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Engineer's Report for Sanitary Sewer

November 20, 2023

Prestige Commerce Center

Block 4.46, Lots 1.04 & 1.07
Township of North Brunswick, Middlesex County, New Jersey

Prepared for:

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Project No. 19005023A

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1.0 Introduction

This engineer's report for sanitary sewer is being submitted as part of the site plan development application known as Prestige Commerce Center located on lots 1.04 & 1.07 of block 4.46 as shown on Sheet 19 on the Official Tax Map of the Township of North Brunswick, Middlesex County, New Jersey. This report was prepared in accordance with the New Jersey Department of Environmental Protection (NJDEP) and current industry standards and practices for sewer construction. The purpose of this report is to summarize the water demand generated from the proposed development.

The project location is currently developed as an overflow parking lot associated with the Regal Cinema. The proposed development proposes modifying existing site conditions to remove ninety-five (95) parking spaces and the construction of two (2) pad sites. These pad sites include a Freddy's quick service restaurant and a spec building with two (2) restaurant tenants.

Additional site improvements include, but are not limited to, pavement, curb, sidewalk, utility relocation, landscaping, and lighting.

2.0 Sanitary Sewer Design

The wastewater from the Freddy's restaurant will be conveyed through two (2) 6" lines, one kitchen waste line (including a 1,000-gallon grease trap) and one sanitary waste line. Both lines join at a proposed sanitary manhole on site.

The wastewater from the spec building is conveyed separately for both tenants. This includes two (2) 6" lines each, which consists of one kitchen waste line each (including two 1,000-gallon grease traps) and one 6" sanitary waste line each. The lines will join into a single 6" line which connects to the proposed sanitary sewer manhole located on-site. Ultimately, the wastewater from the site is conveyed via an 8" gravity line to an existing sanitary manhole on the southwestern side of the Crunch Fitness building on South Center Drive.

3.0 Anticipated Flows

The Average Daily Flows (ADF) were calculated in accordance with N.J.A.C. 7:14A-23.3 summarized in Table 1 below:

Table 1: Anticipated Average Daily Flow

Description	Type of Establishment Under N.J.A.C. 7:14-23.3	Measurement Units	Gallons Per Day Per Unit	Number of Units	Average Daily Flow (GPD)
Freddy's Restaurant (Pad B)	Fast Food Restaurant	Seat	15	43	645
Tenant #1 (Pad C)	Average Restaurant	Seat	35	100	3,500
Tenant #2 (Pad C)	Average Restaurant	Seat	35	100	3,500
				TOTAL:	**7,645**

Total anticipated flow is 7,645 GPD or 0.007645 MD

4.0 Proposed Collection System

All proposed sewer pipes exceed minimum pipe slope and capacity requirements as required by NJDEP. A total of approximately 1,050 LF of gravity sanitary sewer PVC is proposed within the development.

In accordance with N.J.A.C. 7:14A-23.6(b), gravity sewers are to be designed to carry twice the estimated average projected flow when flowing half full. The design capacity of the proposed collection system was evaluated utilizing Manning's equation as follow:

$$Q_{\frac{1}{2}} = \frac{1.486}{n} * A * R^{\frac{2}{3}} * S^{\frac{1}{2}}$$

Where,

Q = Capacity flowing half-full, cfs
n = Manning's value
A = Cross-sectional area of flow when flowing half full
R = Hydraulic radius when flowing half full = A/WP
S = Pipe Slope

The proposed collection system mains to be utilized are SDR-35 gasketed PVC with a Manning's value of (n) of 0.01. The resulting capacity of the mains are summarized in Table 2 below:

Table 2: Pipe Capacity

Pipe Size (in.)	Pipe Material	Minimum Slope (%)	Coefficient (n-value)	Area of Flow (ft^2)	Hydraulic Radius (ft)	Design Capacity (cfs)	Design Capacity (gpd) (Flowing Half Full)	Design Capacity (MGD) (Flowing Half Full)
6	PVC	1.0	0.01	0.098	0.125	0.52	333,365	0.33
8	PVC	0.5	0.01	0.175	0.167	0.56	358,971	0.36

The sanitary flow is limited by the lowest capacity pipe which, in this case, is the 6" PVC. The calculated capacity of the 6-inch is greater than twice the average daily flow expected from the individual project sections; therefore, the 6-inch diameter pipe is sufficient.

