, and other facilities necessary for trench excavation, or as designated on the plans.

221.3.02 Dewatering - The Contractor shall provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe and until the backfill at the pipe zone has been completed. The Contractor shall dispose of the water in a suitable manner without damage to adjacent property. Groundwater shall be controlled such that softening of the bottom of excavations or formation of "quick" conditions or "boils" during excavation shall be prevented. Where the native trench material is sand, the Contractor shall use appropriate trench dewatering methods, to include vacuum dewatering, such that running sand, moving sand and "quick" sand conditions are prevented at the bottom of the excavation. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils and so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

221.3.03 Trench Foundation - When, in the judgment of the Project Engineer, the existing material in the bottom of the trench is unsuitable for supporting the pipe, the Contractor shall excavate below the pipe, as directed by the Engineer. The Contractor shall backfill the trench to subgrade of the pipe bedding, with select trench foundation material over the full width of the trench and compacted in layers not exceeding 6 inches deep to the required grade. Where the native trench material is sand, the Contractor shall stabilize the native sand trench foundation with adequately designed dewatering systems in accordance with Subsection 221.3.02.

221.3.04 Pipe Bedding consists of leveling the bottom of the trench or the top of the foundation material and placing bedding material to the horizontal centerline of the pipe. Bedding material shall be as specified hereinbefore and placed in at least two lifts. Place the first lift to provide the minimum 6-inch depth of bedding material as shown on the plan before the pipe is installed. The Contractor shall spread the bedding smoothly to proper grade so that the pipe is uniformly supported along the barrel and excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Bedding under the pipe shall provide a firm, unyielding support along the entire pipe length. The Contractor shall place subsequent lifts of not more than 6 inches in thickness up to the horizontal centerline of the pipe, bring lifts up together on both sides of the pipe and carefully work under the pipe haunches by slicing with a shovel, tamping or other approved procedure. Particular attention must be given to the area from the flow line to the horizontal centerline of the pipe or top of bedding to insure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone. Pipe bedding shall be placed the full width of the trench.

221.3.05 Initial Backfill - The Contractor shall place the specified initial backfill material carefully around the pipe in 6-inch thick layers and thoroughly hand tamp with approved tamping sticks supplemented by "Walking In" and slicing with a shovel. The Contractor shall prevent pipe from movement either horizontally or vertically during placement and compaction of initial backfill material. Mechanical compactors shall not be utilized in placement of the initial backfill material.

221.3.06 Trench Backfill - The Engineer will sample excavated material to determine the suitability of the native material for backfill use. If the native backfill is found to be compactible and within the tolerance range of the moisture content, the Contractor will be allowed to use it for trench backfill. The Contractor shall take reasonable precautions to prevent excavated material

from becoming saturated beyond the critical moisture limits and replace any saturated native material with other approved native material at no expense to the City. When, in the opinion of the Engineer, the excavated material is unsuitable for trench backfill by reason of pre-existing moisture content or other undesirable physical characteristics, the Contractor shall use suitable excess excavated material at the direction of the Engineer. The Contractor shall backfill the trench above the pipe zone to within 8 inches of the final surface grade, or as shown on the plans, in lifts not to exceed 8-inch loose depth. The Contractor shall compact each lift to a minimum of 92 percent of the maximum density as determined by AASHTO T-99. Lifts of up to 3 feet may be used if a backhoe mounted vibratory compactor is used to compact backfill. The Contractor shall then place the proper surface replacement as required. Any subsequent settlement of the trench during the warranty period shall be considered to be the result of improper compaction and shall be promptly corrected. The Contractor shall compact and rake the soil to match the ground surface adjacent to the trench and maintain the surface of the backfilled trench level with the existing grade until the entire project is accepted by the City. In paved or graveled areas the Contractor shall maintain the surface of the backfill trench level with the existing grade 3/4 inch-minus crushed aggregate material, or asphalt concrete, if directed, until final pavement replacement is completed on the entire project, and is accepted by the City. In paved or graveled areas, this maintenance shall include, but not be limited to, the addition of asphalt concrete or crushed aggregate material to keep the surface of the backfilled trenches reasonably smooth, free from ruts and potholes, and suitable for normal traffic flow. In areas where controlled density fill is placed, it shall be poured into the trench from a distance not greater than a 36-inch vertical drop. It shall be tamped into place using a mechanical vibrator or hand shovel, so as to form a level surface.

221.3.07 Surface Removal and Restoration:

221.3.07A General - The intent of surface restoration is not to replace what was actually removed in kind, but rather, it is to effect a restoration which will mate with the original surface and minimize raveling and maintenance problems.

221.3.07B Paved Surfaces - All bituminous pavement or oiled surface, regardless of thickness, shall be sawcut prior to excavation of trenches. Width of cut shall be a minimum of 2 feet wider than the top width of the trench, 1 foot on each side and shall follow lines parallel to the pipe centerline. The use of any machine or device that, during the course of operation, results in damage to adjacent pavement, existing utilities, adjacent structures or improvements shall not be permitted. When the trench has been backfilled to within 3 inches of the final surface grade, the Contractor shall place 3 inches of asphaltic concrete. Any pavement or roadway surfacing not immediately over or adjacent to the trench which is disturbed or damaged as a result of the operations of the Contractor shall be similarly repaired or replaced to the satisfaction of the City.

221.3.07C Gravel Surfaces - The restoration shall be the same as for paved surfaces except that 3/4 inch-minus crushed rock shall be placed and compacted to the final surface grade.

221.3.07D Other Surfaces - The ground surface shall be left in a neatly dressed and finished condition wherever it has been disturbed by the operations of the Contractor. Previously planted areas shall be replanted with the same type vegetation. Portland cement concrete pavement, curbs and sidewalks shall be cut with a pavement saw. Portland cement concrete surfaces shall be replaced and finished to match the depth and finish surface of the removed surface.

270 MANHOLES AND CLEANOUTS

270.1 DESCRIPTION:

This item includes all work necessary for the construction of manholes and cleanouts.

270.1.01 Related Technical Specifications - The APWA Standard Specifications for Public Works Construction, 1990 Edition, is incorporated into this specification by reference. It shall be understood that in any matter addressed by both the text of this technical specification and the referenced specification, be it in construction method, material, or quality control, the more stringent specification is intended and shall be enforced.

270.2 MATERIALS:

270.2.01 Cast-in-Place Manholes:

270.2.01A Aggregates shall conform to the requirements of APWA Standard Specifications for Public Works Construction, Section 212.

270.2.01B Portland Cement and Portland Cement Concrete (PCC) shall conform to the requirements of APWA Standard Specifications for Public Works Construction, Section 212, and shall be Class 3000-1 1/2. Slump shall be between 2 inches and 4 inches.

270.2.01C Metal Reinforcement shall conform to the requirements of ASTM A 615, Grade 60, deformed bars.

270.2.01D Forms - Exterior surfaces shall be formed with steel or plywood. Other surfaces shall be formed with matched boards, plywood, or other approved material. Trench walls, rock, or earth will not be acceptable form material.

270.2.02 Metal Castings:

270.2.02A General - Manhole covers shall be designed so they may be secured to the frames. Matching surfaces of covers and frames shall be flat to prevent any movement of covers within frames. Covers and frames shall be interchangeable.

270.2.02B Cast Iron materials shall conform to the requirements of ASTM A 48. Class 30B. The foundry shall certify as to the tensile and transverse properties and Brinell Hardness. The City reserves the right to require a rough transverse bar, size of bar 1.2"

(diameter) x 20" (long), and/or a tensile bar as per ASTM A 48 for each 20 castings or heat when fewer than 20 castings are made.

270.2.02C Manhole frames and covers shall be of heavy duty design with minimum weight of 295 pounds. Frames and covers shall be machine finished or ground on seating surfaces to assure a non-rocking fit in any position and interchangeability. Covers shall be marked with "SEWER" or "S" in minimum 2-inch raised or indented letters, and shall have 1 or 2 vent holes only. Frames shall provide for a minimum 23-inch diameter clear opening.

270.2.02D Clean out frames and covers shall have a minimum weight of 80 pounds.

270.2.03 Cap screws and washers for watertight manhole covers shall be stainless steel with 60,000 p.s.i. minimum tensile strength conforming to the requirements of ASTM A453.

270.2.04 Precast Concrete Manholes:

270.2.04A Precast concrete manhole sections and appurtenances shall conform to the requirements of ASTM C478. Minimum wall thickness shall be 4 inches. Cones shall have the same wall thickness and reinforcement as riser sections. Cones shall be eccentric. Joints shall be tongue-and-groove or keylock type. Prior to delivery of precast manhole sections to the job site, yard permeability tests may be required at the point of manufacture. The precast sections to be tested will be selected at random from the stockpiled material which is to be supplied to the project. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C 14. Precast manhole sections shall consist of circular sections in standard nominal inside diameters of 42, 48, 54, 60, 72, 84, or 96 inches. Heights of sections shall be multiples of 12 inches. Heights of manhole sections 72 inches through 96 inches in diameter shall be as required to fit site conditions. Other sections shall be 24-inch diameter riser and flattop sections.

270.2.04B Precast concrete manhole bases may be used provided all the details of construction are approved prior to construction. Inlet and outlet pipe holes shall be core-drilled at the plant location or in the field. Conical-type flexible neoprene boots shall be installed in the factory core-drilled hole to create a water-tight connection between manhole and sewer pipe. Where a flexible boot is not practical, and plastic pipe is used, an approved manhole water stop or collar shall be installed on the pipe at the manhole.

270.2.05 Joint Materials:

270.2.05A Mortar shall conform to the requirements of ASTM C387, or be proportioned 1 part Portland cement to 2 parts clean, well-graded sand which will pass a 1/8-inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent. Consistency of mortar shall be such that it will readily adhere to the precast concrete if using the standard tongue-and-groove type joint. If the keylock type joint is used, the consistency shall be such that excess mortar will be forced out of the groove and support

is not provided for the next precast manhole section to be placed. Mortar mixed for longer than 30 minutes shall not be used.

270.2.05B Non-Shrink grout shall be Sika 212, Euco N-S, Five-Star, or approved equal non-metallic cementitious commercial grout exhibiting zero shrinkage per ASTM C-827 and CRD-C-621. Grout shall not be amended with cement or sand and shall not be reconditioned with water after initial mixing. Unused grout shall be discarded after 20 minutes and shall not be used. Non-shrink grouts shall be placed or packed only with the use of an approved commercial concrete bonding agent applied to all cured concrete surfaces being grouted. The bonding agent shall be compatible with the brand of grout being used. Water shall not be used as a substitute for the commercial bonding agent.

270.2.05C Preformed plastic gaskets shall be used in addition to mortaring all joints. Preformed plastic gaskets shall meet all the requirements of federal specification SS-S-00210.

270.2.05D Rubber gaskets shall conform to ASTM C 443.

270.2.06 Manhole steps shall be plastic-coated reinforcing steel and shall conform to the requirements of ASTM C478 and A615.

270.2.07 Pipe anchor bolts and straps for inside drop pipe connections shall be stainless steel.

270.2.08 Pipe Fittings:

270.2.08A General - Pipe and fittings shall conform to the applicable portions of APWA Standard Specifications, Sections 303 and 305. Tees, ells and other fittings for drop manholes shall be of the same material as the pipe in the adjacent trench.

270.2.08B PVC pipe shall be joined to the manhole with an approved conical-type flexible boot, where practical, or an approved short stub section of a factory bonded fiberglass pipe with sand coating.

270.2.09 Flexible manhole boots shall be required in all connections where practical between PVC sewer pipe and manhole. The conical-type flexible boot shall be made of a NEOPRENE-EPDM blended compound that meets ASTM C 443 with a 3/8-inch minimum wall thickness. The internal expanding band shall be made of non-magnetic, corrosion-resistant stainless steel. The flexibility shall allow for 22° angular deflection in any direction and 2-inch vertical displacement. PVC pipe adapters shall be Fernco CMA, Romac LCT, Tylox Manhole Adapter, Vassally Series 32850, Kor-N-Seal, Sealtite, Z-Lok-XP, or approved equal commercial product.

270.2.10 Pipe stubouts for future sewer connections shall be the same type as approved for use in the lateral, main or trunk sewer construction. Strength classifications shall be the same as in the adjacent trench. Where there are two different classes of pipe at a manhole, the higher strength pipe will govern strength classification. Rubber-gasketed water-tight plugs, adequately braced against hydrostatic or air test pressures, shall be furnished with each stubout. A white-painted vertical pressure-treated 2x4 shall be installed at the end of each stubout.

270.2.11 Pipe Stubouts for service connections shall conform to the applicable portions of APWA Standard Specifications for Public Works Construction, Section 304, and are to be of the same size and kind of material as the service connection pipes.

270.2.12 Cleanouts shall be constructed with pipe and fittings conforming to the applicable portions of Sections 271 and 272 and shall be of the same material as the pipe in the section of sewer main to which the cleanout is constructed. Rubber-gasketed, water-tight, end-style mechanical plugs with stainless steel hardware shall be furnished at each cleanout.

270.2.13 Manhole Inflow shields shall be constructed of stainless steel or HDPE. Shields will include a gasketed bottom sealing surface, handle for removal, and gas relief valve. Use USA Bluebook #65414, or equal.

270.3 CONSTRUCTION:

270.3.01 General:

270.3.01A - Manhole excavation, foundation stabilization, bedding and backfill shall be in accordance with applicable portions of Section 221.

270.3.01B Pipe connections at manholes shall be made according to manufacturer's recommendations. Special care shall be taken by the Contractor to see that the pipe connections at manholes are completely watertight. All pipes entering or leaving the manhole shall be provided with flexible joints within 1 foot of the exterior surface of the manhole and shall be placed on firmly compacted bedding material.

270.3.01C Pipe connections to existing manholes shall be constructed such that connections are watertight and will provide a smooth flow into and through the manhole. Existing pipe stubouts may be used for new pipe connections provided that the existing pipe stubout is not damaged and is in proper alignment with the new pipe. Connections to existing pipe stubouts shall be made with approved flexible couplings as specified in Section 271. When existing pipe stubouts are damaged or not in proper alignment with the new pipe, the existing stubout shall be removed and the new pipe installed in the manhole base as described in Subsection 270.3.01B. The Contractor shall provide all diversion equipment and facilities and perform all work necessary to maintain flow in existing lines and manholes during work on any manhole.

270.3.02 Bases shall be placed on a prepared bedding of 8 inches compacted thickness of 3/4 inch-minus crushed rock.

270.3.02A Cast-in-place bases shall be constructed according to the plans. The concrete shall be consolidated by mechanical vibration, hand spading, rodding, or tamping. The concrete shall be screeded off such that the manhole riser section has a level uniform bearing for the full circumference.

270.3.02B Precast bases shall be carefully placed level on the prepared bedding so as to be fully and uniformly supported in true alignment, making sure that all entering pipes can be inserted on proper grade. Concrete pipe connections to sanitary manholes shall be grouted watertight with non-shrink grout conforming with Subsection 270.2.05B. PVC pipe shall be connected to sanitary manholes using an approved adapter specifically manufactured for the intended service, and conforming to Subsections 270.2.08 and 270.2.09. Field-fabricated waterstops or improvised adapters shall not be used. Adapters requiring the use of grout for installation shall be anchored and finished using non-shrink grout conforming with Subsection 270.2.05B.

The invert shall be constructed to a section identical with that of the sewer pipe. Where the size of the sewer pipe is changed at the manhole, the invert shall be constructed to form a smooth transition without abrupt breaks or unevenness of the invert surfaces. Where a full section of concrete sewer pipe is laid through the manhole, the top shall be broken out to the springline of the pipe for the full width of the manhole, and the exposed edge of the pipe completely covered over with mortar. During construction, the Contractor shall divert existing flows of water or sewage from new concrete or mortar surfaces to prevent damage to the fresh concrete or mortar until the initial set has been achieved.

270.3.02C Manhole inverts shall be carefully formed, the curves of tributary sewers made as smooth and easy as possible. The base shall be constructed to an elevation of at least 1-inch above the top of the largest pipe.

270.3.03 Precast Concrete Manhole Risers - All lift holes shall be thoroughly wetted, then completely filled with mortar, and smoothed and pointed both inside and out to ensure watertightness. Preformed plastic or rubber gaskets shall be used on all sanitary manholes. Mortar shall be used on up to 11 inches of extension rings above the cones. All mortar joints between precast elements shall be thoroughly wetted, then completely filled mortar. On proposed street grades, a minimum of one 2-inch pre-cast riser will be required between the cone and the manhole cover frame. Watertight seals between the precast concrete manhole section(s) and the precast bases and eccentric cones shall be effected by placing a preformed plastic or rubber gasket between the precast sections, then filling the remaining voids in the joint seam, both inside and outside, with mortar.

270.3.04 Manhole grates, frames and covers shall be installed in such a manner as to prevent infiltration of surface or ground water between the frame and the concrete of the manhole section. All mortared sanitary sewer manhole necks and all riser ring joints made with mortar shall be constructed using an approved commercial concrete bonding agent applied to all cured concrete surfaces being mortared. No joints, necks, or frames on sanitary manholes shall be mortared without an approved bonding agent. Rim elevations shall be adjusted with approved precast concrete grade rings.

270.3.05 Shallow manholes shall be constructed using a flat top manhole lid. Construct bases per section 270.3.01 - 4. All manholes less than 6 feet from rim to invert shall be considered as shallow manholes

270.3.06 Manhole Inflow Shields shall be installed on each manhole, fitted between the manhole frame and cover.

270.3.07 Cleanouts shall be constructed as shown on the plans. The riser pipe shall be supported at the bends by encasement in concrete. Cleanout frame and cover shall be centered about cleanout plug, with enough space to remove the mechanical plug.

270.4 TESTING:

270.4.01 General - The Contractor shall be responsible for quality control testing of manholes and shall conduct such tests as necessary during the construction process. The tests required in this subsection are for the information of the Engineer. The results of the tests will not indemnify the Contractor of responsibility for defects in the construction. Acceptance tests shall be conducted on all of the manholes constructed. The City Public Works staff shall be advised 24 hours in advance of any testing.

270.4.02 Infiltration Testing - When the ground water is within 18 inches of the top of the manhole, the manhole shall be tested for infiltration by the following procedure:

1. Plug all openings into manhole.
2. Completely dry manhole.
3. Provide Engineer with means to measure ground water elevation.
4. Request the Engineer to inspect manhole, measure and record ground water elevation, record time, and re-check manhole and ground water elevation at the end of 24 hours. The manhole shall remain dry for 24 hours.

270.4.03 Vacuum Test - Vacuum testing is performed by creating a vacuum in the manhole and monitoring a gauge for vacuum loss. The contractor shall follow the procedures below:

1. Plug all openings into the manhole.
2. Install the vacuum tester assembly, following the manufacturer's instructions and safety precautions.
3. Start the vacuum pump and evacuate the manhole to 10 inches Hg. (mercury) close the vacuum inlet/outlet ball valve, disconnect vacuum pump, and monitor vacuum for the specified time. If the vacuum does not drop in excess of 1-inch hg. over the specified time period, the manhole is considered acceptable and passes the test. The specified time for a 48-inch diameter manhole is 2.5 seconds per 1 foot of depth measured from the invert to the rim (the specified time is from ASTM C924-85).

271 GRAVITY SEWER PIPE & FITTINGS

271.1 DESCRIPTION:

This item includes all work necessary for the installation of sanitary sewer gravity pipe and fittings.

271.2 MATERIALS:

271.2.01 General - Sanitary sewer gravity pipe shall have solvent welded or flexible elastomeric gasket joints. Materials and strength specifications shall be as hereinafter specified for the particular kind of pipe and fittings required. Joints on all fittings shall be the same as the joints used on the pipe. Caps or plugs shall be furnished with each fitting, outlet, or stub as required with the same type gasket and/or joint as the pipe. No pipe and fittings that are not hereinafter specified will be allowed on the project.

271.2.02 Pipe:

271.2.02A Polyvinyl Chloride (PVC) pipe shall conform to the requirements of ASTM D3034 and D2729.

271.2.02B Material Certification - The manufacturer or fabricator shall furnish appropriate certification based on manufacturer's routine quality control tests, that the materials in the pipe meet the requirements specified herein.

271.2.03 Jointing Materials:

271.2.03A PVC pipe gaskets shall conform to the requirements of ASTM D3212.

271.2.04 Fittings:

271.2.04A General - Tee or wye fittings shall be provided in the sewer main for side sewer or inlet connections. All fittings shall be of sufficient strength to withstand all handling and load stresses encountered. All fittings shall be of the same materials as the pipe. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface. All fittings shall be capped or plugged and gasketed with the same gasket material as the pipe joint, fitted with an approved mechanical stopper, or have an integrally cast knockout plug. The plug shall be able to withstand all test pressures without leaking, and when later removed, shall permit continuation of piping with jointing similar to joints in the installed line.

271.2.04B PVC Pipe - Fittings shall conform to the applicable portions of the following specifications: ASTM D1785, ASTM D2729, ASTM D2466, ASTM 2467, ASTM D3033 and ASTM D3034. Fitting joints shall be the same as the pipe joints.

271.2.04C Flexible couplings and donuts shall be as manufactured by Calder, Fernco, or approved equal, properly sized to fit.

271.2.04D Service saddles for lateral connections to existing pipe shall be full circle stainless steel saddles, ROMAC style CB sewer saddle or equal.

271.2.05 Service connection markers shall be new, one piece Douglas Fir or Cedar, 2 x 4's, utility grade or better, painted white. Attachment to service line stopper shall be by means of 9-gauge minimum galvanized wire or 1/4-inch minimum polypropylene rope.

271.3 CONSTRUCTION:

271.3.01 Line and Grade - Survey line and grade control hubs will be provided by the Engineer on an offset line at intervals not greater than 100 feet when the Contractor uses a laser beam for pipe alignment, and at intervals not greater than 40 feet for other methods of pipe alignment. The Engineer will furnish the Contractor with the elevation of the hubs and the corresponding sewer invert elevation at such hubs. Should the Contractor's operations cause or allow removal of stakes or hubs, their replacement shall be at the expense of the Contractor. Variance from established line and grade shall not be greater than 1/2 inch for line and 1/4 inch for grade, provided that such variation does not result in a level or reverse sloping invert. The Contractor shall establish line and grade for pipe by the use of lasers or by transferring the cut from the offset hubs to the trench at whatever intervals necessary to maintain the line and grade. The method of transferring the cut from the offset hubs to the trench shall be subject to the approval of the Engineer. A transfer method not approved by the Engineer shall not be used. The Contractor shall constantly check both line and grade for each length of pipe laid and in the event they do not meet the limits described, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work. When using laser alignment the Contractor shall check beam alignment at 100 foot intervals.

271.3.02 Pipe Distribution and Handling - The Contractor shall not distribute material on the job faster than it can be used to good advantage. The Contractor shall unload pipe only by approved means. Pipe will not be unloaded by dropping to the ground. The Contractor shall inspect all pipe and fittings prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are used. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep it clean during laying and joining. The Contractor shall use approved implements, tools, and facilities for the safe and proper protection of the work. The Contractor shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. The Contractor shall remove all damaged pipe from the job site. Pipe shall not be dropped or dumped into trenches.