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Appendix A

Tax Map
Location Map
USGS Map

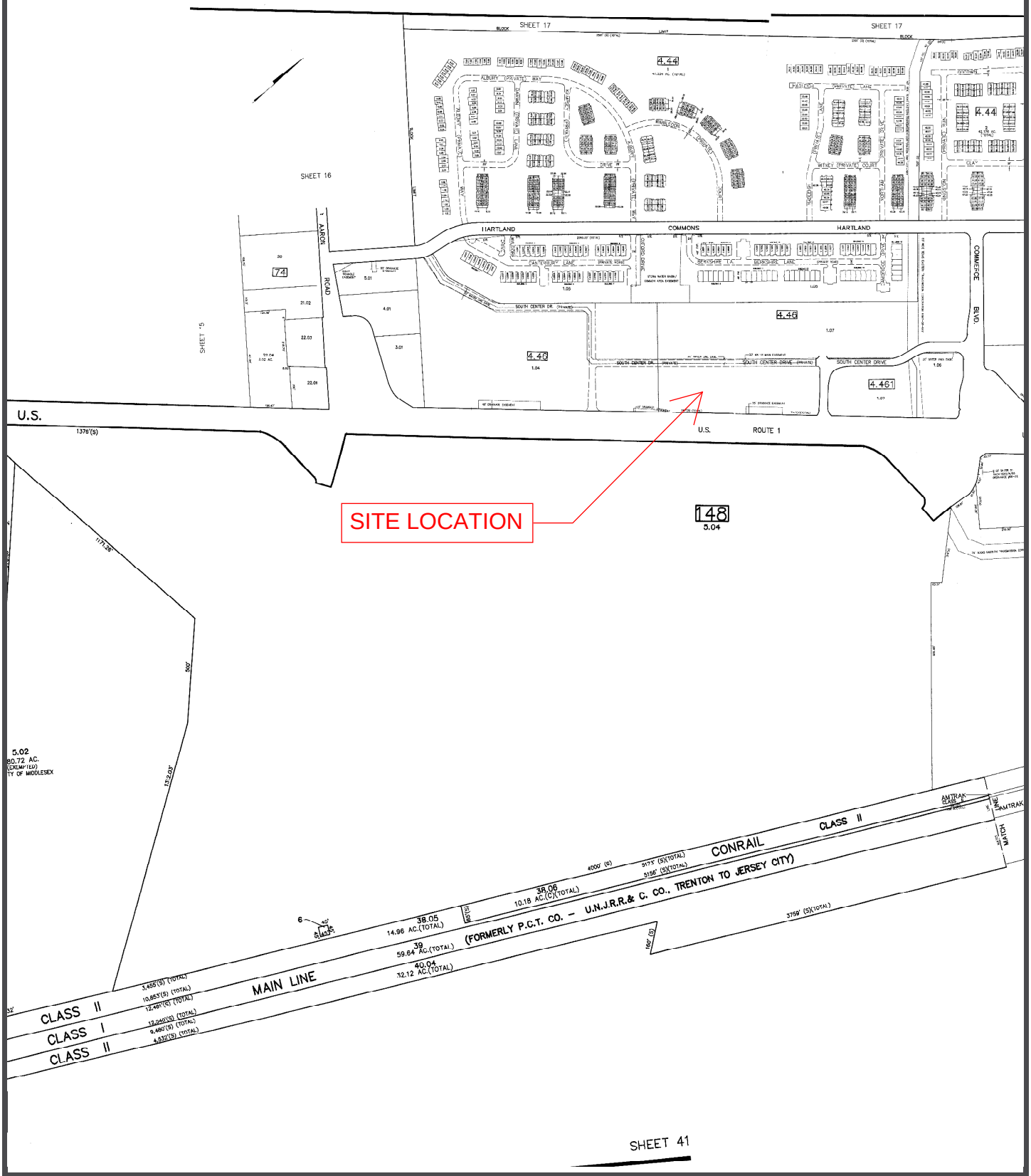

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Figure 1: Tax Map

Township of North Brunswick – Prestige Commerce Center

Scale: NTS

Date: October 19, 2023

Project No. 21000124A

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Figure 2: Aerial Map

Township of North Brunswick – Freddy's

Source: Google Earth

Scale: NTS

Date: October 19, 2023

Project No. 21000124A

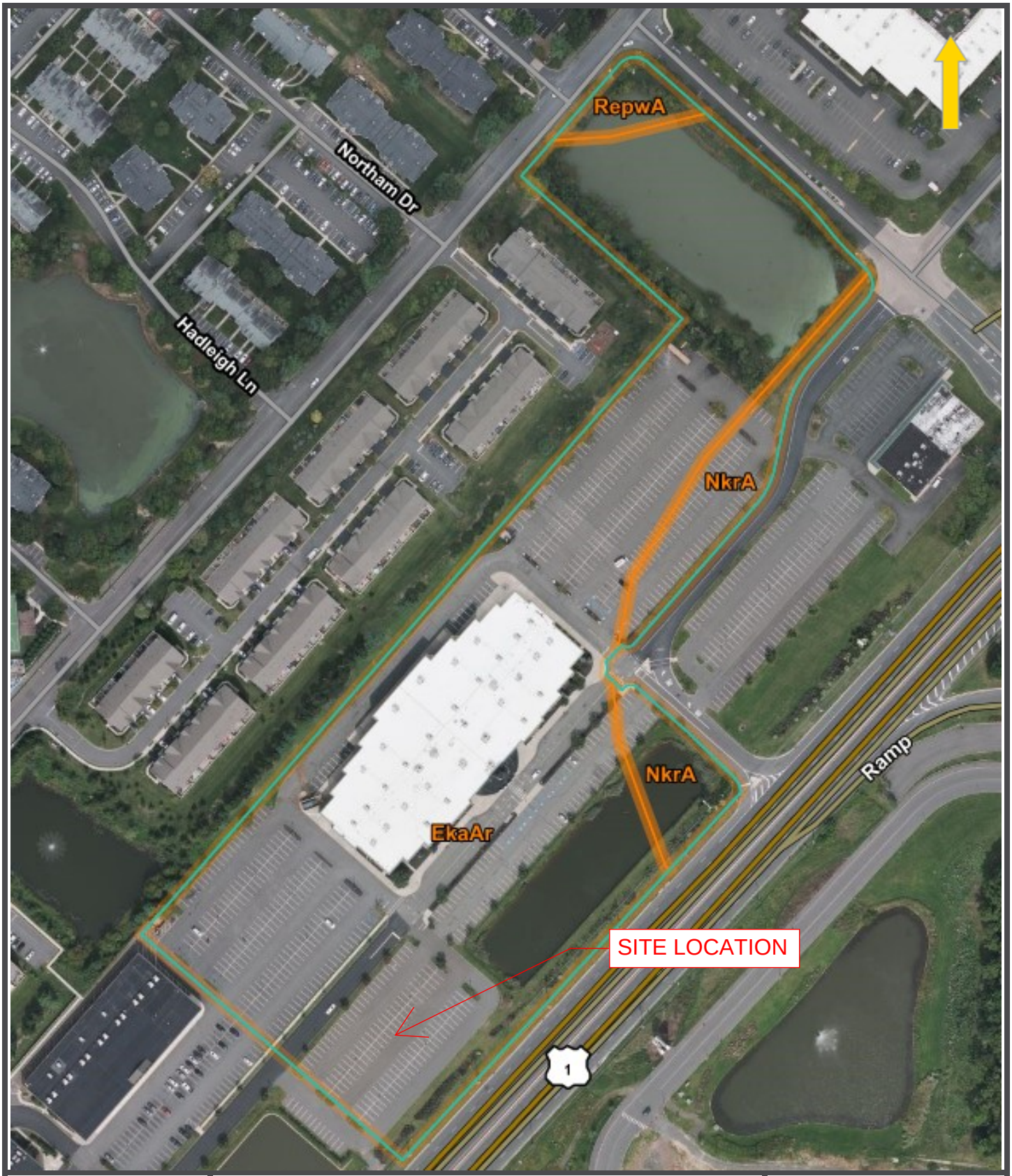

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Figure 3: Soils Map

Township of North Brunswick – Freddy's

Source: Web Soil Survey

Scale: NTS

Date: October 19, 2023

Project No. 21000124A

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Appendix B

Cost Estimate

PRELIMINARY OPINION OF PROBABLE COST
For
Prestige Commerce Center
Township of North Brunswick, Middlesex County, New Jersey
Date: 11/17/23
CED Project No: 21000124A

Prepared By: MB
Checked By: VDK

	QUANTITY	UNIT	UNIT PRICE	AMOUNT	
SANITARY					
In Road:					
8" PVC (SDR 35)	671	LF	$36.00	$24,156.00	
8" Concrete Encasement	19	LF	$25.00	$475.00	
4' Diameter Manhole	4	EA	$50.00	$200.00	
Connection to existing manhole/main	1	EA	$1,500.00	$1,500.00	
On Site:					
6" PVC (SDR 35)	332	LF	$32.00	$10,624.00	
8" PVC (SDR 35)	45	LF	$34.00	$1,530.00	
4' Diameter Manhole	1	EA	$2,700.00	$2,700.00	
8" Concrete Encasement	16	LF	$25.00	$400.00	
Cleanout	2	EA	$350.00	$700.00	
Double Cleanout	9	EA	$350.00	$3,150.00	
1,000 Gallon Grease Trap Interceptor	3	EA	$4,200.00	$12,600.00	
Connection to existing manhole/main	1	EA	$1,500.00	$1,500.00	
Stone Bedding	49	CY	$28.00	$1,372.00	
			Subtotal		**$60,907.00**
				SUBTOTAL:	$60,907.00
				CONSTRUCTION STAKEOUT:	$1,827.21
				15% CONTINGENCY:	$9,136.05
				TOTAL:	**$71,870.26**
Notes:					

1.) This preliminary construction cost estimate has been prepared based upon review of plans entitled "Preliminary & Final Major Site Plan for Prestige Commerce Center" as prepared by Colliers Engineering & Design dated April 27, 2023.

2.) The unit pricing included is based upon available pricing indices or this firm's historical experience in the general geographical area. It is only an approximation and shall not be used for any other purpose than an informational budgetary estimate. Actual construction costs are based upon current market conditions and other constructability factors.

3.) This preliminary construction cost estimate excludes costs that may be associated with the dewatering, unforeseen sub-surface conditions, environmental conditions, earthwork, adverse weather conditions, material requirements, temporary utility installations, electrical transformer costs, water meter costs, etc. This estimate shall not be utilized for proforma or finance purposes.
4.) The unit pricing for pipes and structures assumes depths up to ten feet (10'). For additional depths of installation, price adjustments should be made accordingly.

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Appendix C

Sanitary Sewer Specifications

DIVISION 1 - GRAVITY SEWERS

GENERAL

1.01-1 GENERAL

Under the respective items as hereinafter defined, the Contractor shall: stake out sewer lines and prepare cut sheets on approved forms in accordance with the plans; make all excavations to lines and grades indicated; shall provide proper bedding, foundations, and thrust blocks or joint restraints for the pipe as indicated on the drawings and specified herein; shall dewater and keep the trench dry; shall provide temporary sheeting and/or temporary bracing as required to protect the work and adjacent structures; shall furnish, lay, joint and test in place all gravity sewers; shall do all backfilling; shall provide for temporary replacement and maintenance or paved surfaces, shall permanently restore all areas including paved surfaces, roadways, sidewalks, driveways, grassed areas, curbing, etc., which have been removed, disturbed or damaged in the course of construction, to a condition at least equal to that in which they were found immediately prior to his operation; and shall restore all easements, acceptable to the Engineer and the New Jersey State Department of Environmental Protection, all as indicated on the drawings and as herein specified.

Cut sheets shall be submitted on approved forms to the Engineer at least five (5) days in advance of laying pipe.