271.3.03 Laying Pipe on Curves - The Contractor shall lay pipe on horizontal or vertical curves only when approved by the City and at the direction of the Project Engineer.

271.3.04 Installation of Service Tees and Wyes - Fittings shall be placed where indicated on the plans or as staked by the Engineer, or as required by existing services. The Contractor shall provide ends of all inactive service laterals and fittings with approved watertight plugs, caps, or stopper, suitably braced to prevent blowoff during internal hydrostatic or air testing. Such plugs or caps shall be removable and their removal shall provide a socket suitable for making a flexible

joint lateral connection or extension. If any fitting is placed when the Engineer is not present, the Contractor shall place a stake and see that it is maintained to mark the location of such fitting until the Engineer has recorded the location of the fitting.

271.3.05 Pipe Placing and Laying - Trench excavation, bedding and backfill shall be in accordance with Section 221.

271.3.05A PVC pipe shall be laid upgrade with spigot ends in the direction of flow. After a section of pipe has been lowered into the prepared trench, the end of the pipe to be joined will be cleaned as will the inside of the joint and the rubber ring, immediately before joining the pipe. The joint will be assembled in accordance with the recommendations of the manufacturer of the type of joint used. All special tools and appurtenances required for the jointing assembly will be provided by the Contractor. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints. Sufficient pressure will be applied in making the joint to assure that the joint is "home", as defined in the standard installation instructions provided by the pipe manufacturer. Sufficient bedding material will be placed to secure the pipe from movement before the next joint is installed to assure proper pipe alignment and joint make-up. After the joint has been made, the pipe will be checked for alignment and grade. When in correct alignment and grade, the pipe shall be supported by placing the specified initial backfill material as described in Section 221.

When the pipe is laid within a movable trench shield, all necessary precautions will be taken to prevent pipe joints from pulling apart when the shield is moved ahead. The Contractor shall take the necessary precautions required to prevent excavated or other foreign material from getting into the pipe during the laying operation. At all times, when laying operations are not in progress, at the close of the day's work, or whenever the workers are absent from the job, the open end of the last laid Section of pipe will be closed and blocked to prevent entry of foreign material or creep of the gasketed joints.

The Contractor shall plug or close off pipes which are stubbed off for manhole construction or for connection by others, with temporary plugs as specified in Subsection 270.2.10. The Contractor shall take all precautions necessary to prevent the uplift or floating of the line prior to the completion of the backfilling operation. Where pipe is connected to manholes or concrete structures, the connection will be constructed so that the standard pipe joint is located not more than 18 inches from the outside edge of the structure. When cutting and/or machining of the pipe is necessary, the Contractor shall use only the tools and methods recommended by the pipe manufacturer. The Contractor shall join the pipe in conformance with the manufacturer's recommendations. Joints or pipe will not be deflected more than recommended by the manufacturer.

271.3.05B Cased Pipe - Where timber cradles are shown, the Contractor shall provide a strapped timber cradle under the barrel of the pipe, join pipe and slide into casing. Pipe barrel shall bear continuously on cradles. Pipe installation shall conform to the applicable requirements of hydrostatic or air testing and line and grade.

271.3.06 New Service Laterals - Pipe and fittings for service lines shall be of one type of material throughout and no interchanging of pipe and fittings will be allowed. Residential services shall normally be 4 inches, extending from the main to the property line. Larger service laterals shall be as shown or specified. The Engineer will stake the location of the terminus of the service line. Vertical one-sixteenth bends are required on all service laterals at the connection to the main. Additional bends may be installed, at the Contractor's option, to reduce the depth of service laterals. The depth of new service lines at the property line shall be a minimum of 4' deep unless otherwise approved by the City. The Contractor shall install the sewer main tee or wye so as to locate the service connection pipe within a horizontal distance of one foot either side of the stake location. The Contractor shall install the pipe on a uniform grade between the tee or wye and the stake at a minimum slope of 1/4 inch per foot unless otherwise permitted by the Engineer. The terminus of the new service lateral shall be sealed with stopper in a manner similar to that required for the tee or wye. The Contractor shall install service connection markers at the terminus of new service laterals so as to extend from the end of the service line to 12 inches above ground. The Contractor shall determine the distance in feet and inches from the ground surface to the top of the service lateral and paint it on the marker. The service connection marker shall be firmly attached to the service lateral stopper by means of a 9-gauge minimum galvanized wire or 1/4 inch minimum polypropylene rope.

271.3.07 Existing Service Laterals - The Contractor shall disconnect existing service laterals from sewers to be abandoned and reconnect them to the new sewers. It shall be the Contractor's responsibility to locate the existing service laterals prior to installing the tee or wye in the new sewer line. Existing service laterals to be replaced shall be removed and replaced over the length shown on the plans or as designated by the Engineer. Installation shall be as specified for new service laterals, except that the depth of the service laterals at the property line shall be as required by the existing service, and except that stopper and service connection markers will not be required. Connections between new and existing service laterals shall be made with approved flexible couplings or donuts. Concrete or mortar connections will not be permitted. All connections shall be inspected by the inspector prior to covering. The Contractor shall coordinate all service interruptions with the occupants of the affected property. Service interruptions shall be for as short a time period as possible and the Contractor shall be responsible for arranging for alternative service of the affected property as required.

271.4 TESTING:

271.4.01 General - An internal or air pressure test shall be made by the Contractor of every section of sewer, including service connections, after the completion of the final trench backfill as follows:

271.4.02 Air Test:

271.4.02A General:

1. Leakage allowance: The portion of line being tested shall be considered "acceptable" if the time required for the pressure to decrease 1.0 p.s.i.g. is not less than the time shown for the given diameters in the following table:

Pipe Diameter In Inches	Minutes
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5

If the section of line being tested includes more than one size of pipe (e.g. sewer main and building connections) the time used for the test, from the above table, shall be that for the largest size pipe.

271.4.02B Procedure

1. Clean reach of pipe to be tested including building connections.
2. Furnish plugs, air compressors, gauges, etc.
3. Plug all openings including building connections.
4. Measure the average back pressure in pounds per square inch ground water by one of the following methods:
 - a. Dig test holes to the top of the pipe; measure ground water depth in feet and tenths of feet; divide the water depth by 2.31.
 - b. Insert a pipe probe by boring or jetting into the backfill material adjacent to the center of the pipe; read the pressure in the probe in pounds per square inch, when air passes slowly through it.
5. Introduce air into the sealed line until the internal air pressure reaches 4 p.s.i.g. greater than the average back pressure of ground water over the pipe.
6. Allow at least two minutes for air pressure to stabilize.
7. After the stabilization period, read the pressure gauge; 3.5 p.s.i.g. greater than the average back pressure of ground water over the pipe is the minimum pressure in the pipe under which the test can be started. (For example, if the height of water is 11 1/2 feet, the probe gauge pressure will be 5 p.s.i.g. This increases the minimum 3.5 p.s.i.g. starting test pressure to 8.5 p.s.i.g., and, in such case, the 2.5 p.s.i.g. minimum final pressure to 7.5 p.s.i.g. The allowable drop of one pound and the timing remain the same.)
8. Disconnect the air hose from the control panel to the air supply.
9. Wait 4 minutes and read and record the gauge pressure.

271.4.03 Deflection Test for PVC Pipe - In addition to air testing, sanitary sewer mains constructed of PVC pipe shall be deflection tested after the trench backfill and compaction has been completed. The test shall be conducted by pulling an approved solid pointed mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the pipe diameter unless otherwise specified by the Engineer. Testing shall be conducted on a manhole to

manhole basis and shall be done after the line has been completely flushed out with water. The Contractor will be required, at the Contractor's expense, to locate and repair any sections failing to pass the test and to retest the section.

271.4.04 Cleaning Prior to Test - Prior to the internal pressure testing and inspection of the system by the Engineer, the Contractor shall flush and clean all parts of the system. The Contractor shall remove all accumulated construction debris, rocks, gravel, sand, silt and other foreign material from the system at or near the closest downstream manhole. If necessary, the Contractor shall use mechanical rodding or bucketing equipment. Upon the Engineer's inspection of the system, if any foreign matter is still present, the sections and portions of the system shall be reflushed and cleaned as required. The City Public Works staff shall be advised 24 hours in advance of any pipe cleaning.

271.4.05 Television Inspection of Sanitary Sewers - Upon completion of all sewer construction, testing and repairs, the Contractor shall conduct a color or black & white TV acceptance inspection of all installed lines 6 inches to 72 inches. Unless otherwise directed, the Contractor shall conduct a subsequent warranty TV inspection of all installed lines. Warranty TV inspections shall be in color and shall be conducted during the warranty period in a season of high ground water conditions as defined by the Engineer. The acceptance inspection and the warranty inspection shall be conducted by an approved technical service which is equipped to make audio-visual tape recordings of the televised inspections.

The audio-visual recordings shall be compatible with the City's playback equipment. The Contractor shall ensure that recording equipment is functioning properly and that a clear and usable record is made of all possible defects. The equipment used for recording shall be equipped with a footage meter which records a visual record on the tape. A voice accounting of suspected deficiencies shall be made on the sound track.

A written report shall be made at the time of each television inspection. This report shall be made on a form approved by the Engineer. The video record and the written report of the acceptance inspection and the warranty inspection shall be submitted to the Engineer and will become the property of the City.

The audio and visual reports of the acceptance inspection and the warranty inspection shall include identification of individual groundwater infiltration sources such as sewer laterals, building sewer connection and construction defects.

271.4.06 Requirements Prior to Tests:

271.4.06A General - All gravity systems and appurtenances shall successfully pass an air test prior to acceptance and shall be free of visible leakage, using either method of testing. All details of testing procedure shall be subject to approval of the Project Engineer. The City Public Works staff shall be advised 24 hours in advance of any testing.

271.4.06B Plugging of Tees, Wyes, Stubs and Service Connections - The Contractor shall plug all wyes, tees, stubs and service connections with gasketed caps or plugs securely fastened or blocked to withstand the internal test pressure. Such plugs or caps shall be removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

271.4.06C Testing Equipment and Procedure - The Contractor shall furnish all necessary testing equipment and perform the tests in a manner satisfactory to the Engineer. Any arrangement of testing equipment which will provide observable and accurate measurements of either air or water leakage under the specified conditions will be permitted. Gauges for air testing shall be calibrated with a standardized test gauge provided by the Engineer at the start of each testing day. The calibration shall be witnessed by the Engineer.

271.4.06D Time of Test - The Contractor shall test the system during the normal work day, scheduling the plugging, capping and other preparatory work so as to conduct the test during daylight hours.

272 PRESSURE SEWER PIPE AND FITTINGS

272.1 DESCRIPTION:

This item includes all work necessary for the installation of sanitary sewer force main pressure pipe and fittings as shown on the plans.

272.2 MATERIALS:

272.2.01 Pressure sewer pipe materials and strength specifications shall be as hereinafter specified for the particular kind of pipe and fittings as shown on the plans:

272.2.01A Cast Iron pipe shall conform to the requirements of AWWA C106 or C108, or ANSI specification A21.6, with Type II push-on joints or Type III mechanical joints, conforming to federal specification WW-P-421c. The minimum acceptable thickness class for cast iron pipe shall be class 22 for 4-inch pipe, class 21 for 6-inch and class 20 for 8-inch and larger for 21/45 iron strength; and for 18/40 iron strength the minimum acceptance thickness shall be class 22 for pipes up to 12 inches diameter. The pipe shall not be cement lined.

272.2.01B Ductile Iron pipe shall conform to the requirements of ANSI A21.51 or AWWA C151, push-on joint. The minimum thickness class shall be class 2 for diameters through 12 inches and class 1 for 14-inch diameter and larger pipe. The pipe shall not be cement lined.

272.2.01C Polyvinyl Chloride (PVC) pipe shall conform to ASTM D2241 for SDR 21, 200 p.s.i. rating. Gasketed joints shall conform to ASTM D1869 and F477.

272.2.01D Joint restraint fittings shall be Uniflange Series 1500 for PVC pipe and Uniflange Series 1400 for ductile iron pipe, or approved equal. PVC pipe restraints shall provide full 360 degree contact and support.

272.2.02 Pipe fittings shall be of a class and rating at least equal to the adjacent pipe unless specified otherwise. Joint materials shall be compatible with the adjacent pipe. All fittings shall be cast or ductile iron. Mechanical joint and push-on joint type coupling shall conform to AWWA Standard C-111. Other types of joints shall conform with Federal Specifications WWP-421b, Type II for push-on joints. Flanged couplings shall be drilled and faced in accordance with ANSI B-16.1 or B-16.2. Rubber gasket type shall be U.S. Pipe, Tyton or approved equal. Ordinary cast iron fittings shall conform to the AWWA Standard C-110. Cast iron fittings for use with Federal Specifications Type II and Type III cast iron water pipe shall conform to the same specifications except that joints shall be mechanical type and include cast iron glands, plain rubber gaskets and T-head cast iron bolts and nuts per ANSI A21.11 or an approved compression type with rubber gasket.

272.2.03 Force main air release assembly shall include the following fittings:

272.2.03A Pipe saddle shall be double stainless steel strap with bronze body, straps and nuts, Rockwell 323 or approved equal. Tap size shall fit the air release valve.

272.2.03B Ball valve shall be threaded bronze top-entry Ball Valve, Lunkenheimer Fig. 700-ST or approved equal.

272.2.03C Air release valve shall be short body compound lever type with stainless steel float, APCO Model 400 or approved equal. Factory options shall include short body, blow off valves, quick disconnect couplings and minimum 6 feet of hose. Operating pressure shall be below 20 p.s.i.

272.2.04 Thrust blocks shall be constructed of Portland cement concrete conforming to the requirements of ASTM C94. Compressive field strength shall be not less than 2,000 p.s.i. at 28 days. Maximum size of aggregate shall be 1 1/2 inches.

272.3 CONSTRUCTION:

272.3.01 Line and Grade - All pipe shall be laid to and maintained at the lines and grades required by the Project Engineer. Fittings and air valves shall be installed at the required location. No deviation shall be made from the required line or grade without prior approval from the Engineer.

272.3.02 Pipe distribution and handling shall be as specified in Subsection 271.3.02.

272.3.03 Installation - Trench excavation, bedding and backfill shall be in accordance with Section 221.

272.3.03A Cast and Ductile Iron pipe installation shall conform to the requirements of AWWA C600.

272.3.03B PVC pipe installation shall be in accordance with the manufacturer's recommendations, and as specified in Section 271.3.05.

272.3.03C Force main air release valve shall be installed as shown on the plans or as directed by the Engineer.

272.3.03D Thrust Blocks - All tees, plugs, caps, bends and offsets, as well as all other appurtenances which are subject to unbalanced thrust, shall be properly braced with lateral thrust blocks of concrete. The concrete shall be formed and placed so that the bolts and glands can be removed. The concrete shall bear against solid undisturbed earth at side and bottom of trench excavation.

Lateral thrust block bearing areas shall be of the size as specified below for the indicated pipe size, unless specific size requirements for specific locations are given by the Engineer.

BEARING AREA, SQ. FEET

Pipe Size, Inches	Tee, Valve, or 90° Bend	45° Bend	Dead-End
4	0.65	0.36	0.46
6	1.35	0.73	0.95
8	2.33	1.25	1.88
10	3.48	1.89	2.71
12	4.93	2.70	3.48

Restrained joints may be constructed in lieu of thrust blocks. Joint restraint fittings shall be Uniflange Series 1500 for PVC pipe and Uniflange Series 1400 for ductile iron pipe, or approved equal.

272.4 TESTING:

272.4.01 Pressure Test:

272.4.01A Pressure During Test - After the pipe has been laid and backfilled, all laid pipe shall be subjected to a hydrostatic pressure of 1.5 times the working pressure or 100 psi, whichever is greater.

272.4.01B Procedure - At least 36 hours after the casting of the last thrust block of high early strength cement or 7 days after the last thrust block cast of standard cement the pressure test shall be a duration of 30 minutes. The pump, pipe connections and all necessary apparatus and gages shall be furnished by the Contractor. Each section of pipe shall be slowly filled with water, and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. During the filling of the pipe and before applying the specified test pressure, all air shall be expelled from the pipe line. During the test, all exposed pipe,

fittings or valves and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound material. The test shall then be repeated until satisfactory.

272.4.02 Leakage Test:

272.4.02A General leakage tests shall be conducted after completion of the pressure tests and shall consist of an examination of all exposed joints for leakage as well as overall leakage test of the completed pipe line.

272.4.02B Procedure - The pressure to be maintained during the test shall be the same as for the pressure test and shall be measured at the low point of the system. The same procedure for filling the line and expelling air shall be used for the pressure test and the Contractor shall furnish all necessary pump, pipe connections, apparatus and gages. Any joint found where accumulated leakage of the joint exceeds the rate of leakage specified by the manufacturer of the pipe shall be rejected. The overall permissible leakage for the section of pipe tested shall not be over 10.0 U.S. gallons per 24 hours per mile per inch diameter of pipe. Should any test of a section of pipe line disclose joint leakage greater than that permitted, the Contractor shall at his own expense locate and repair the defective joints until the leakage is within the permitted allowance.

275 WORK ON EXISTING SEWERS AND STRUCTURES

275.1 DESCRIPTION:

This item includes all work necessary for joining new sewer work to existing, and for the adjustment of existing sewer structures.

275.2 MATERIALS:

275.2.01 Concrete shall conform to the requirements of ASTM C94. Compressive field strength shall be not less than 3,000 p.s.i. at 28 days. Maximum size of aggregate shall be 3/4 inch. Slump shall be between 2 inches to 4 inches.

275.2.02 Mortar shall conform to the requirements of ASTM C387, or be proportioned 1 part Portland cement to 2 parts clean, well graded sand which will pass a 1/4 inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent. Consistency of mortar shall be such that it will readily adhere to the precast concrete. Mortar mixed longer than 30 minutes shall not be used.

275.2.03 Precast concrete grade rings shall conform to the requirements of ASTM C478.

275.2.04 Pipe fittings:

275.2.04A Concrete pipe shall be joined to the manhole with mortar to form a watertight joint.

275.2.04B PVC pipe shall be joined to the manhole with an approved water-tight manhole collar or coupling.

275.2.04C Flexible couplings shall be as manufactured by Calder, Fernco, or approved equal, and properly sized for a watertight joint.

275.3 CONSTRUCTION:

275.3.01 Excavation, bedding and backfill shall be in accordance with applicable portions of Section 221.

275.3.02 Pipe connections to existing structures shall be made according to manufacturer's recommendations. All connections shall be completely watertight. All pipes entering or leaving the structure shall be provided with flexible joints within 12 inches of the exterior surface of the structure and shall be placed on firmly compacted bedding material.

275.3.03 Pipe connections to existing manholes shall be constructed such that connections are watertight and will provide smooth flow into and through the manhole. Existing pipe stubouts may be used for new pipe connections provided that the existing pipe stubout is not damaged and is in proper alignment with the new pipe. Connections to existing pipe stubouts shall be made with approved flexible couplings. When existing pipe stubouts are damaged or not in proper alignment with the new pipe, the existing stubout shall be removed and the new pipe installed in the manhole base as described in Subsection 270.3.02. Where there are no existing pipe stubouts, the Contractor shall construct openings in the existing manhole base or barrel as required and shall construct connections that are watertight and will provide a smooth flow into and through the manhole, in accordance with Subsection 270.3.02. The Contractor shall provide all diversion equipment and facilities and perform all work necessary to maintain flow in existing lines and manholes during work on any manhole.

275.3.04 Manhole Adjustment - Manholes shall be raised or lowered by removing the existing frames, grates or covers and adjusting the height as necessary to correspond to grade. Manholes may be raised or lowered by any of the following or combination of methods when no particular method is specified.

275.3.04A Manhole necks are defined as that upper portion of a manhole having vertical walls and a uniform diameter or dimensions sufficient to receive and support the metal frame. The manhole neck may be extended by the use of precast extension rings and mortar or by reconstructing the neck except that the total distance from the top of the metal frame at its new adjusted grade to the bottom of the neck shall not exceed 18 inches.

275.3.04B Manhole cones may be cut down and rebuilt provided the batter or slope of the cone does not exceed 6 inches horizontal per 12 inches vertical.

275.3.04C Manhole barrels of brick, block or concrete shall be extended in kind with like materials.

275.3.04D Existing frames, grates or covers shall be reset in fresh mortar and brought to proper grade following manhole adjustment.

276 SEWER PIPE ANCHORS

276.1 DESCRIPTION:

This item includes all work necessary for the installation of sewer pipe anchors to secure gravity sewer pipe on slopes in excess of 20 percent.

276.2 MATERIALS:

276.2.01 Concrete anchor walls shall be constructed of the following materials:

276.2.01A Concrete shall conform to the requirements of ASTM C94. Compressive field strength shall be not less than 3,000 p.s.i. at 28 days. Maximum size of aggregate shall be 1 1/2 inches. Slump shall be between 2 inches to 4 inches.

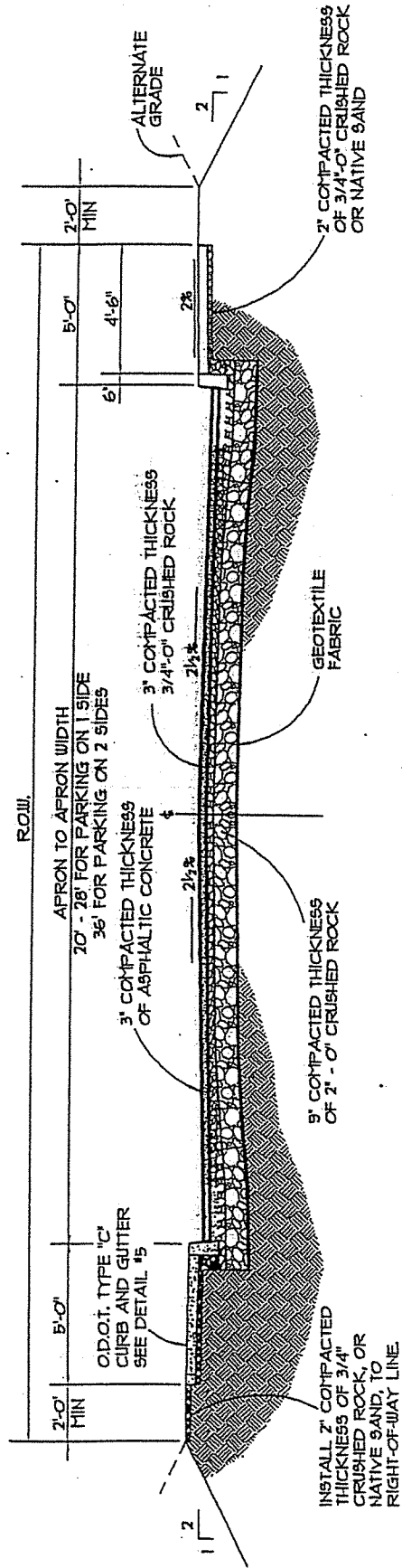
276.2.01B Metal reinforcement shall conform to the requirements of ASTM A615, grade 40, deformed bars.