The Contractor shall note that the work under this Contract will comply with the New Jersey Department of Environmental Protection's "Environmental Guidelines for Planning, Design and Constructing Interceptor Sewers". Accordingly, the Contractor shall not:

1. Dump spoil material into any stream corridor, any wetlands or surface waters.

2. Indiscriminately, arbitrarily, or capriciously operate equipment in any stream corridor, wetlands or surface waters.

3. Pump silt-laden water from trenches or other excavations into any surface waters, stream corridors or wetlands.

4. Damage any vegetation adjacent to or outside of the easement or rights-of-way.

5. Dispose of trees, brush, or other debris in any stream corridor, wetlands, or surface water.

6. Alter flow line of streams in a permanent way.

7. Burn project debris.

1.01-2, SEWER AND WATER MAIN SEPARATOR

Sewers and water mains generally shall be separated, a distance of at least 10 feet horizontally. If such lateral separation is not possible, the pipes shall be in separate trenches with the sewer at least 18 inches below the bottom of the water main; or such other separation as approved by the New Jersey Department of Environmental Protection shall be made. In general, the vertical separation at a crossing of sewer and water line shall be at least 18 inches. Where this is not possible, the sewer shall be constructed of ductile iron pipe using mechanical or slip-on joints or encased in concrete for a distance of at least 10 feet on either side of the crossing.

CLEARING AND PREPARATION OF SURFACES

1.02 - 1 GENERAL

The Contractor shall clear and prepare surfaces only to the extent as required for facilitation of the actual construction work. In easement areas, the Contractor shall limit his operations to, and within, the permanent and construction easements acquired by the Owner. In no case shall clearing and preparation of surfaces exceed the right-of-way or easement limits. The Contractor's stakes shall be so located as to be outside ground, unless otherwise specified or directed, the cleared and prepared surfaces. The Contractor shall exercise care in clearing and preparation of surfaces to avoid the destruction of monuments, bench marks and other reference points.

1.02.2 - CLEARING TREES AND BRUSH

Where the work is in easements located within privately owned lawn areas, rear yards, etc., the contractor shall make every effort to minimize disturbance to the area. All trees shall be boxed or otherwise protected. Excavated material shall be stored on tarpaulins or other means used to prevent it from being spread on the ground. Backfill shall be completed on the same day. Only under unusual circumstances shall a trench be allowed to remain open overnight. Topsoil shall be removed and stored separately, and upon completion of backfill, shall be evenly spread over the disturbed area. If settlement occurs, the contractor shall bring in additional topsoil of an approved variety, to bring the trench up to grade. No work shall be commenced within any easement area without the express consent to the Engineer, nor will any work within such areas be allowed to continue should the Engineer direct curtailment due to inclement weather or other unsatisfactory conditions.

The Contractor shall remove only trees and brush as are necessary to facilitate the actual construction work. No clearing will be permitted beyond easement or right-of-way limits. No trees on private property shall be removed or cut without prior permission of the property owner. Trees and brush designated by the Engineer for preservations hall be

protected by suitable means and extreme care shall be taken to prevent damage to such trees and brush. No grubbing shall be done beyond the area to be excavated. Outside of areas where grubbing is to be done, all trees, roots, and stumps shall be cut off flush with the original ground surface, unless otherwise specified or directed. In areas where landscaping existed prior to construction, all stumps and roots of trees and shrubbery cut down which are two inches in diameter or larger, shall be removed. If the property owner should desire to reclaim shrubs or hedges, then the Contractor shall use reasonable care in removing and storing the item beyond the work limits.

The Contractor shall chip suitable material accumulated as a result of clearing and grubbing. Wood chips shall be produced by a wood chipping machine. They shall be hard chips and shall not contain leaves, twigs, branches, wood shaving, dirt, stones, clods of turf, tin cans or other foreign material or debris. Chipped material not used shall become the property of the Contractor and shall be promptly removed. Wood, brush, and debris not used for chipping shall also become the property of the Contractor. It shall be disposed of promptly and shall not be left until the completion of the Contract.