276.3 CONSTRUCTION:

276.3.01 Spacing - Sewer pipe anchors shall be constructed on all sewers of 20 percent slope and greater. The horizontal spacing of the anchors shall be as follows:

Slope, percent	Horizontal spacing, feet
20-34	35
35-50	25
greater than 50	15

276.3.02 Concrete anchor walls shall be constructed as shown on the plans. The niche in the trench wall and floor in which the anchor wall is constructed shall be neatly cut in a vertical plane and at right angles to the horizontal direction of the pipe. Backfill shall be carefully compacted around and over the anchor wall to the full depth of the trench in lifts not to exceed 8 inches.



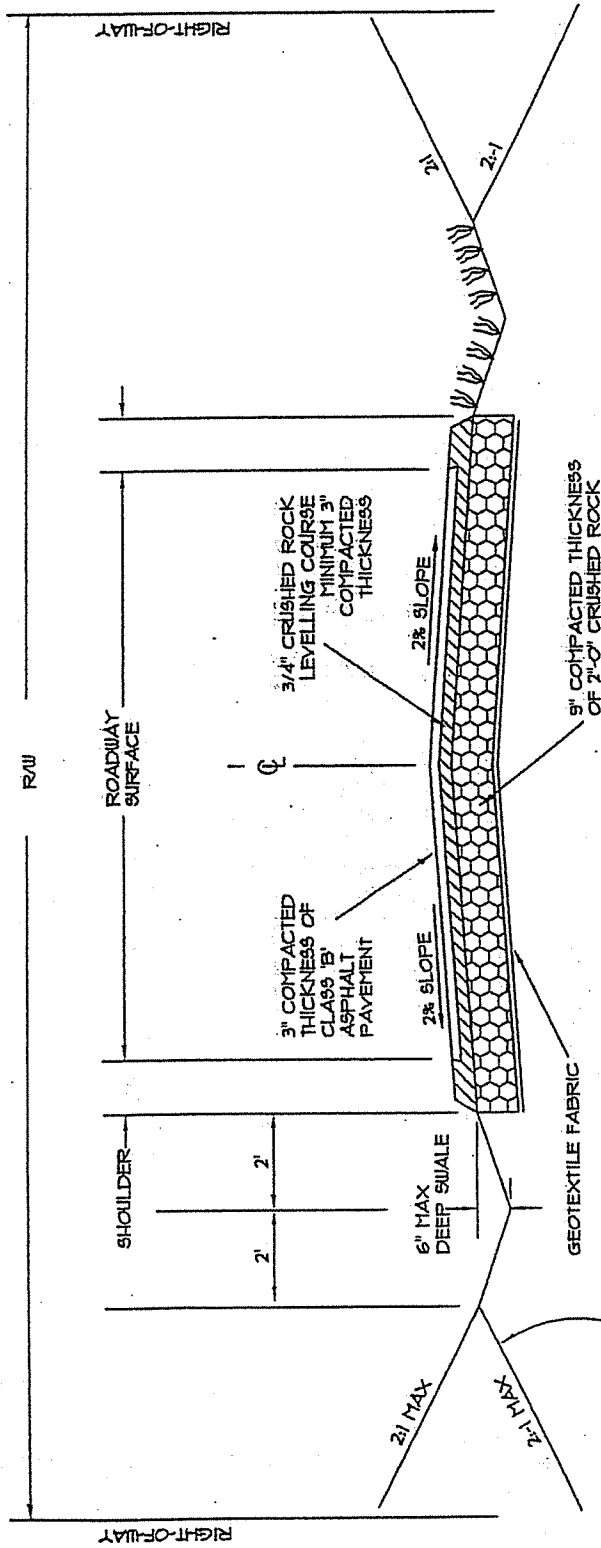
MIN. R/W	TRAFFIC LANES AND PARKING
40'	TWO 10' LANES + ONE 8' PARKING = 28'
50'	TWO 11' LANES + TWO 8' PARKING = 39'
60'	TWO 12' LANES + TWO 8' PARKING = 40'

NOTE: FOR GRADES GREATER THAN 5%, A STEEPER CROWN MAY BE REQUIRED.

CITY OF ROCKAWAY BEACH

STREET CROSS SECTION WITH SIDEWALK

DATE: APRIL 2002	DRAWING NO. RB-01
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INSTALL 2" COMPACTED THICKNESS OF 3/4" CRUSHED ROCK, OR NATIVE SAND, TO RIGHT-OF-WAY LINE.

MIN. R/W	TRAFFIC LANES AND PARKING
40'	4' SWALES + 4' SHOULDERS + 10' LANES'
50'	4' SWALES + 8' SHOULDERS + 11' LANES'
60'	4' SWALES + 8' SHOULDERS + 12' LANES'

CITY OF ROCKAWAY BEACH

RESIDENTIAL STREET CROSS SECTION WITHOUT SIDEWALK

DATE: APRIL 2002

DRAWING NO. RB-02

EXPANSION JOINTS:

SHALL BE 1/2" PREMOLDED ASPHALT IMPREGNATED MATERIAL OR EQUAL AND WILL EXTEND FROM SUB-GRADE TO FINISH GRADE.

CONCRETE:

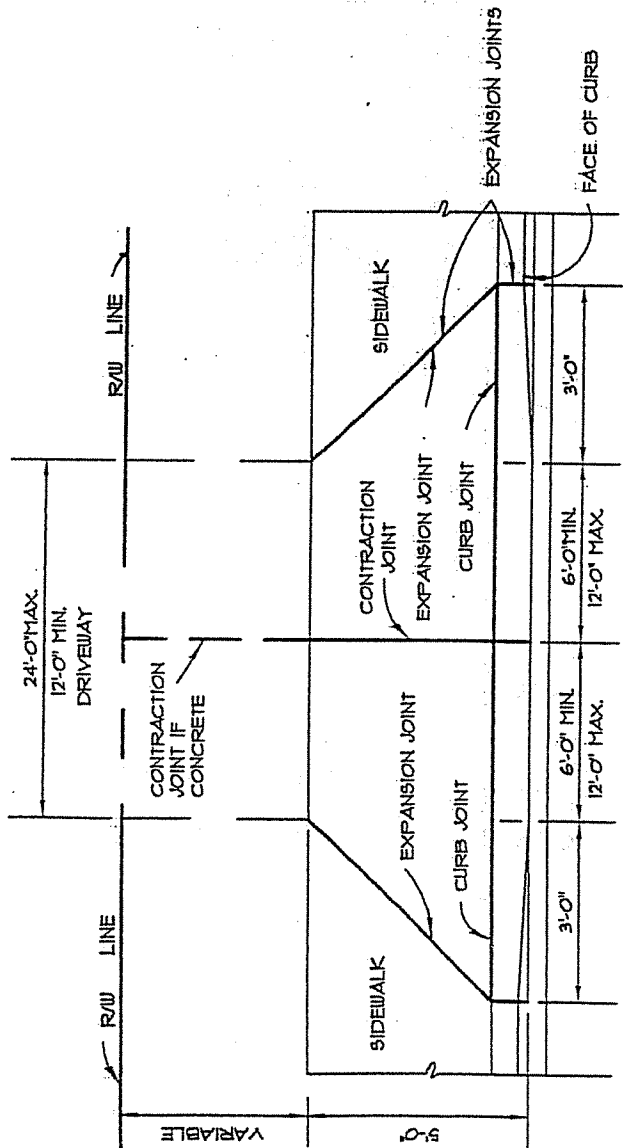
SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 P.S.I. AFTER 28 DAYS, 6 SACK MIX, MIN.

CURB AND GUTTER:

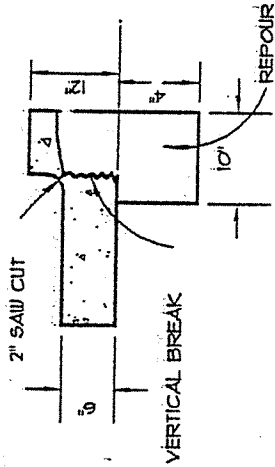
SEE STANDARD DETAIL DRAWING.

CURB JOINTS:

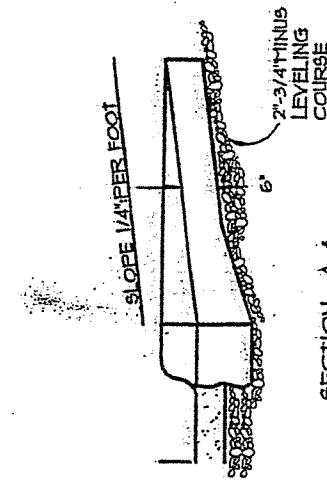
EXPANSION JOINT IF POURED AT THE SAME TIME OR COLD JOINT IF JOINING EXISTING CURB.



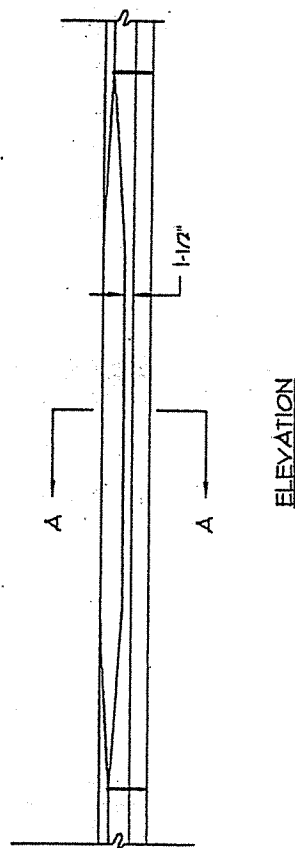
PLAN



CURB CUT

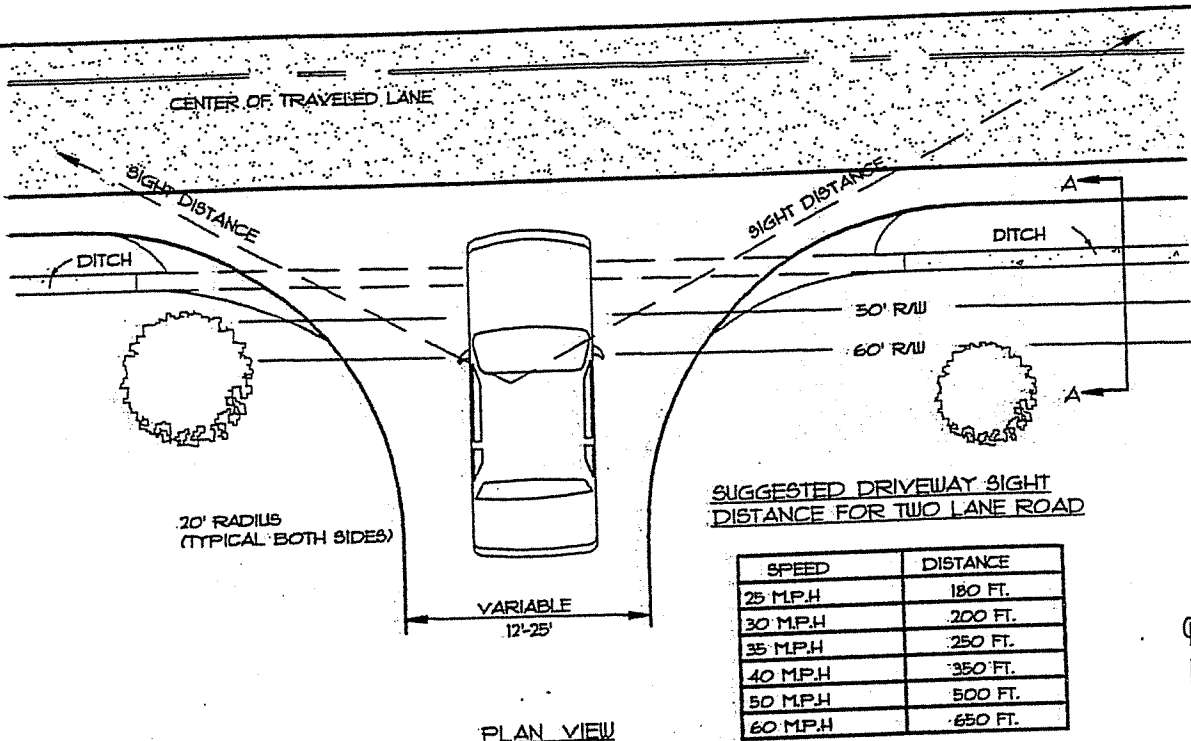


SECTION A-A



ELEVATION

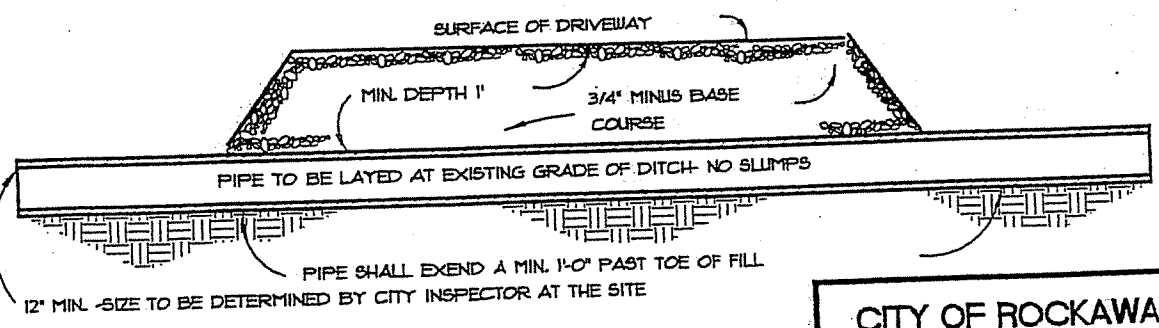
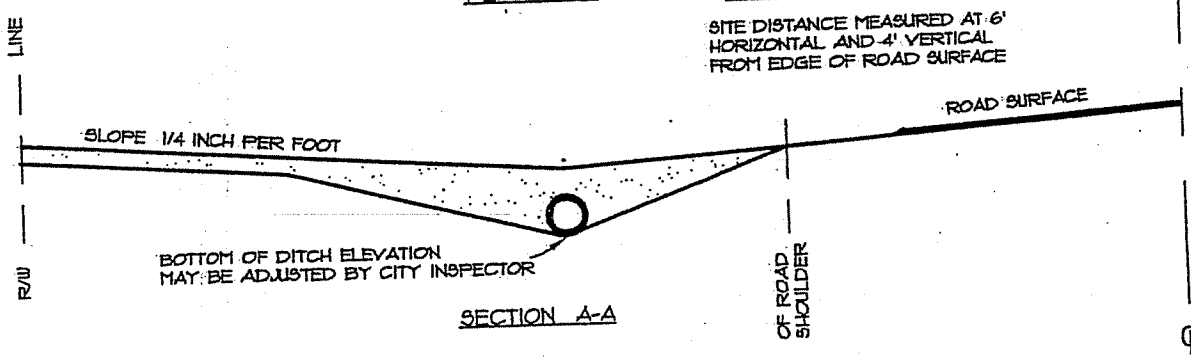
CITY OF ROCKAWAY BEACH	
DRIVEWAY WITH SIDEWALK	
DATE: APRIL 2002	DRAWING NO. RB-03



SUGGESTED DRIVEWAY SIGHT DISTANCE FOR TWO LANE ROAD

SPEED	DISTANCE
25 M.P.H.	180 FT.
30 M.P.H.	200 FT.
35 M.P.H.	250 FT.
40 M.P.H.	350 FT.
50 M.P.H.	500 FT.
60 M.P.H.	650 FT.

SITE DISTANCE MEASURED AT 6' HORIZONTAL AND 4' VERTICAL FROM EDGE OF ROAD SURFACE



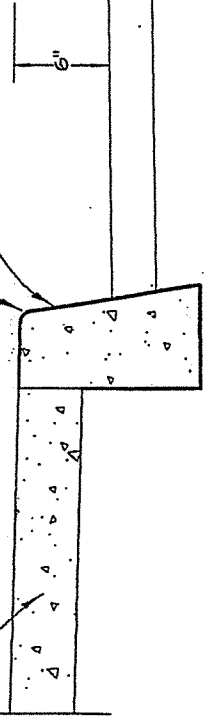
NOTE:
IF A.C. DRIVEWAY IS TO BE INSTALLED, USE 2" OF CLASS "B" MIX ON APPROVED BASE.

CITY OF ROCKAWAY BEACH	
DRIVEWAY WITHOUT SIDEWALK	
DATE: APRIL 2002	DRAWING NO. RB-04

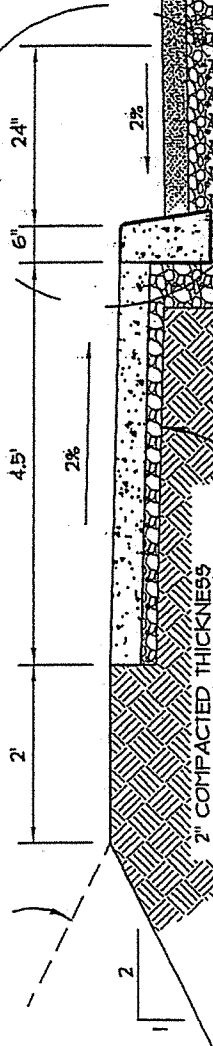
4" CONCRETE SIDEWALK
WHERE REQ'D

WHERE SIDEWALK NOT
REQUIRED, INSTALL 2"
COMPACTED THICKNESS OF 3/4"
CRUSHED ROCK, OR NATIVE
SAND, TO RIGHT-OF-WAY LINE

3/4" R.
BATTER 1:6



ALTERNATE
GRADE



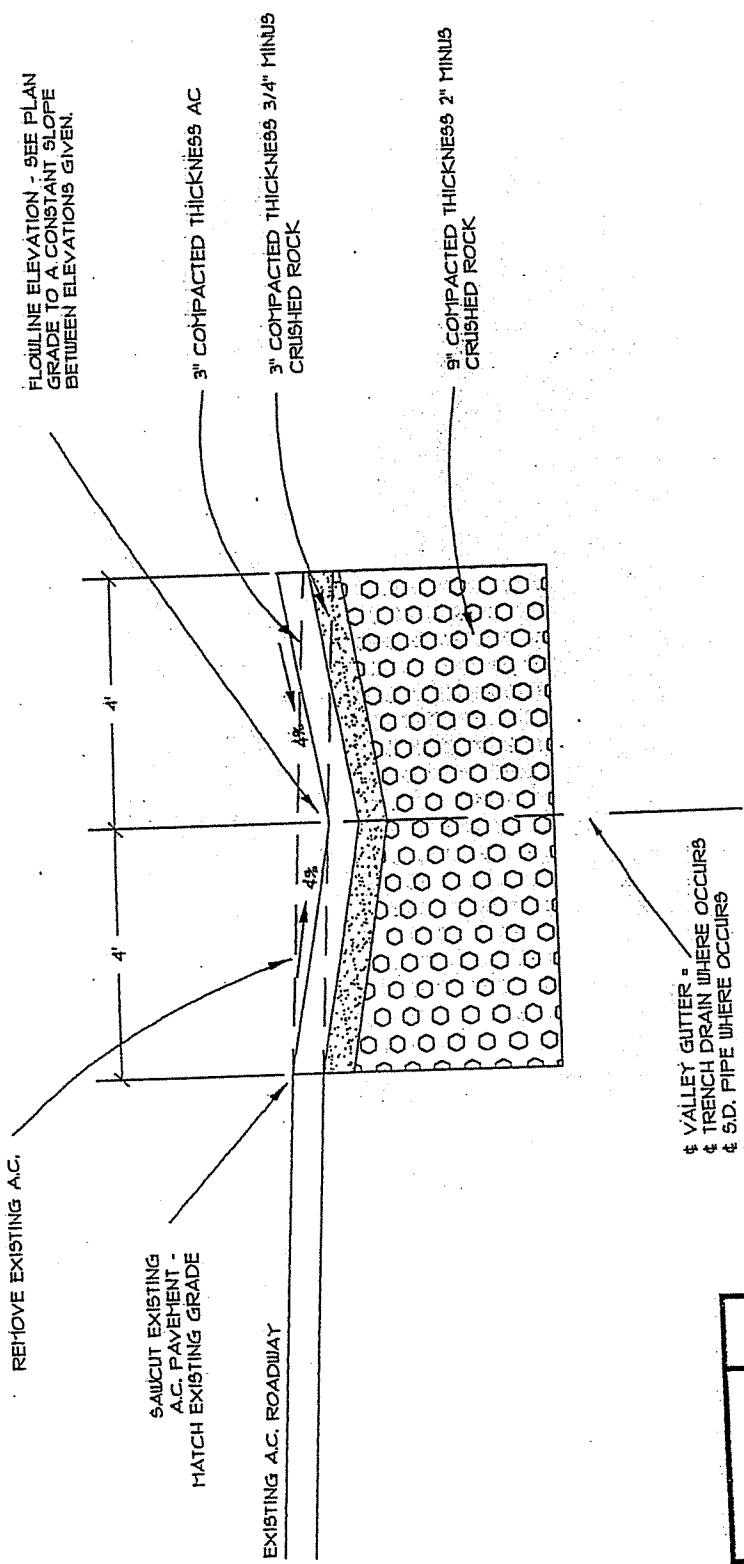
2" COMPACTED THICKNESS
OF 3/4"-Ø CRUSHED ROCK
OR NATIVE SAND

IF APPROVED BY CITY,
CRUSHED ROCK MAY BE USED
BEHIND CURBS. COMPACTED
CRUSHED ROCK WILL EXTEND
TO EDGE OR PROPERTY LINE

SEE ROADWAY
SECTION FOR SUB-BASE
REQUIREMENTS

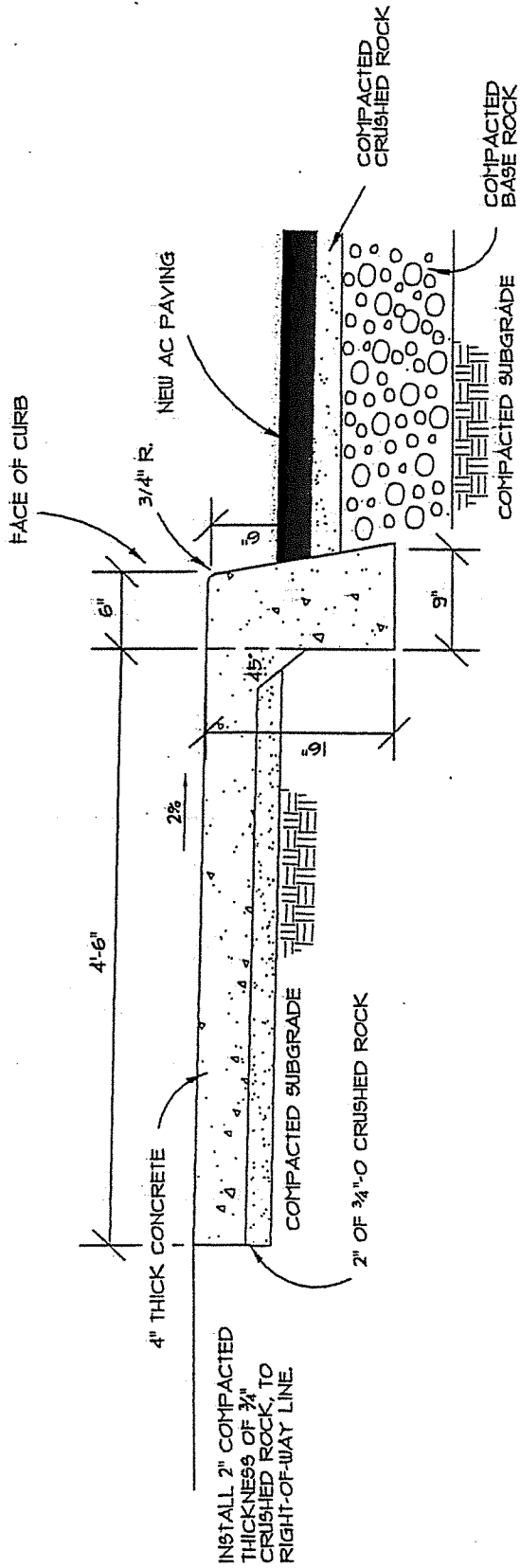
O.D.O.T. TYPE "C" CURB & GUTTER

CITY OF ROCKAWAY BEACH	
CURB AND GUTTER	
DATE: APRIL 2002	DRAWING NO. RB-05



‡ VALLEY GUTTER -
 ‡ TRENCH DRAIN WHERE OCCURS
 ‡ S.D. PIPE WHERE OCCURS

CITY OF ROCKAWAY BEACH	
VALLEY GUTTER	
DATE: APRIL 2002	DRAWING NO. RB-06

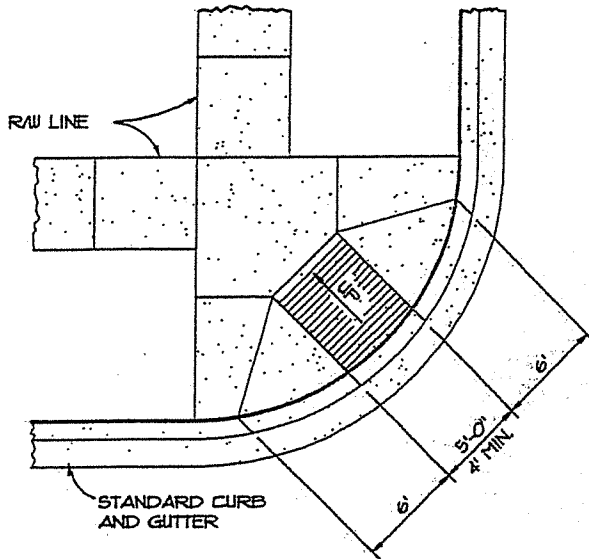


CITY OF ROCKAWAY BEACH

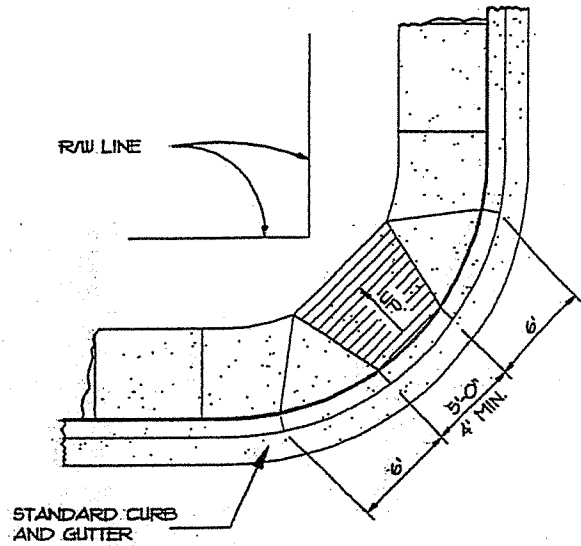
SIDEWALK

DATE: APRIL 2002

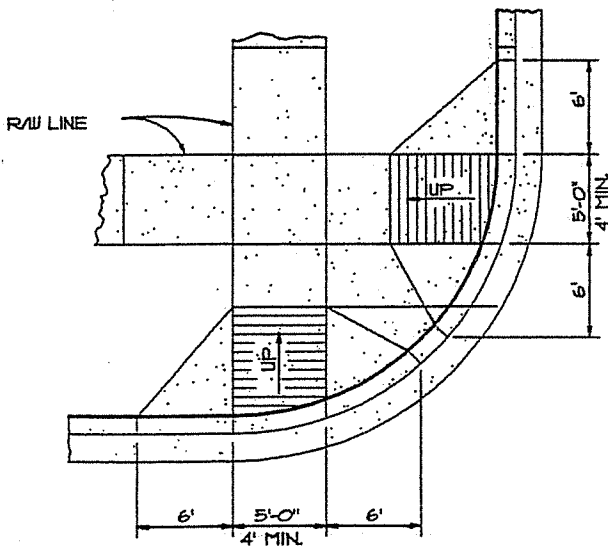
DRAWING NO. RB-07



CENTER RAMP FOR PROPERTY LINE SIDEWALK
(RESIDENTIAL AREAS)



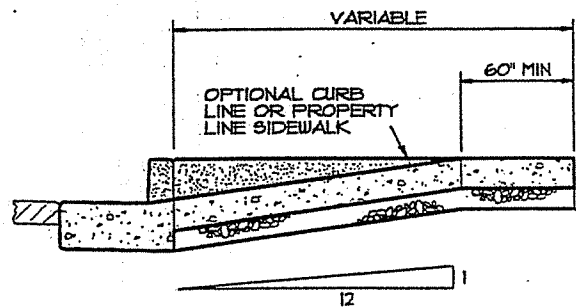
CENTER RAMP FOR CURB LINE SIDEWALK
(RESIDENTIAL AREAS)



END RAMP FOR PROPERTY LINE SIDEWALKS
(COMMERCIAL AREAS OR ARTERIAL STREETS)

NOTE:

1. THE "AMERICANS WITH DISABILITIES ACT" REQUIRES THAT ACCESS RAMP TO SIDEWALKS HAVE NO SLOPES GREATER THAN 12 HORIZONTAL TO 1 VERTICAL.
2. GRATINGS IN WALKING SURFACE SHALL HAVE SPACES NO GREATER THAN 1/2" WIDE, HAVE ELONGATED OPENINGS, AND SHALL BE PLACED PERPENDICULAR TO DIRECTION OF TRAVEL.



SECTION THROUGH RAMP - ALL VIEWS

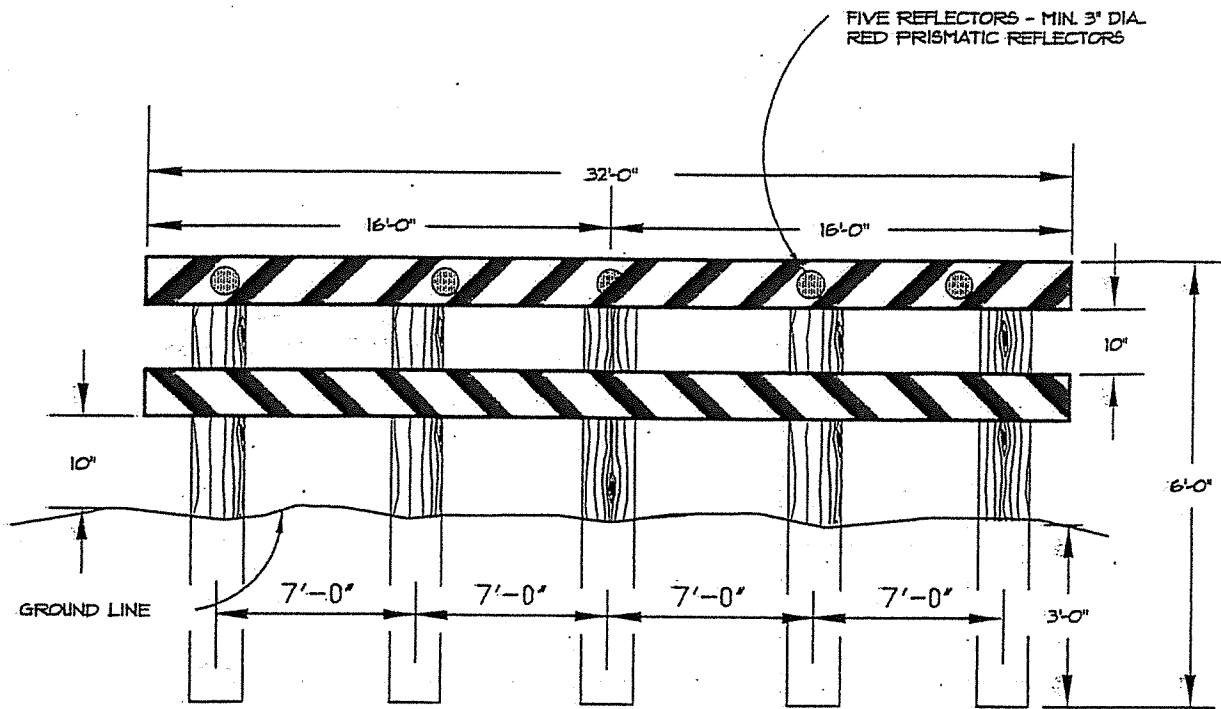
SURFACING OF RAMP
FINISH

CITY OF ROCKAWAY BEACH

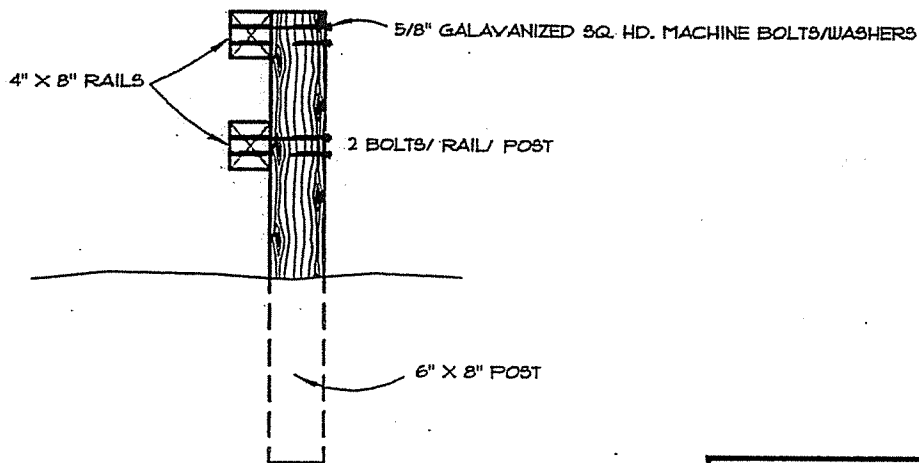
SIDEWALK RAMP

DATE:
APRIL 2002

DRAWING NO.
RB-08



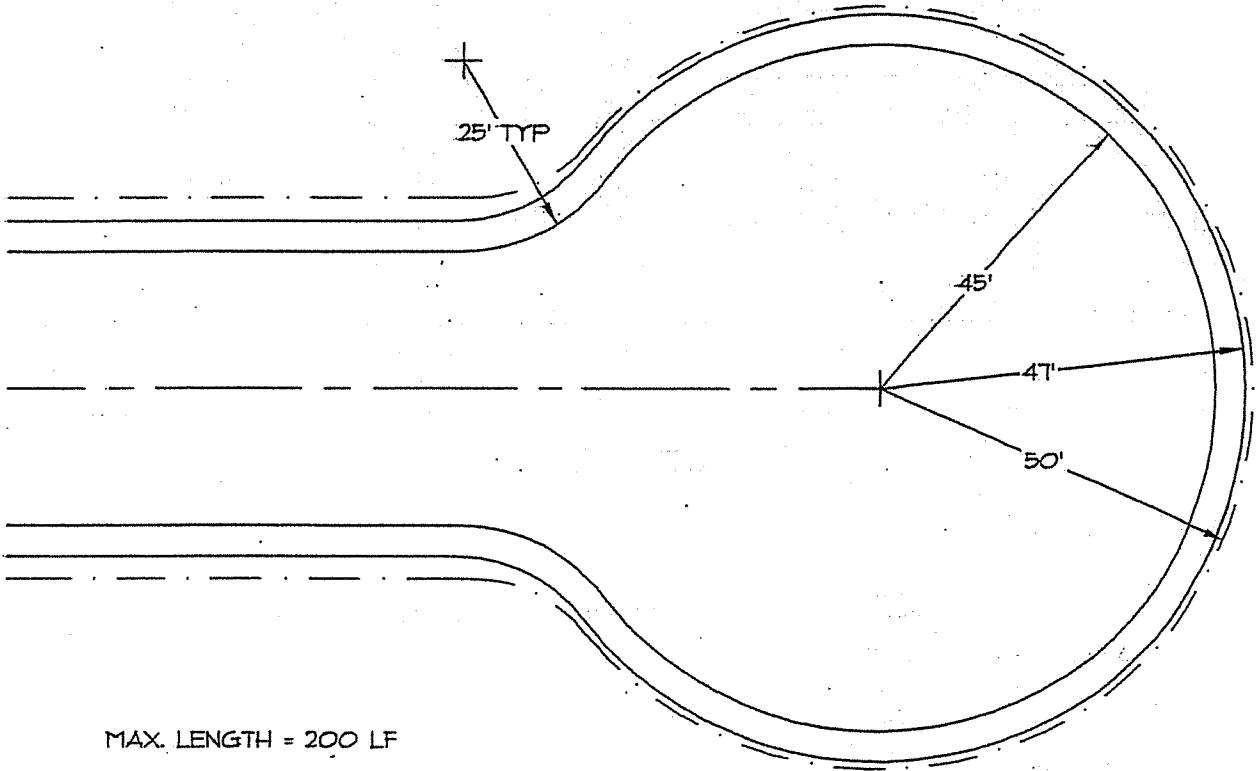
BARRICADE



NOTES:

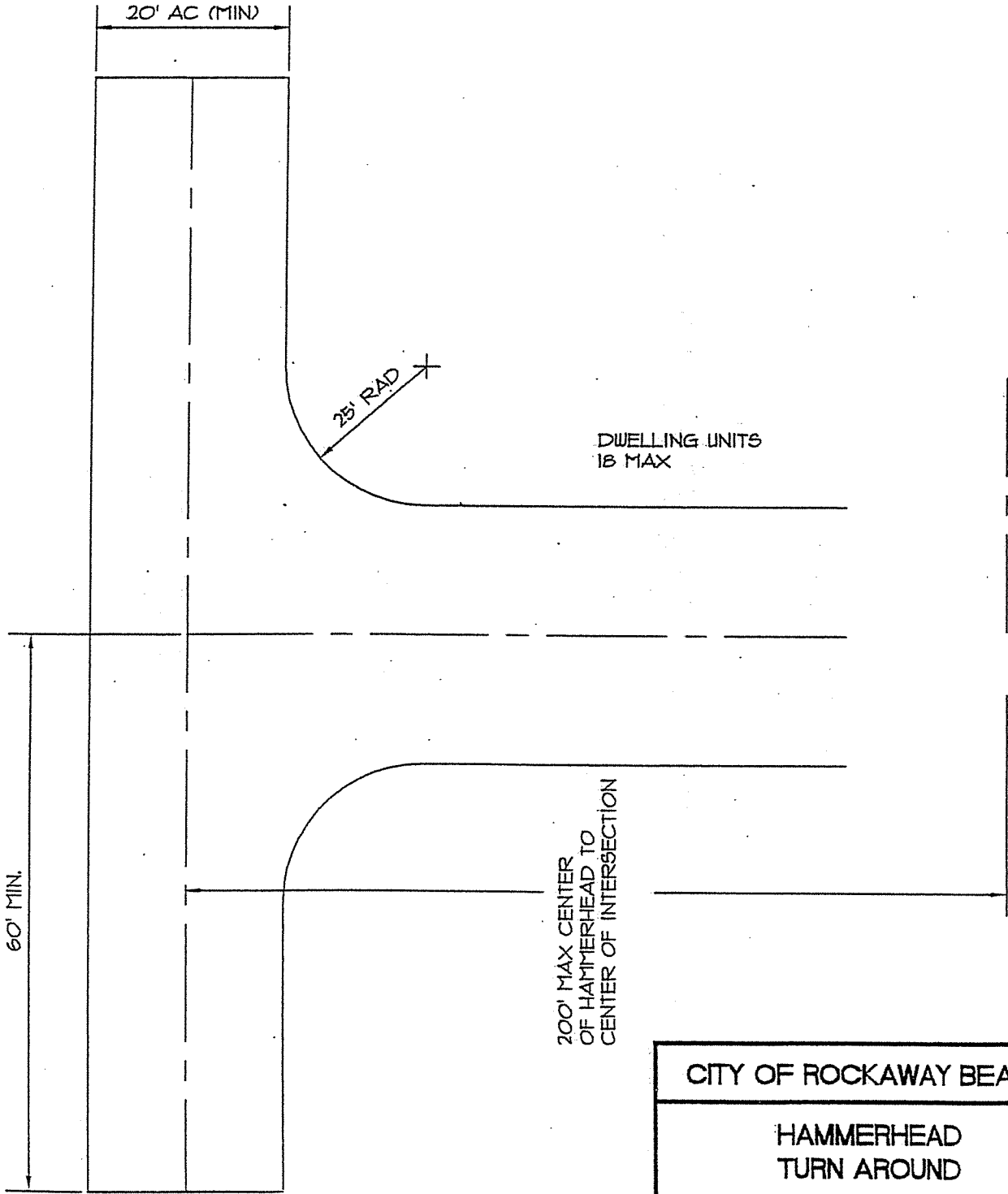
RAILS TO BE PAINTED BLACK WITH WHITE STRIPES-POSTS PAINTED WHITE-ALL WOOD PRESSURE TREATED.

CITY OF ROCKAWAY BEACH	
STREET BARRICADE	
DATE: APRIL 2002	DRAWING NO. RB-09



MAX. LENGTH = 200 LF

CITY OF ROCKAWAY BEACH	
CUL-DE-SAC	
DATE: APRIL 2002	DRAWING NO. RB-10

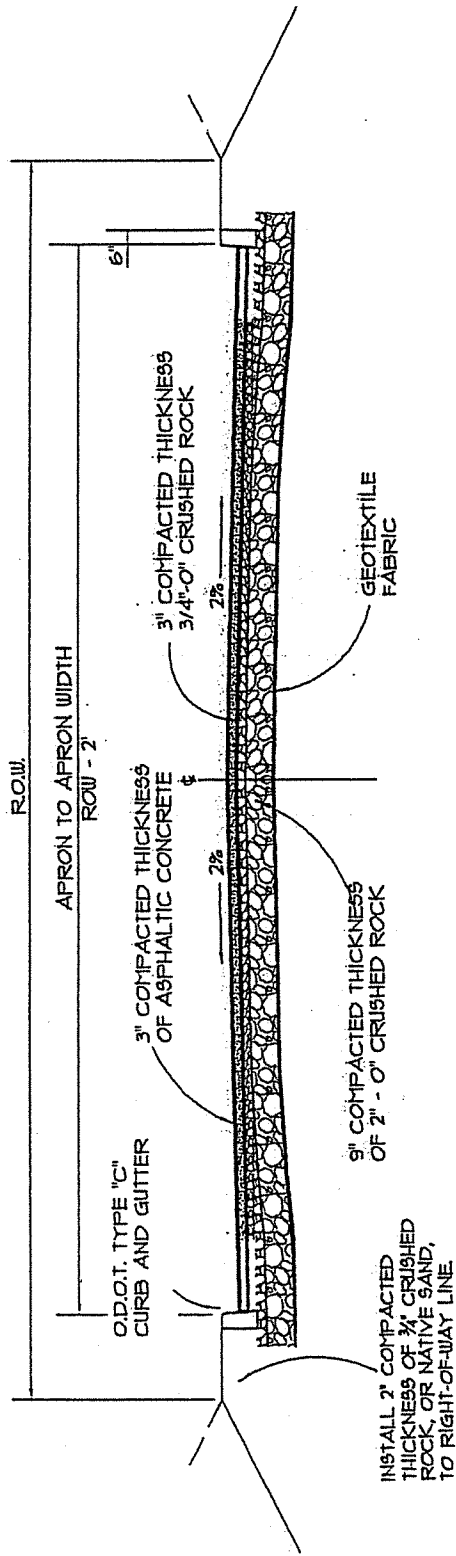


CITY OF ROCKAWAY BEACH

HAMMERHEAD
TURN AROUND

DATE:
APRIL 2002

DRAWING NO.
RB-11



R/W	A/C WIDTH
20'	18' A/C
10'	8' A/C

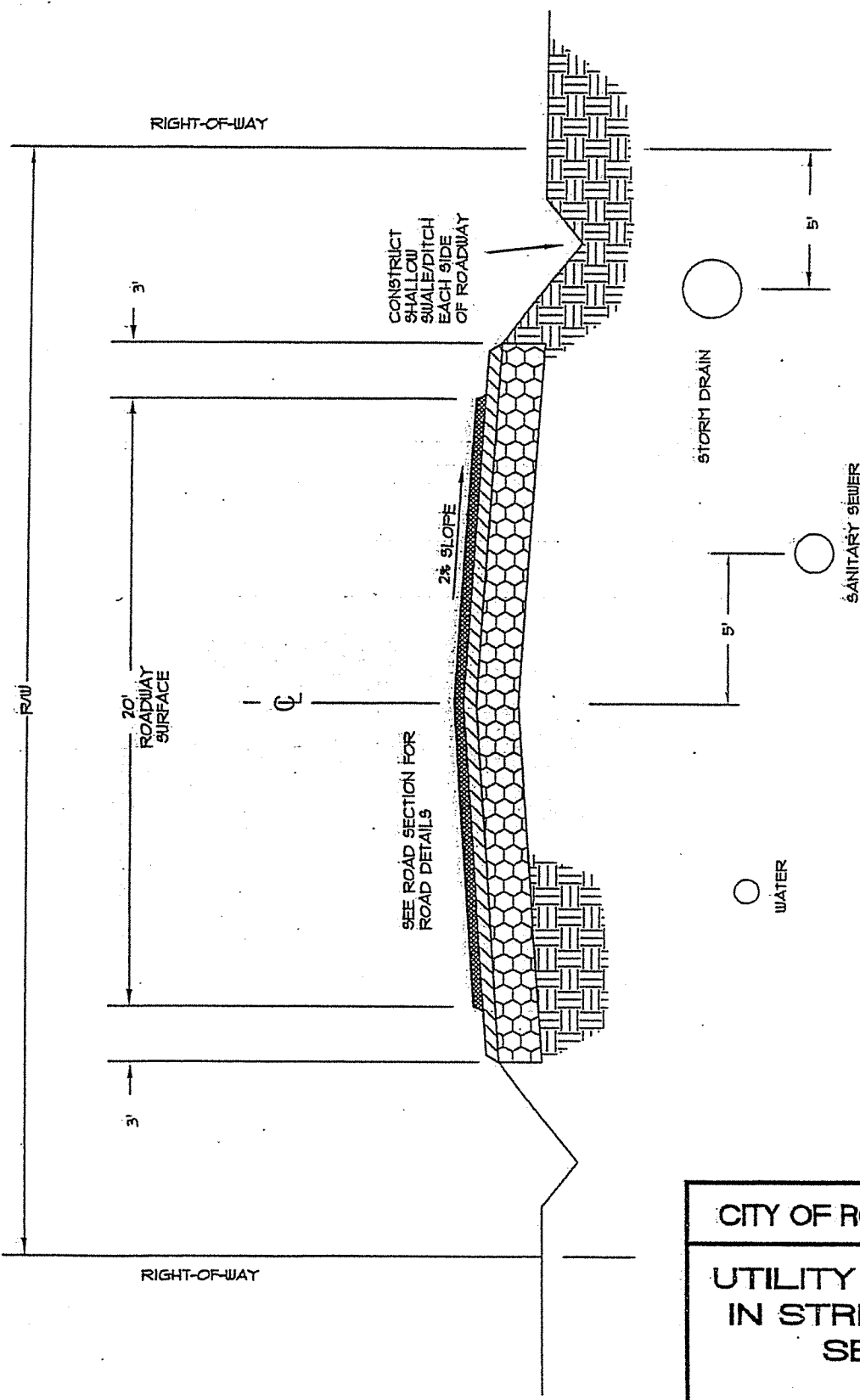
NARROW ROAD'S:
 FOR PUBLIC RIGHT-OF-WAYS 10'-20' WIDE,
 CURBS ARE REQUIRED (NO SIDEWALKS).
 ASPHALT SURFACE = R/W WIDTH - 2'

CITY OF ROCKAWAY BEACH

NARROW ROAD
CROSS SECTION

DATE:
APRIL 2002

DRAWING NO.
RB-12



CITY OF ROCKAWAY BEACH

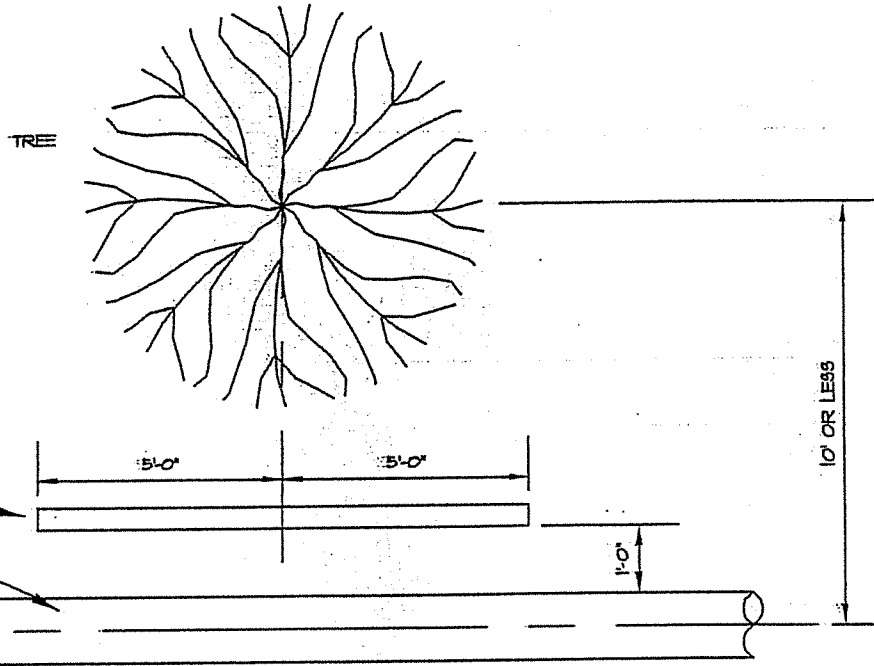
UTILITY LOCATIONS
IN STREET CROSS
SECTION

DATE:
APRIL 2002

DRAWING NO.
RB-13

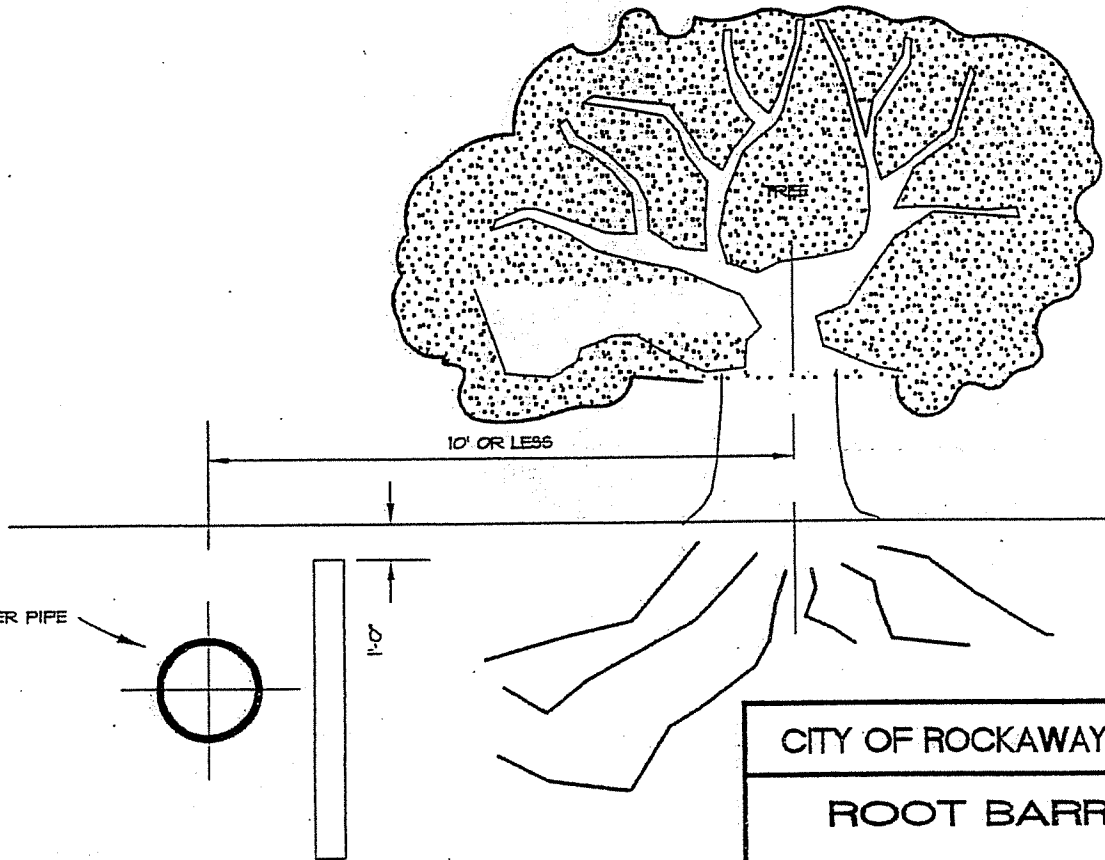
ROOT BARRIER,
10'-0" LONG X 4'-0" HIGH
X 10 GAGE GALVANIZED STEEL

WATER PIPE



WATER PIPE

ROOT BARRIER,
10'-0" LONG X 4'-0" HIGH
X 10 GAGE GALVANIZED STEEL

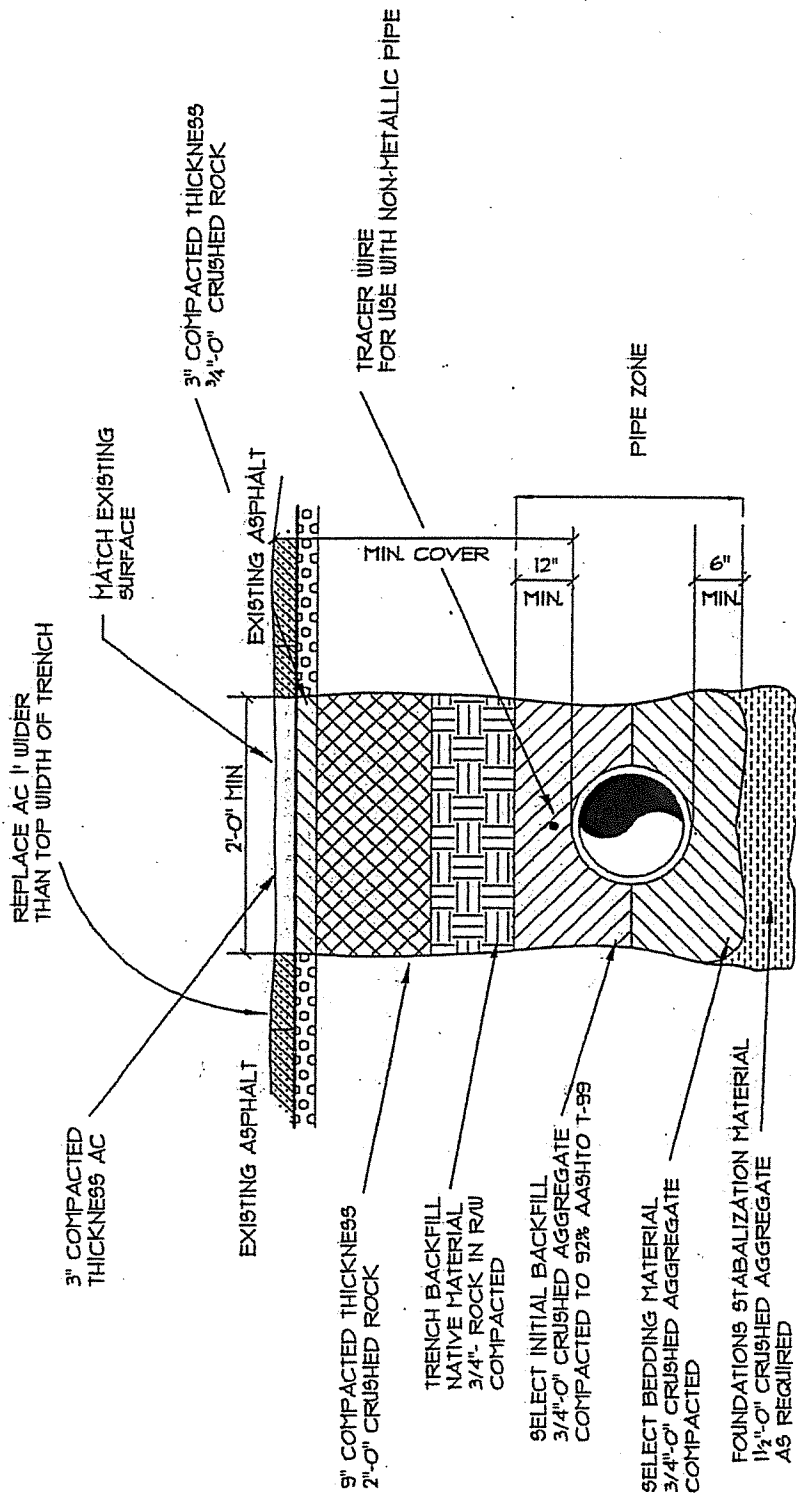


CITY OF ROCKAWAY BEACH

ROOT BARRIER

DATE:
APRIL 2002

DRAWING NO.
RB-14



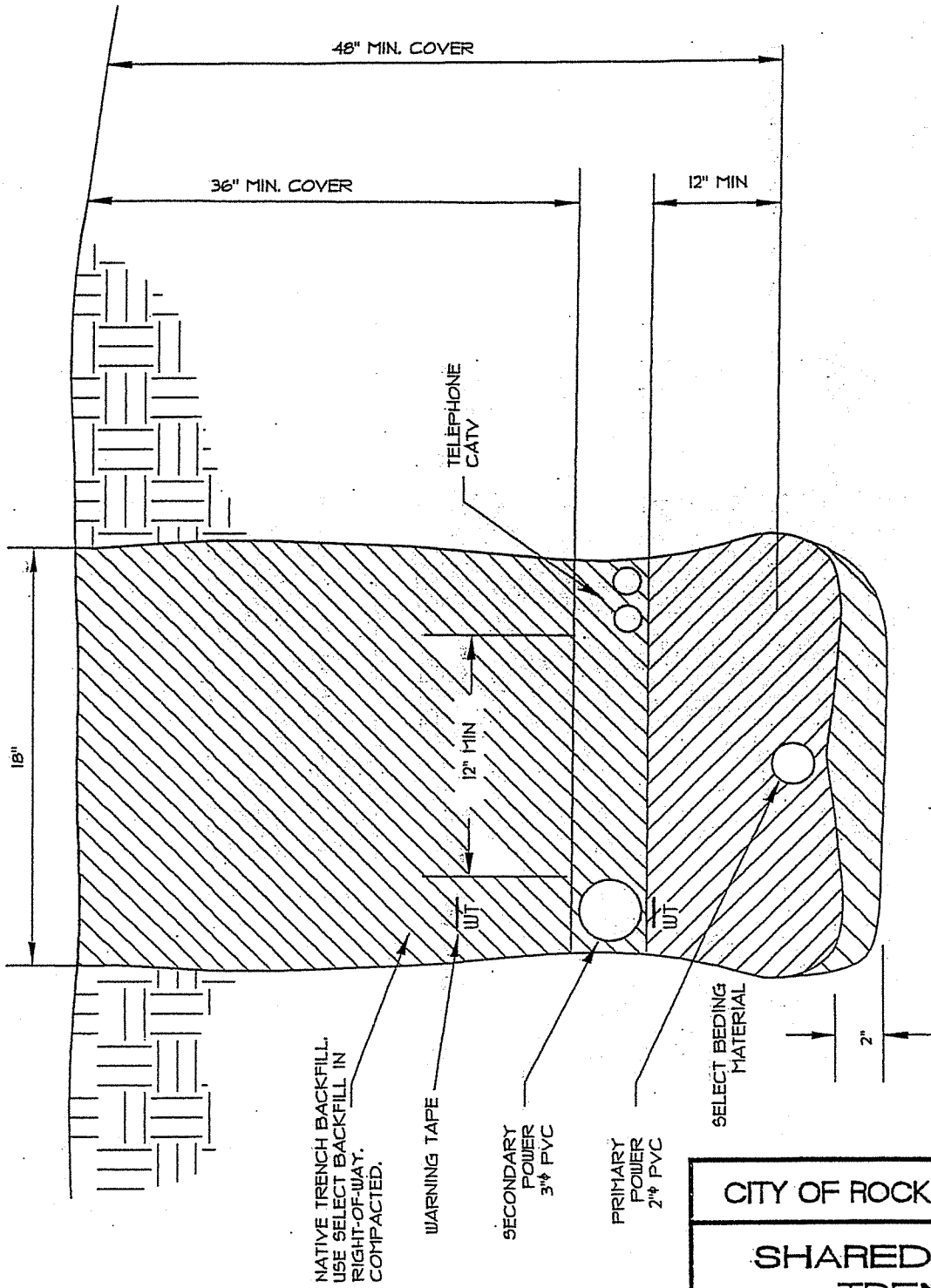
NOTE:
 FOR REQUIRED MINIMUM TRENCH COVER
 DRAINAGE CULVERT 12" MINIMUM
 WATER MAIN 30" MINIMUM
 SEWER 36" MINIMUM

CITY OF ROCKAWAY BEACH

TRENCH CROSS SECTION

DATE: APRIL 2002

DRAWING NO. RB-15

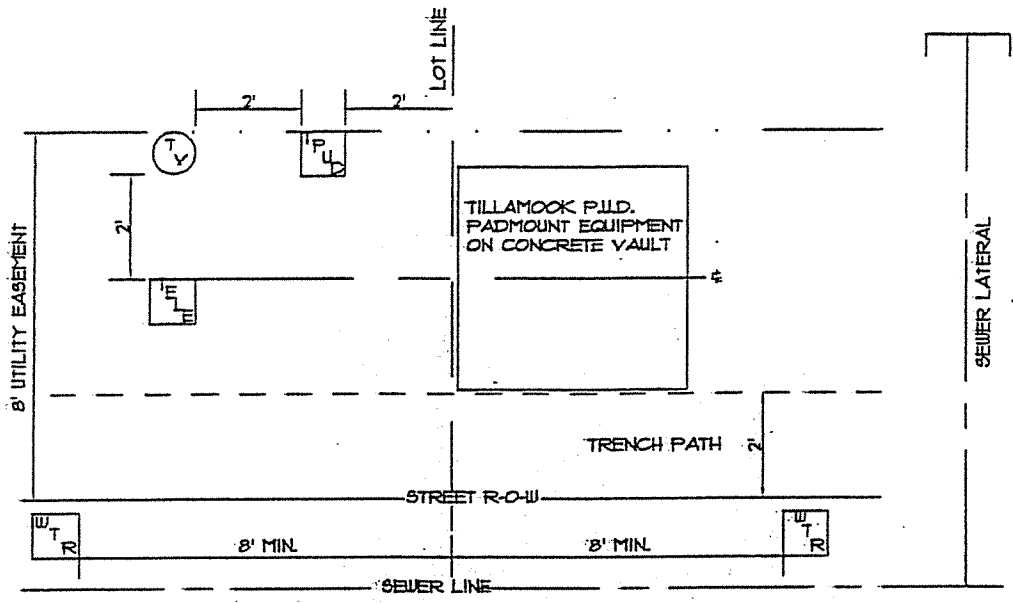


CITY OF ROCKAWAY BEACH

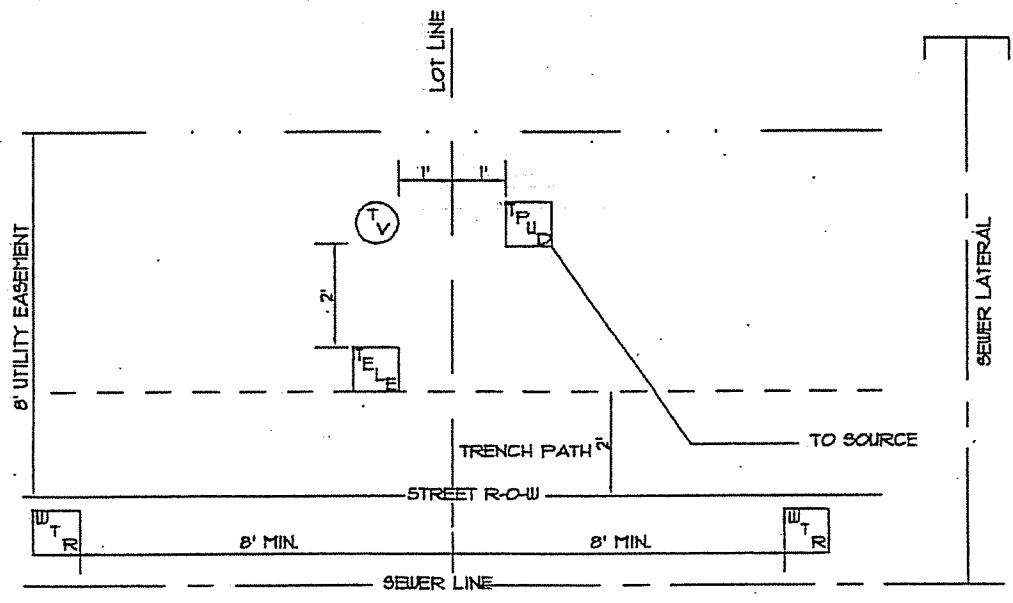
SHARED UTILITY TRENCH

DATE: APRIL 2002

DRAWING NO. RB-16



LOT CORNER WITH PADMOUNTED EQUIPMENT AND PEDESTALS

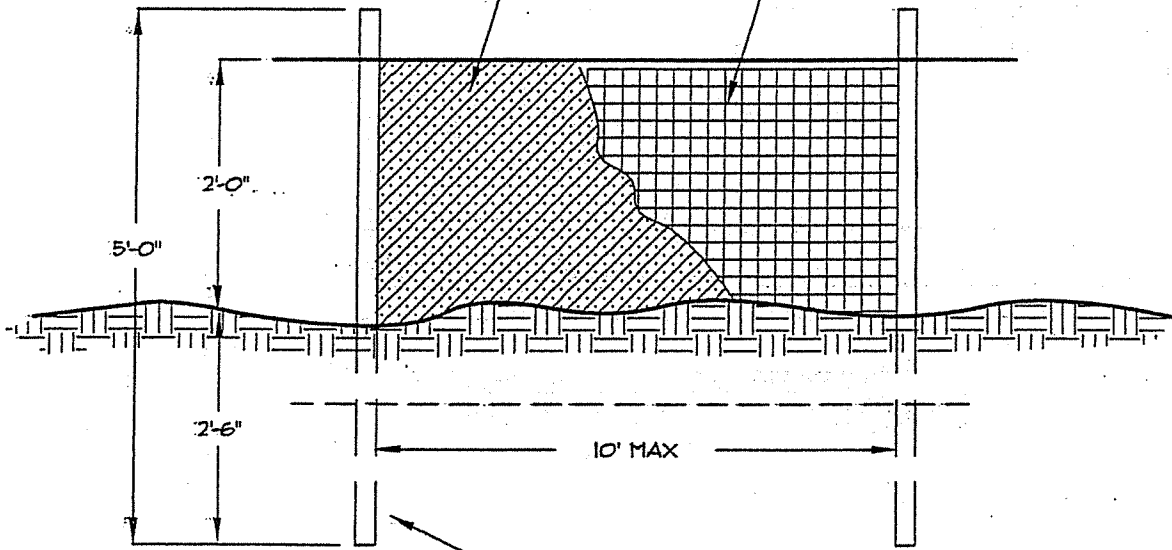


LOT CORNER WITH PEDESTAL INSTALLATION ONLY

CITY OF ROCKAWAY BEACH	
POWER VAULT LOCATION	
DATE: APRIL 2002	DRAWING NO. RB-17

FILTER FABRIC MATERIAL 36"
WIDE ROLLS, USE STAPLES OR
WIRE RINGS TO ATTACH FABRIC
AND WIRE

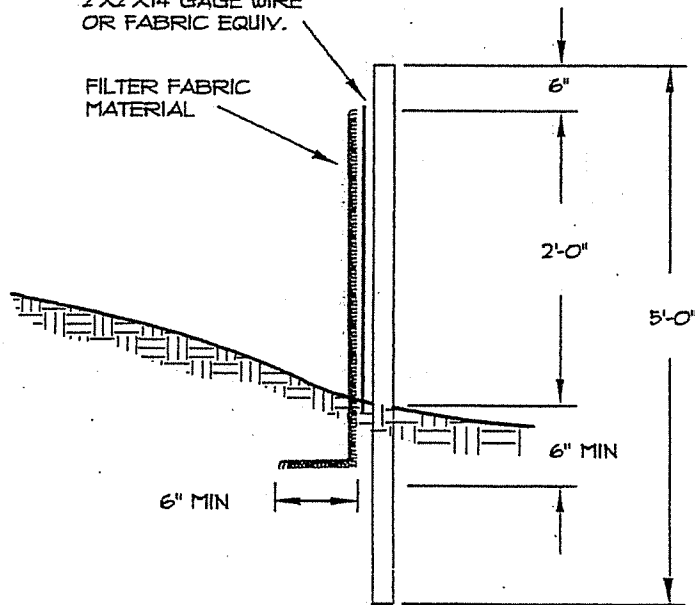
2"x2"x14 GAGE WIRE
OR FABRIC EQUIV.



STEEL FENCE POSTS
OR 2"x4" WOOD POSTS,
STANDARD OF BETTER.

2"x2"x14 GAGE WIRE
OR FABRIC EQUIV.

FILTER FABRIC
MATERIAL



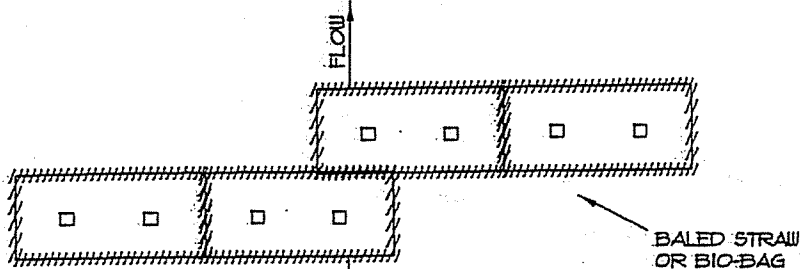
NOTE:
BURY BOTTOM OF FILTER
MATERIAL IN 6" BY 6"
TRENCH

CITY OF ROCKAWAY BEACH

SILT FENCING

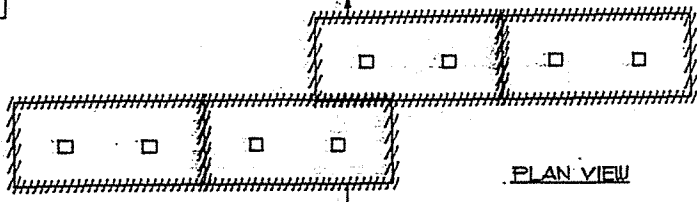
DATE:
APRIL 2002

DRAWING NO.
RB-18



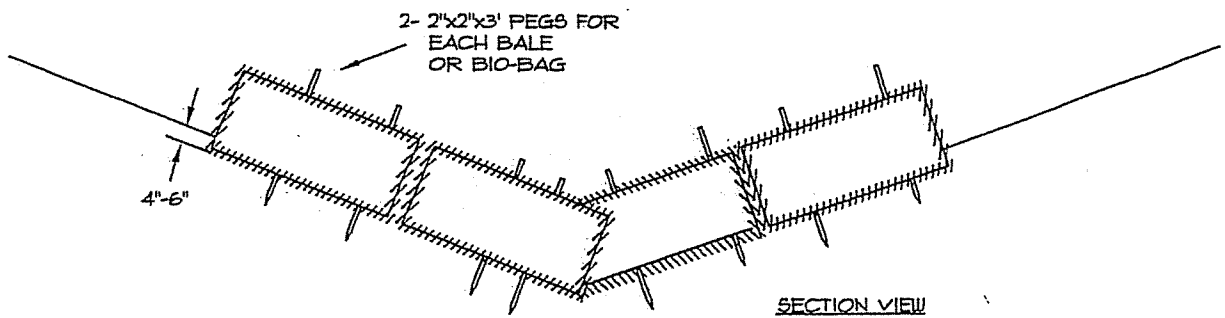
BALED STRAW
OR BIO-BAG

C.L. OF SWALE
OR DITCH



PLAN VIEW

NOTES:
 EMBED BALES OR BAGS
 4 TO 6 INCHES INTO SOIL
 DRIVE STAKES MINIMUM
 12 INCHES INTO GROUND

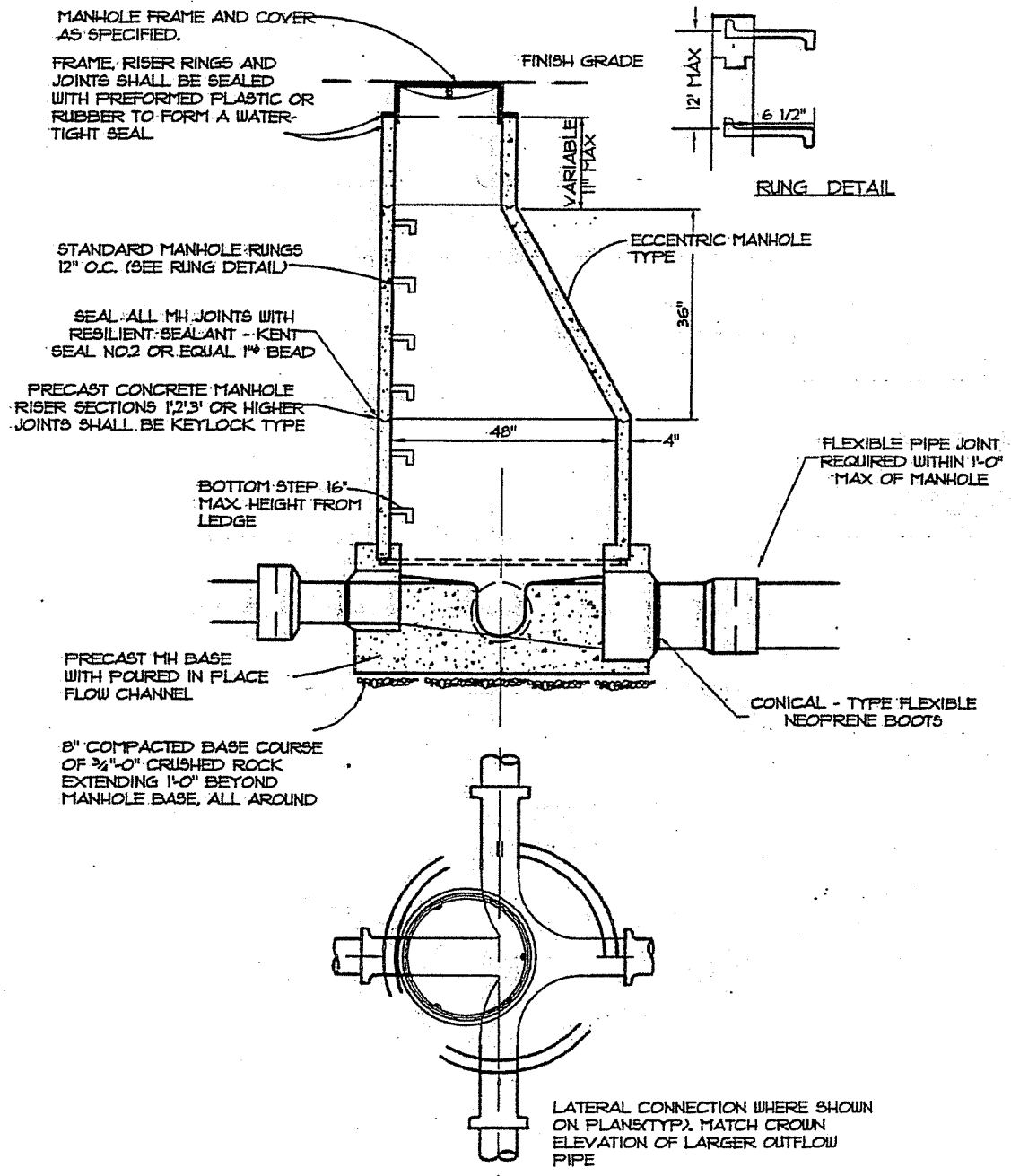


2- 2"x2"x3" PEGS FOR
 EACH BALE
 OR BIO-BAG

4"-6"

SECTION VIEW

CITY OF ROCKAWAY BEACH	
HAY BALE/ BIO-BAG BARRIER	
DATE: APRIL 2002	DRAWING NO. RB-19

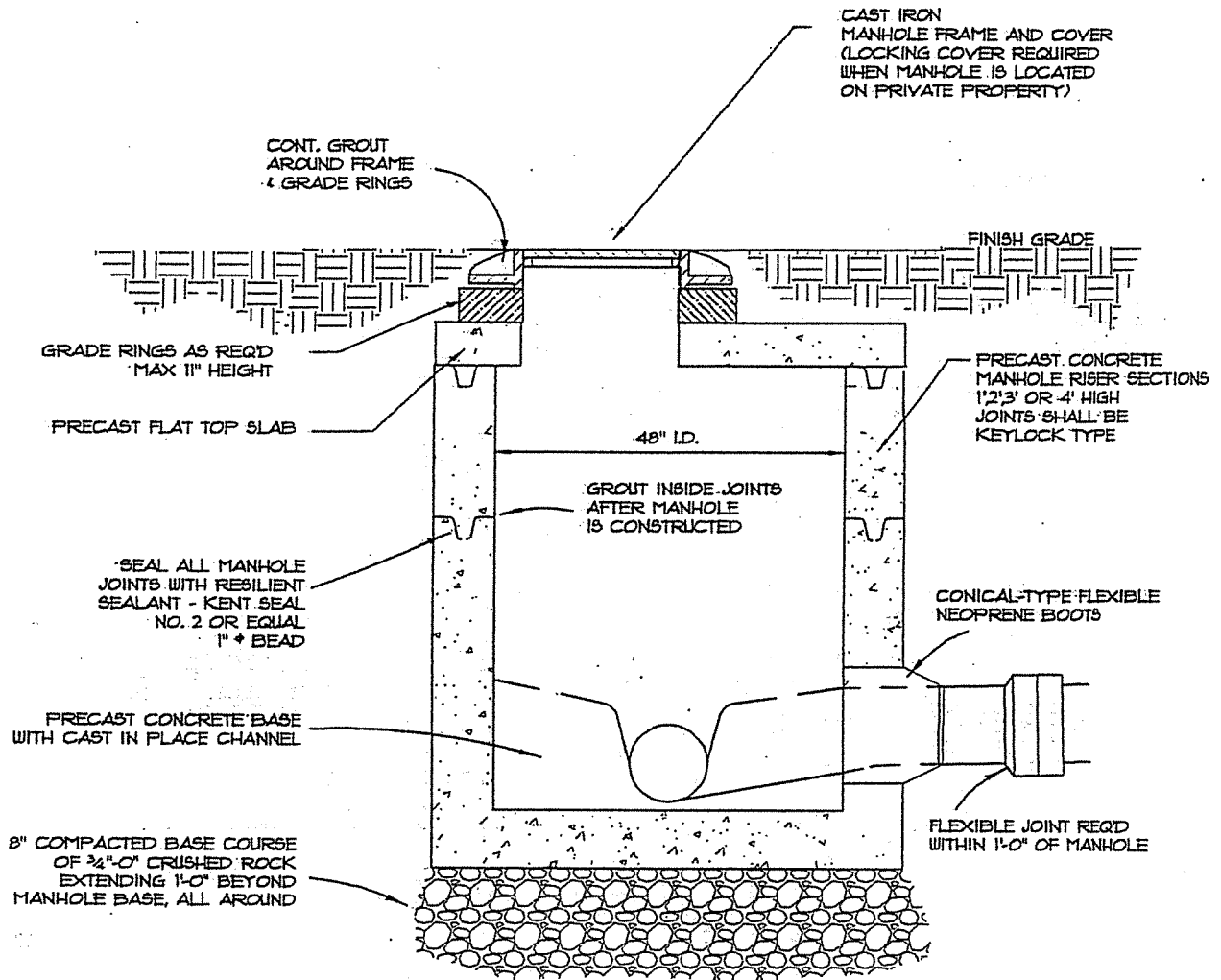


CITY OF ROCKAWAY BEACH

SANITARY SEWER
MANHOLE

DATE:
APRIL 2002

DRAWING NO.
RB-20



CITY OF ROCKAWAY BEACH

SHALLOW
MANHOLE

DATE:
APRIL 2002

DRAWING NO.
RB-21

WATER TIGHT MANHOLE FRAME
AND COVER AS SPECIFIED.

FINISH GRADE

FRAME, RISER RINGS AND
JOINTS SHALL BE SEALED WITH
PREFORMED PLASTIC OR
RUBBER TO FORM A
WATERTIGHT SEAL.

VARIABLE
1" MAX

ECCENTRIC MANHOLE
TYPE

SEAL ALL MANHOLE JOINTS
WITH RESILIENT SEALANT -
KENT SEAL NO. 2 OR EQUAL
1" BEAD

PRECAST CONCRETE MANHOLE
RISER SECTIONS 1'2'3' OR
HIGHER JOINTS SHALL BE
KEYLOCK TYPE

12" MAX

CONTRACTOR SHALL MAINTAIN A
MINIMUM OF 8" SEPARATION
BETWEEN EDGE OF CORE AND
THE NEAREST JOINT.

48"
BOTTOM STEP 16"
MAX HEIGHT FROM
LEDGE

USE FERNCO COUPLER
FOR CONNECTION

ALL PVC TEE, SLEEVE, AND
BENDS

ALTERNATE, USE ALL DUCTILE IRON
PIPE AND DELETE CONCRETE
ENCASEMENT.

PRECAST BASE OR
POURED CONCRETE
BASE, 5 SACK MIX
3000 P.S.I. AT 28 DAYS

8" COMPACTED BASE COURSE
OF 3/4"-0" CRUSHED ROCK
EXTENDING 1'-0" BEYOND
MANHOLE BASE, ALL AROUND

CITY OF ROCKAWAY BEACH

OUTSIDE DROP
MANHOLE

DATE:
APRIL 2002

DRAWING NO.
RB-22

WATER TIGHT PIPE PLUG

CAST IRON RING
AND COVER

FINISHED SURFACE

2'-0" X 10" MINIMUM
PIPE SLEEVE

6" RISER PIPE

ENCASE IN CONCRETE OR
COMPACTED BACKFILL MATERIAL
AT DIRECTION OF ENGINEER.
CONCRETE TO FULL WIDTH OF
TRENCH 6" MIN THICKNESS
ALL AROUND PIPE

6" X 45° ELBOW
BELL X SPIGOT

6" X 45° ELBOW
BELL X SPIGOT

SET CLEANOUT RING TO FINISHED GRADE

WELL COMPACTED
BACKFILL MATERIAL
FOR 6" MIN ALL AROUND
RISER PIPE

COMPACTED
BACKFILL MATERIAL

COMPACTED PIPE
BEDDING

CITY OF ROCKAWAY BEACH

SEWER CLEANOUT

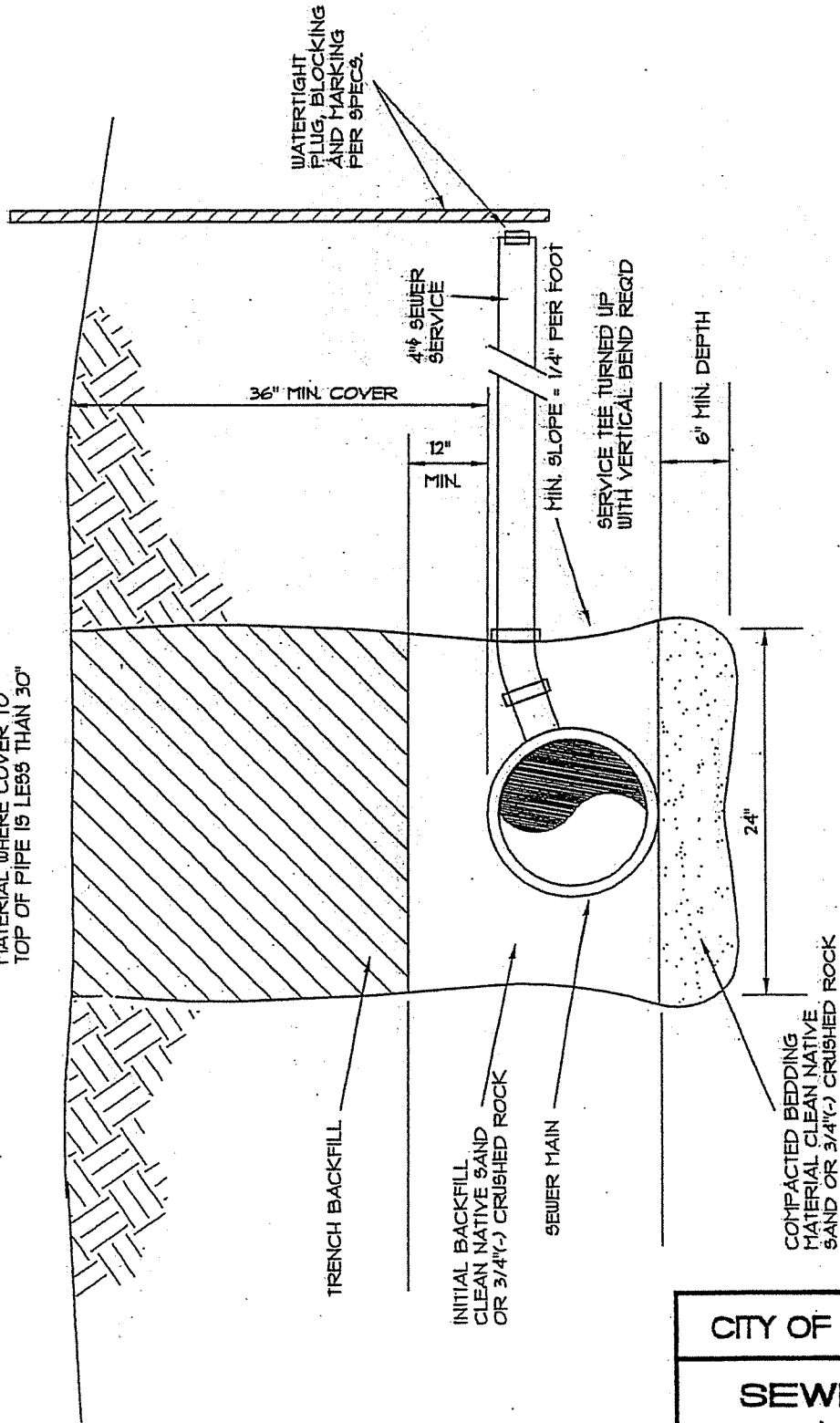
DATE:

APRIL 2002

DRAWING NO.

RB-23

BACKFILL TRENCH W/5 SACK
PCC MIX 18" ABOVE BEDDING
MATERIAL WHERE COVER TO
TOP OF PIPE IS LESS THAN 30"



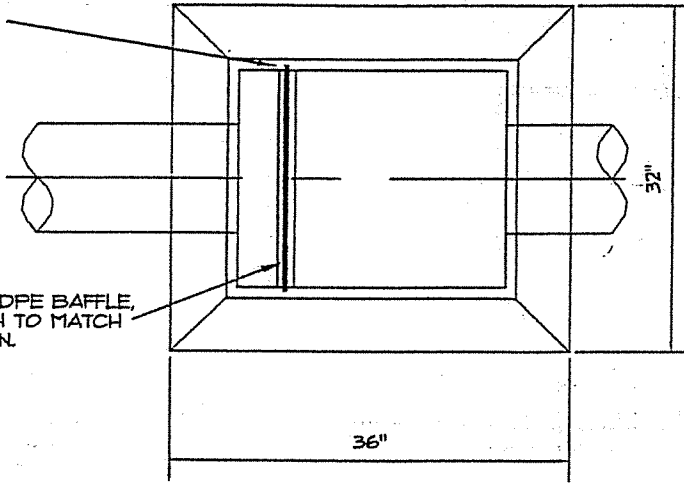
CITY OF ROCKAWAY BEACH

SEWER SERVICE
LATERAL

DATE:
APRIL 2002

DRAWING NO.
RB-24

NOTCH INLET FRAME FOR BAFFLE

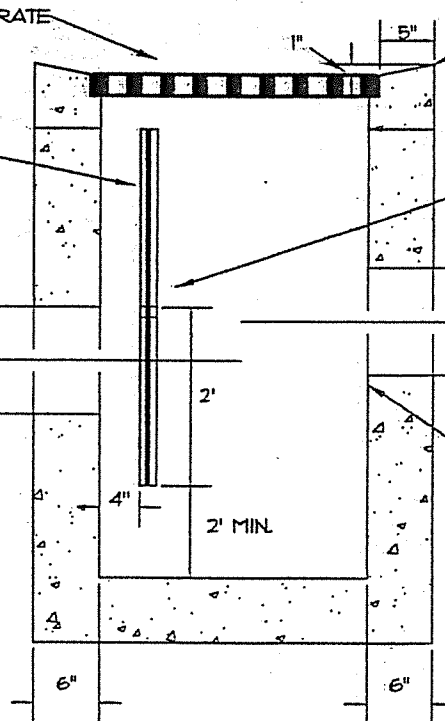


REMOVABLE 1/2" HDPE BAFFLE, LENGTH AND WIDTH TO MATCH EACH CATCH BASIN.

CAST IRON, BICYCLE SAFE GRATE

1 1/2" WIDE CHANNEL INSERT, INSTALLED FLUSH WITH BOTTOM OF FRAME, LENGTH VARIES.

OUTLET PIPE



RIM ELEVATION

DRILL 1/4" HOOK HOLE IN ϕ OF BAFFLE AT TOP OF PIPE

INLET PIPE

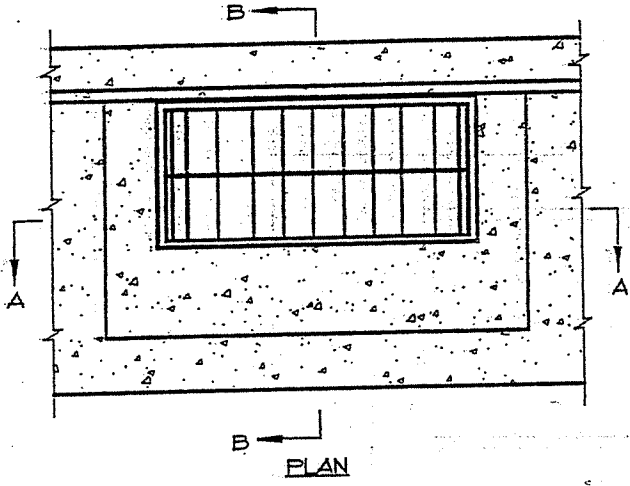
CUT ALL PIPES FLUSH WITH INSIDE WALL, TYP.

CITY OF ROCKAWAY BEACH

STORMWATER
CATCH BASIN

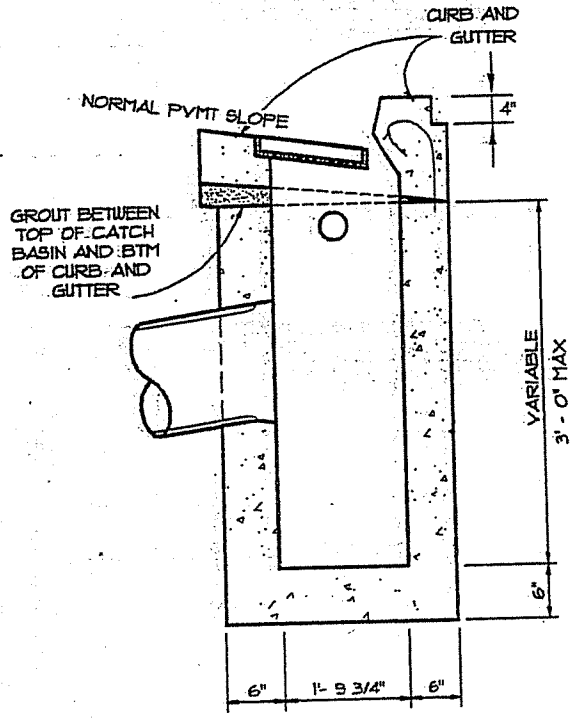
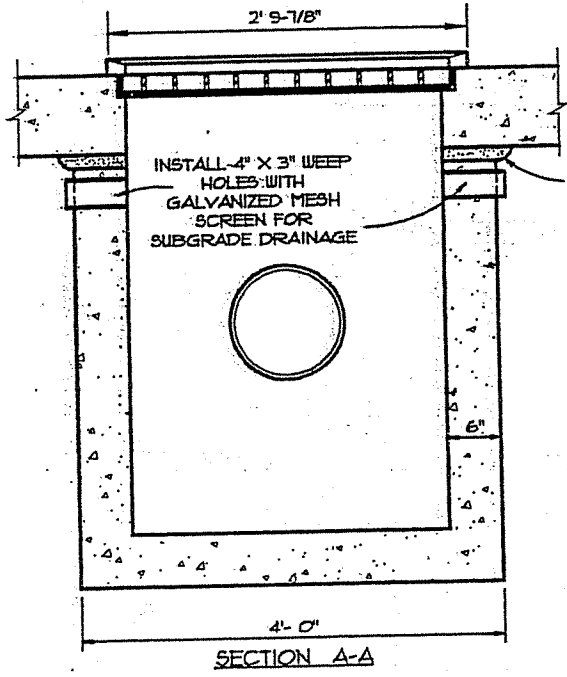
DATE:
APRIL 2002

DRAWING NO.
RB-25

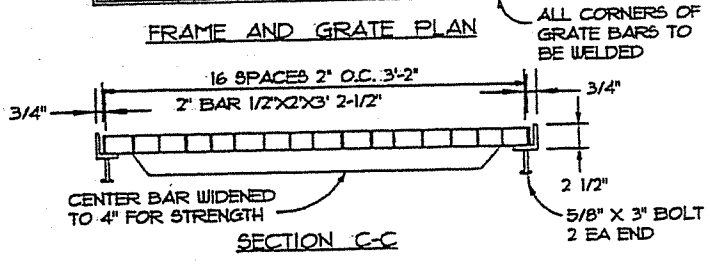
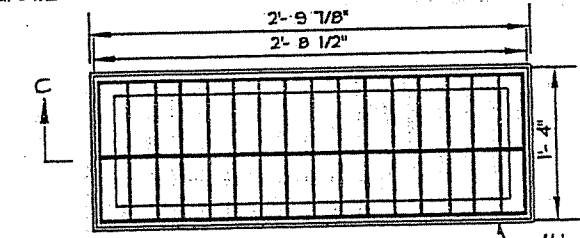


NOTES:

1. PRECAST BASE WALLS MAY BE A MINIMUM OF 4" THICK.
2. CONCRETE SHALL BE CLASS 3000.
3. APPROVED CAST IRON FRAMES AND GRATES MAY BE ACCEPTED.



FRAME 3/8" X 2 1/2" X 2 1/2" STEEL (ASTM A-36) ANGLE
 GRATE 2' 2-1/2" X 3' 2-1/2"



CITY OF ROCKAWAY BEACH	
CURB INLET	
DATE: APRIL 2002	DRAWING NO. RB-26

NOTCH INLET FRAME FOR BAFFLE

REMOVABLE 1/2" HDPE BAFFLE. LENGTH AND WIDTH TO MATCH EACH CATCH BASIN.

CAST IRON GRATE

1 1/2" WIDE CHANNEL INSERT, INSTALLED FLUSH WITH BOTTOM OF FRAME. LENGTH VARIES.

8" OUTLET PIPE TO 18" HDPE OR MANHOLE

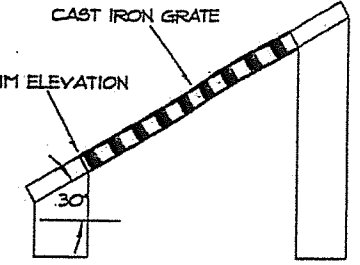
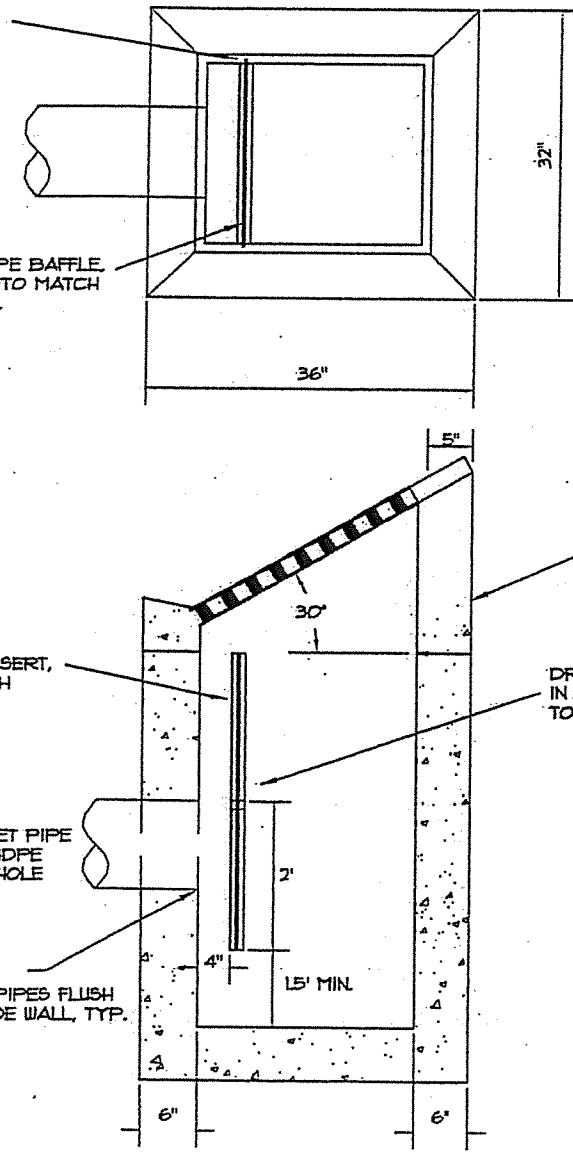
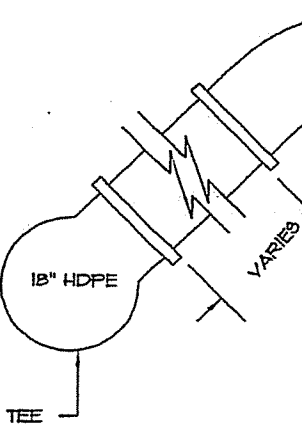
CUT ALL PIPES FLUSH WITH INSIDE WALL, TYP.

CAST IRON GRATE
RIM ELEVATION

30° DITCH INLET SECTION SLOPED SIDE FACING FLOW. TO USE IN DITCHES IN PLACE OF STANDARD TOP UNIT. SET WITH

RIM ELEVATION

DRILL 1" HOOK HOLE IN ϕ OF BAFFLE AT TOP OF PIPE.



CITY OF ROCKAWAY BEACH

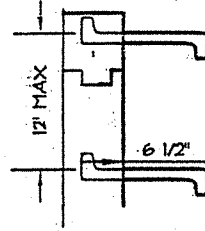
DITCH INLET

DATE: APRIL 2002

DRAWING NO. RB-27

MANHOLE FRAME AND COVER OR GRATE AS SPECIFIED.

FINISH GRADE



RING DETAIL

STANDARD MANHOLE RINGS 12' O.C. (SEE RING DETAIL)

SEAL ALL MH JOINTS WITH RESILIENT SEALANT - KENT SEAL NO.2 OR EQUAL 1" BEAD

PRECAST CONCRETE MANHOLE RISER SECTIONS 1'2'3' OR HIGHER JOINTS SHALL BE KEYLOCK TYPE

BOTTOM STEP 16" MAX. HEIGHT FROM LEDGE

PRECAST MH BASE

8" COMPACTED BASE COURSE OF 3/4" CRUSHED ROCK EXTENDING 1'-0" BEYOND MANHOLE BASE, ALL AROUND

VARIABLE (1" MAX)

ECCENTRIC MANHOLE TYPE

36"

48"

4"

FLEXIBLE PIPE JOINT REQUIRED WITHIN 1'-0" MAX OF MANHOLE

CONICAL - TYPE FLEXIBLE NEOPRENE BOOTS

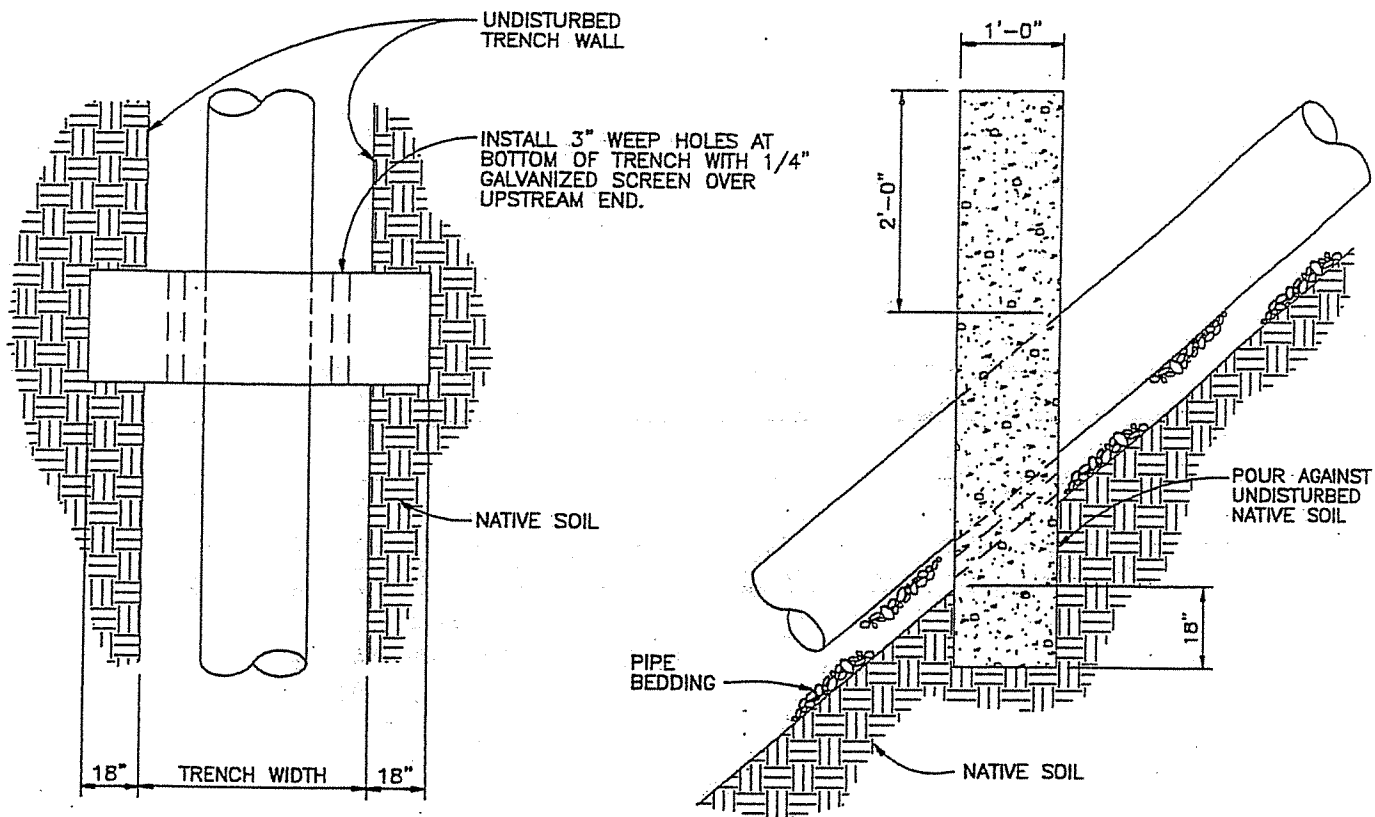
18" MIN

CITY OF ROCKAWAY BEACH

STORM WATER MANHOLE

DATE: APRIL 2002

DRAWING NO. RB-28

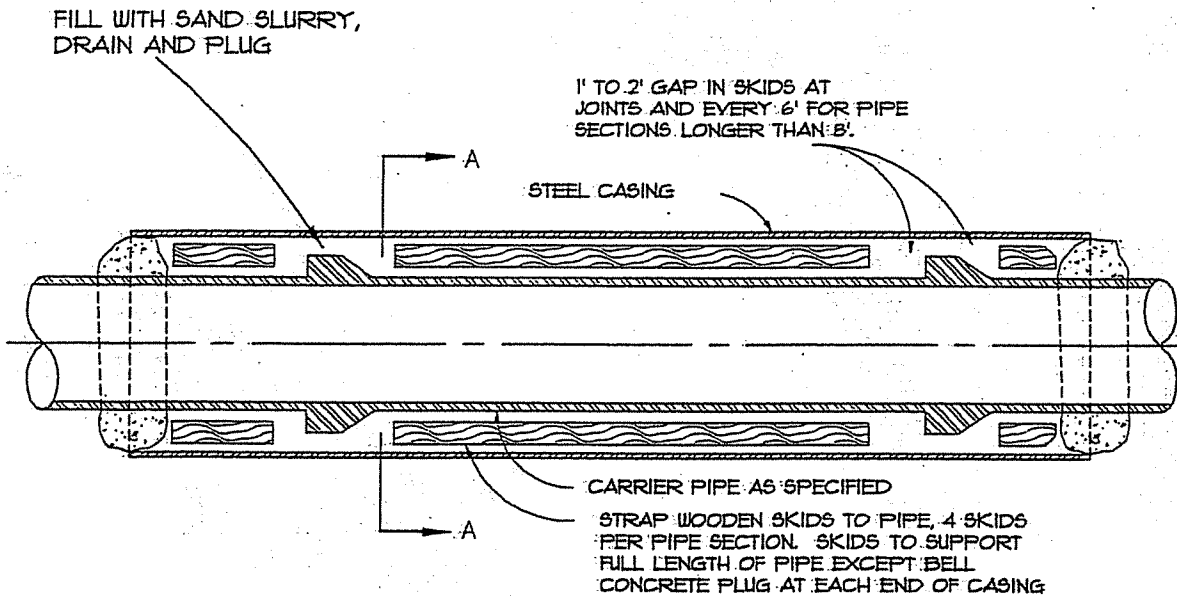


NOTES:

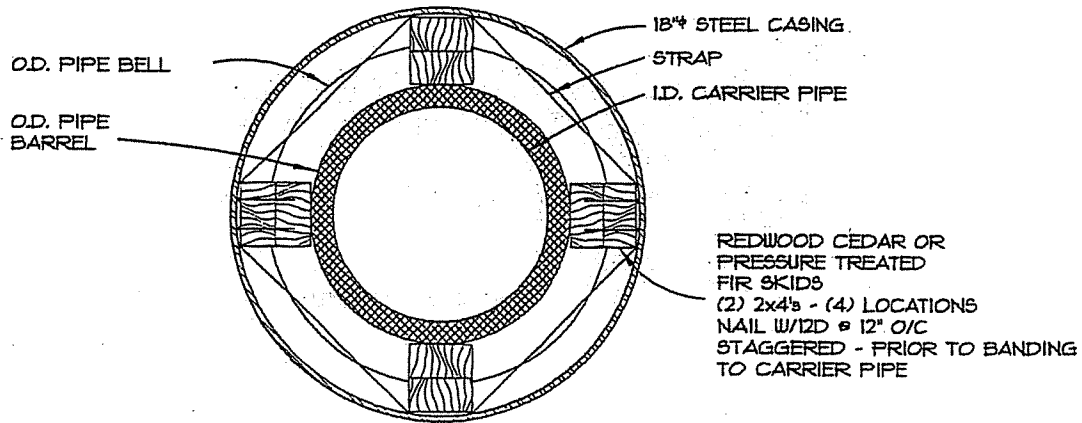
1. CONCRETE ANCHOR WALLS (CLASS 3000) SHALL BE CONSTRUCTED USING FORMS WHEN SEWERS, STORM DRAINS, AND OTHER PIPELINES ARE CONSTRUCTED WITH SLOPES 20 PERCENT OR GREATER. REMOVE FORMS PRIOR TO BACKFILLING TRENCH.
2. SPACING OF ANCHOR WALLS SHALL BE:

SLOPE:	SPACING:
20-34%	35 FEET
35-50%	25 FEET
50+ %	15 FEET OR CONCRETE ENCASEMENT

CITY OF ROCKAWAY BEACH	
PIPE ANCHORS	
DATE: APRIL 2002	DRAWING NO. RB-29



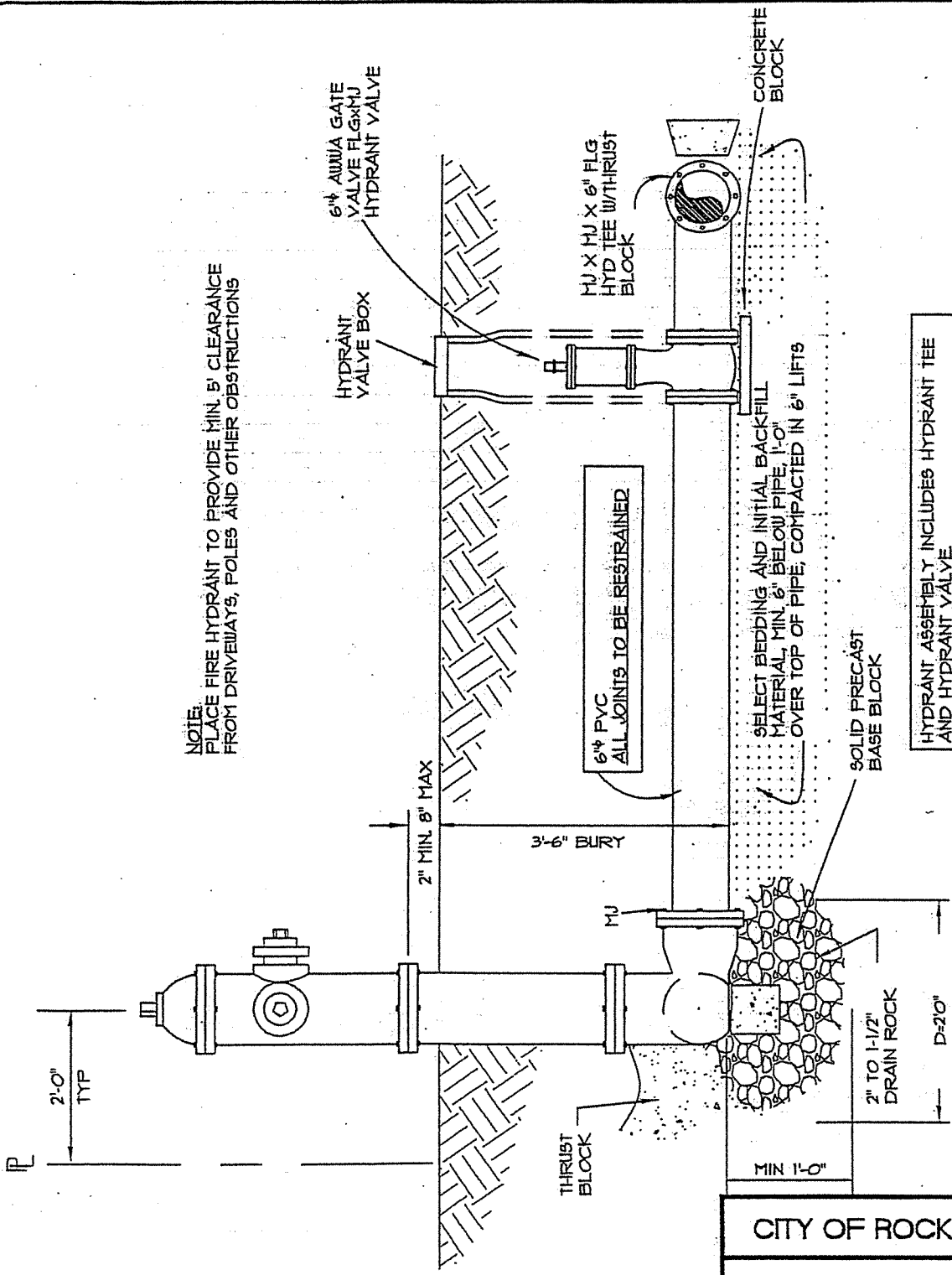
PLAN



SECTION A-A

SCALE: 1 1/2" = 1'-0"

CITY OF ROCKAWAY BEACH	
BORE CASING	
DATE: APRIL 2002	DRAWING NO. RB-30



NOTE:
 PLACE FIRE HYDRANT TO PROVIDE MIN. 5' CLEARANCE
 FROM DRIVEWAYS, POLES AND OTHER OBSTRUCTIONS

HYDRANT ASSEMBLY INCLUDES HYDRANT TEE
 AND HYDRANT VALVE

CITY OF ROCKAWAY BEACH

FIRE HYDRANT

DATE:
 APRIL 2002

DRAWING NO.
 RB-31

(HORIZONTAL) BEARING AREA OF THRUST BLOCKS IN SQUARE FEET								(VERTICAL) VOLUME OF THRUST BLOCK IN CUBIC YARDS				
FITTING SIZE	TEE, WYE, DEAD END AND HYDRANT	STRADDLE BLOCK	90° BEND PLUGGED CROSS	TEE PLUGGED ON RUN		45° BEND	22-1/2° BEND	11-1/4° BEND	90° BEND	45° BEND	22-1/2° BEND	11-1/4° BEND
				A-1	A-2							
4	1.0	1.6	1.4	1.9	1.4	1.0	---	---	---	---	---	---
6	2.1	3.7	3.0	4.3	3.0	1.6	1.0	---	1.3	---	---	---
8	3.8	6.5	5.3	7.6	5.4	2.9	1.5	1.0	2.3	1.1	---	---
10	5.9	10.2	8.4	11.8	8.4	4.6	2.4	1.2	3.7	1.8	---	---
12	8.5	14.7	12.0	17.0	12.0	6.6	3.4	1.7	5.5	2.8	1.2	---
14	11.5	---	16.3	23.0	16.3	8.9	4.6	2.3	7.6	3.9	1.7	---
16	15.0	26.1	21.3	30.0	21.3	11.6	6.0	3.0	9.9	5.1	2.3	0.9
18	19.0	---	27.0	38.0	27.0	14.6	7.6	3.8	---	---	---	---
20	23.5	40.8	33.3	47.0	33.3	18.1	9.4	4.7	---	---	---	---
24	34.0	58.8	48.0	68.0	48.0	26.2	13.6	6.8	---	---	---	---

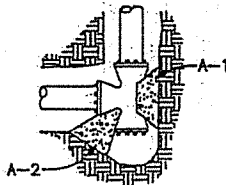
NOTES:

1. ABOVE BEARING AREAS BASED ON TEST PRESSURE OF 150 PSI AND AN ALLOWABLE SOIL BEARING STRESS OF 2000 POUNDS PER SQUARE FOOT. TO COMPUTE BEARING AREAS FOR DIFFERENT TEST PRESSURES AND SOIL BEARING STRESSES, USE THE FOLLOWING EQUATION:

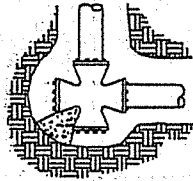
$$\text{BEARING AREA} = (\text{TEST PRESSURE} / 150) \times (2000 / \text{SOIL BEARING STRESS}) \times (\text{TABLE VALUE})$$

2. ABOVE VOLUMES BASED ON TEST PRESSURE OF 150 PSI AND THE WEIGHT OF CONCRETE = 4050 POUNDS PER CUBIC YARD. TO COMPUTE FOR DIFFERENT TEST PRESSURES, USE THE FOLLOWING EQUATION:

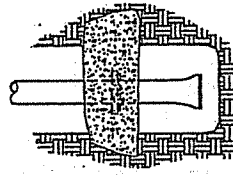
$$\text{VOLUME} = (\text{TEST PRESSURE} / 150) \times (\text{TABLE VALUE})$$



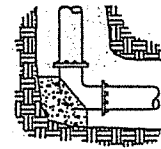
TEE



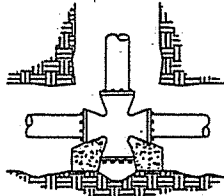
CROSS



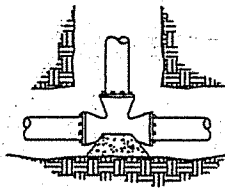
STRADDLE BLOCK



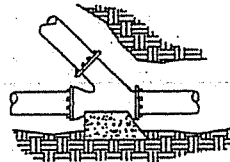
BEND



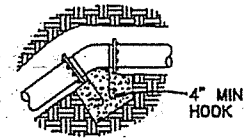
CROSS



TEE



WYE



VERTICAL BEND

RODS FOR VERTICAL BENDS		
FITTING SIZE	ROD SIZE	EMBEDMENT
12" AND LESS	#6	30"
14"-16"	#8	36"

NOTES:

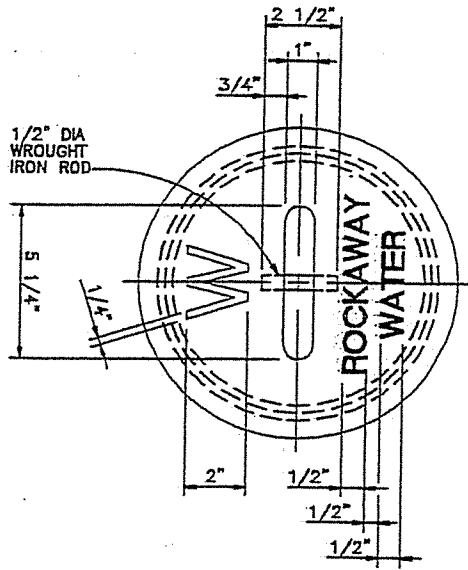
1. CONCRETE BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH.
2. ALL CONCRETE TO BE CLASS 2400 MINIMUM.
3. INSTALL ISOLATION MATERIAL BETWEEN PIPE AND/OR FITTINGS BEFORE POURING CONCRETE BLOCKING.
4. CONCRETE SHALL BE KEPT CLEAR OF ALL JOINTS AND ACCESSORIES.
5. TIE RODS SHALL BE DEFORMED GALVANIZED COLD ROLLED STEEL, 40000 PSI TENSILE STRENGTH.

CITY OF ROCKAWAY BEACH

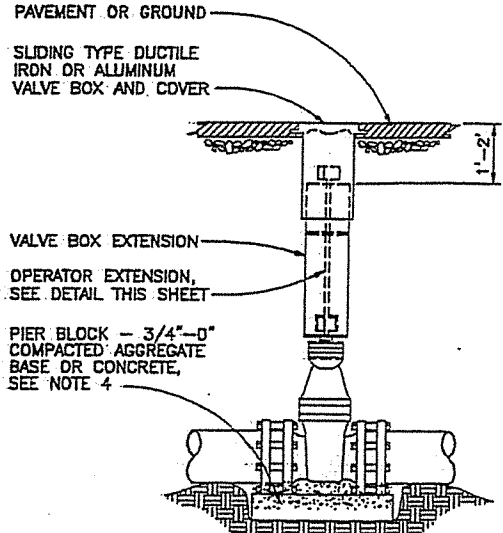
THRUST BLOCKS

DATE:
APRIL 2002

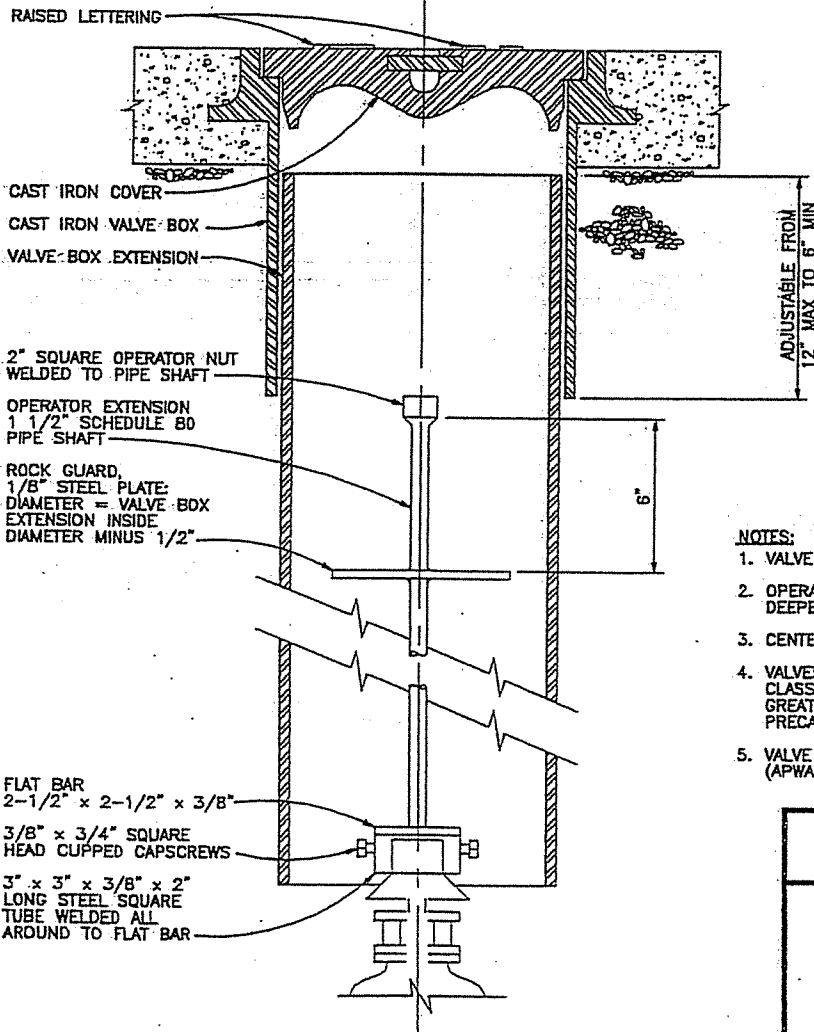
DRAWING NO.
RB-32



COVER PLAN



VALVE BOX ASSEMBLY DETAIL



VALVE BOX EXTENSION SECTION

NOTES:

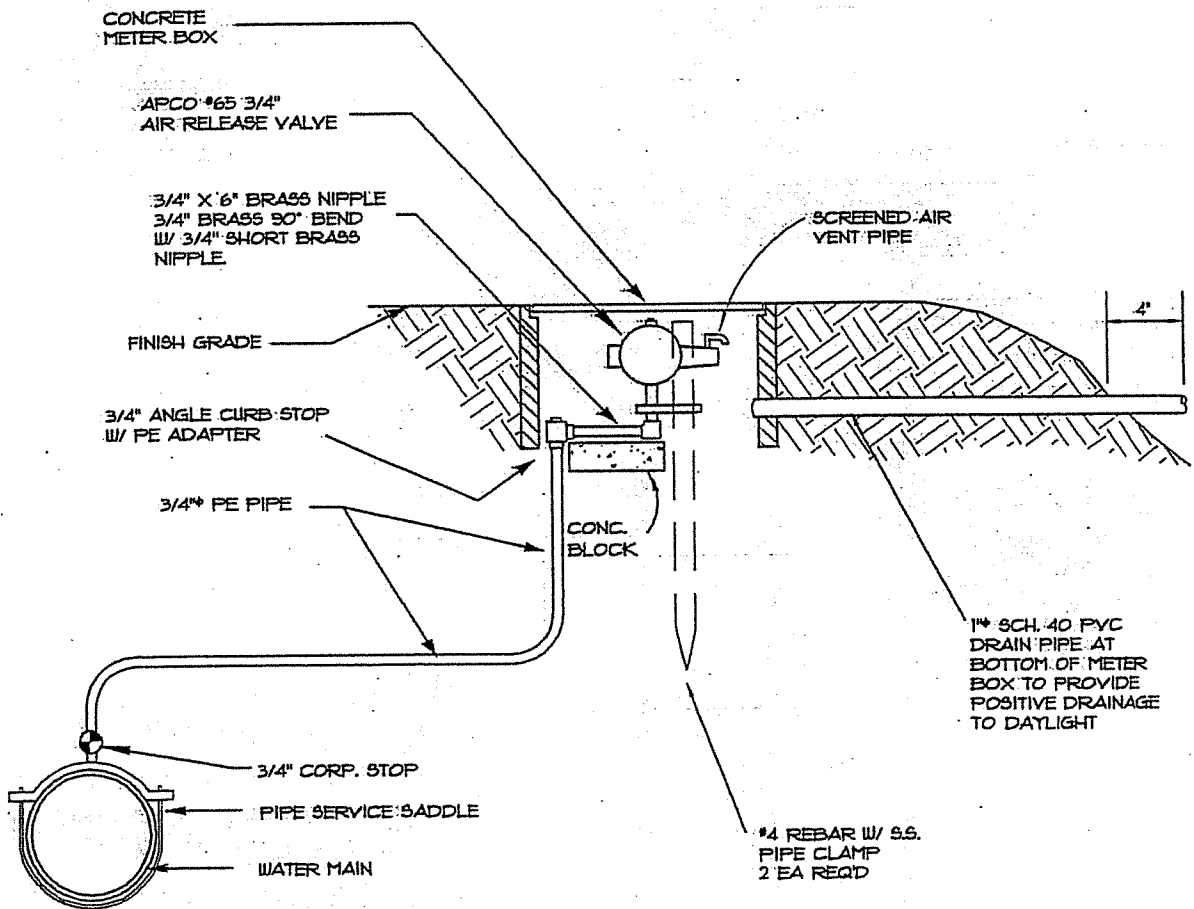
1. VALVE BOX NOT TO REST ON OPERATING ASSEMBLY.
2. OPERATOR EXTENSION REQUIRED WHEN VALVE NUT IS DEEPER THAN 4 FEET FROM FINISH GRADE.
3. CENTER VALVE BOX ON AXIS OF OPERATOR NUT.
4. VALVES 12" AND SMALLER SHALL BE PROVIDED WITH CLASS B BASE ON UNDISTURBED GROUND. VALVES GREATER THAN 12" SHALL BE INSTALLED ON PRECAST CONCRETE PIER BLOCK.
5. VALVE BOX EXTENSION SHALL BE CAST IRON OR PVC (APWA CL 200).

CITY OF ROCKAWAY BEACH

VALVE BOX

DATE: APRIL 2002

DRAWING NO. RB-33

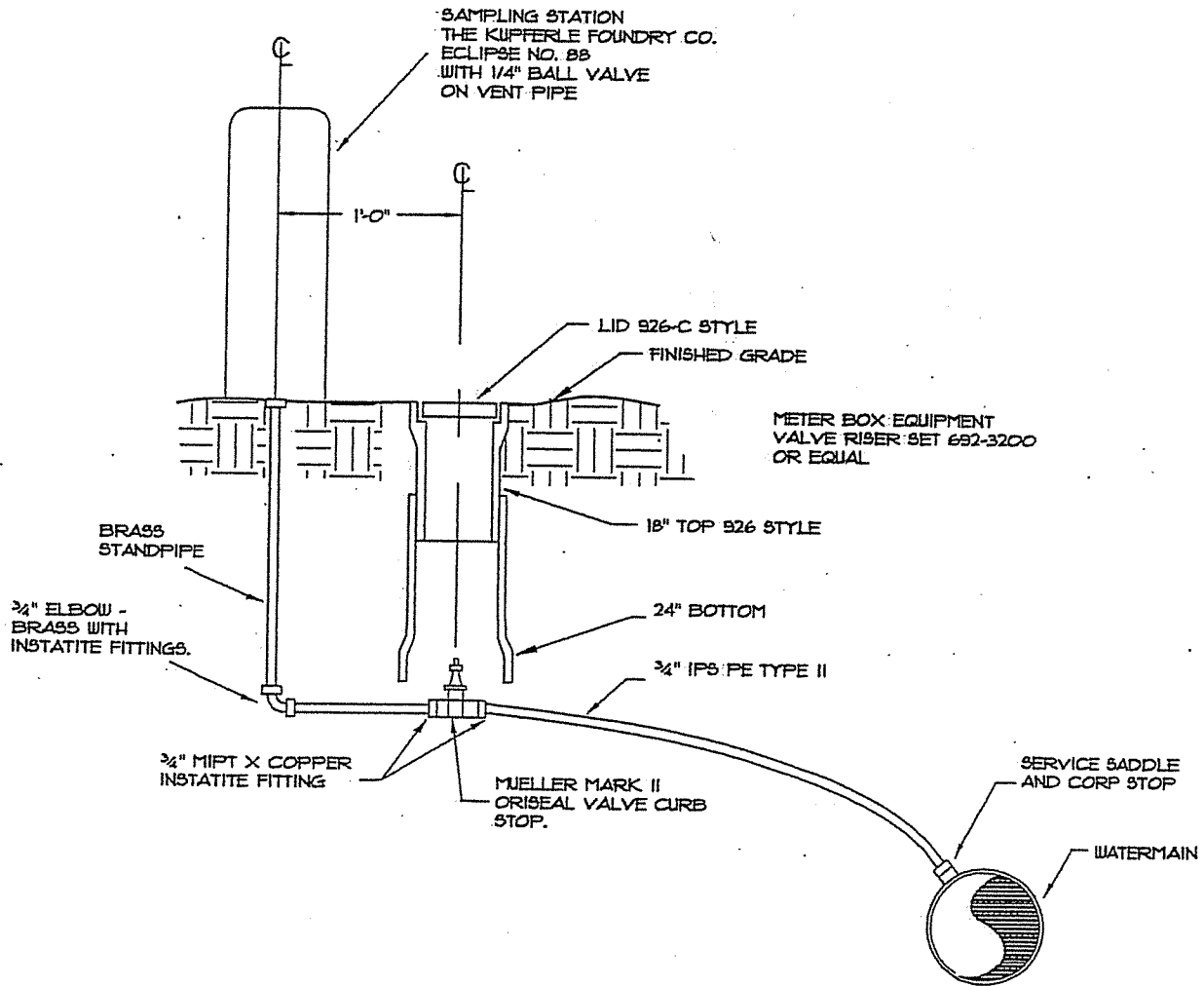


CITY OF ROCKAWAY BEACH

AIR RELEASE VALVE

DATE: APRIL 2002

DRAWING NO. RB-34

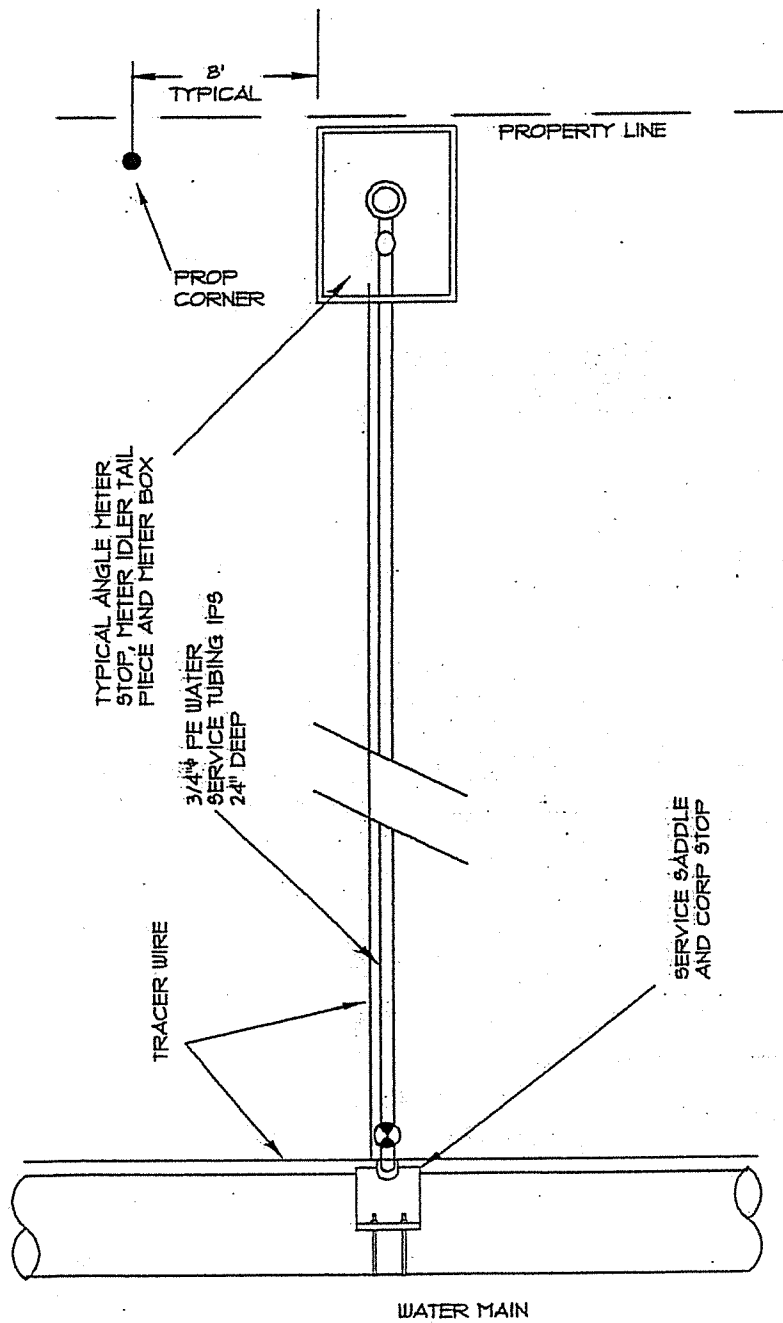


CITY OF ROCKAWAY BEACH

SAMPLING STATION

DATE:
APRIL 2002

DRAWING NO.
RB-35

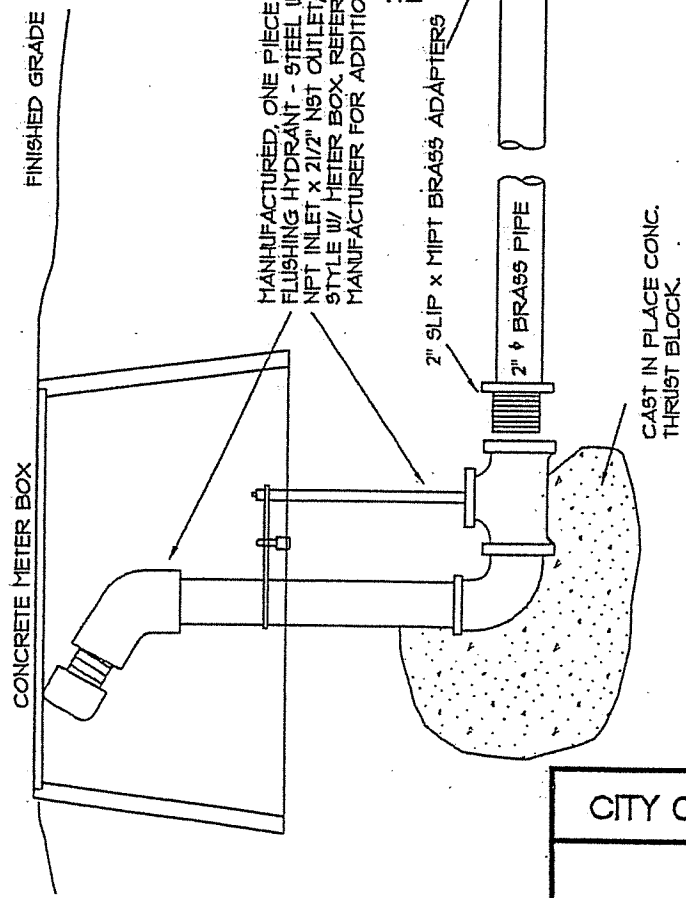
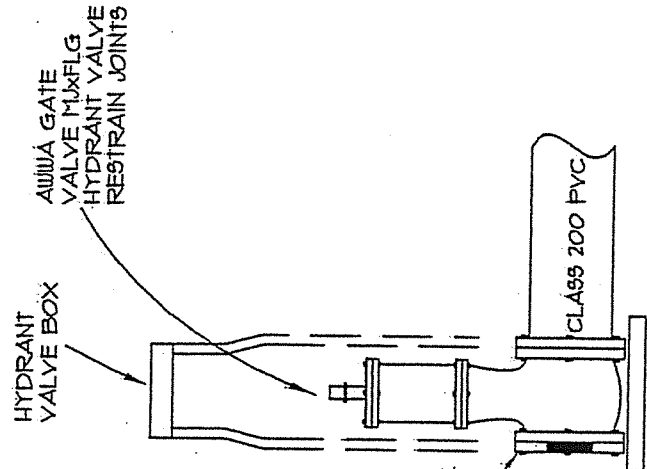


CITY OF ROCKAWAY BEACH

WATER SERVICE LATERAL

DATE: APRIL 2002

DRAWING NO. RB-36



CITY OF ROCKAWAY BEACH	
FLUSHING HYDRANT	
DATE: APRIL 2002	DRAWING NO. RB-37