The Contractor shall note that there are certain special requirements set forth on the drawings for clearing, preparation and restoration of and within specific easements. The Contractor is hereby noticed that negotiations for certain easements have not been fully completed at the time of bidding. However, the Contractor must comply with clearing, preparation and restoration requirements for all easements acquired or to be acquired by the Owner in which construction is shown on the Drawings.

All disturbed lawns, trees, shrubs, bushes, plantings, fences, walls, driveways, walkways, etc., shall be restored to the satisfaction of the owner. Claims made by affected owners shall be withheld from payments due the contractor until such claims are settled. It is suggested that the contractor take "before and after" photographs of all such areas.

1.02-3 CUTTING PAVEMENT

When excavations are to be made in paved surfaces, the pavement shall be cut ahead of the excavation by means of pneumatic or other suitable tools to provide a clean, uniform edge with minimum disturbance of remaining pavement.

If pavement is removed in large pieces, it shall not be mixed with other excavated materials, but shall be disposed of away from the site of the work before the remainder of the excavation is made.

The attention of the Contractor is called to the specifications for replacing the pavement.

1.02-4 SEPARATION OF SURFACE MATERIALS

From areas within which excavations are to be made, approved loam and topsoil shall be carefully removed and separately sorted to be used again as directed; or, if the Contractor prefers not be separate surface materials, he shall furnish, as directed and at his own expense, loam and topsoil as specified in Section 1.21-4 **Top Soiling.**

In salt marshes, sufficient quantities of Native marsh peat shall be removed and stockpiled to be used in restoration as specified in Section 1.21-17, **Restoration Types for Withholding and Rebate**, for areas designated E-E.

1.03 EXCAVATION

1.03-1 GENERAL

All excavation shall be unclassified. The Contractor shall make excavations in such manner and to such widths as will give suitable room for building the structures or laying and jointing pipe; and shall furnish and place all sheeting, bracing, and supports.

The work to be performed in excavation shall include removal of all water to a point at least twelve (12") inches below the invert of any pipe laid by complete dewatering of the trench, including stone or gravel used for control of water in the trench. Payment of stone used to dewater the trench shall be included in the price bid per linear foot of pipe.

1.03-2 CHARACTER OF MATERIAL

Ground elevations are shown on the contract drawings. The Contractor shall, by inspection, by test pits or borings made by him or by other adequate methods, satisfy himself regarding the character and amount of the various classes of material to be encountered in the work to be performed. If quicksand is encountered, no separate classification will be made.

1.03-3 EXTENT OF EXCAVATION

Excavations shall be made to the approved lines which shall be of sufficient width outside the structures to give room for placing and removing forms for concrete and for forming the pipe joints. Excavations for all structures shall not be plowed, scraped, or machine-dug closer than 3 inches to the finished subgrade. The last 3 inches of depth for all structures including pipe shall be removed with pick and shovel to the exact lines and grades just before placing foundation material, or pipe supports. Due allowance shall be made for excavating to a depth below the pipe invert to accommodate foundation material or pipe supports. Bell holes shall be hand excavated for any pipe with a bell dimension larger than the pipe barrel.

In general, the widths of pipe trenches shall not be wider than the outside diameter of the pipe barrel plus 2 feet at the level of one foot above the top of the pipe unless otherwise approved.

All excavations, except as otherwise permitted, shall be made in the open. The extent of excavation open at any one time will be controlled by the conditions, but shall always be confined to the limits prescribed by the Engineer and shall not exceed 200 feet per pipe crew per contract, including easements which have not been at least rough graded to original contours or as directed by the Engineer.

In all excavations for pipe; boulders, rock, masonry, or other similar material shall be excavated to a level at least six inches below the invert of the pipe, and carefully refilled with tamped earth or other approved material. Rock or bounders shall be removed from sides to trenches to a plane 12 inches outside the inside wall of the pipe, unless permission to do otherwise is expressly given.

1.03-4 UNAUTHORIZED EXCAVATION

If the bottom of any excavation is taken out beyond the limits indicated on the drawings or in the specifications, it shall be backfilled at the Contractor's expense with select, thoroughly compacted gravel or crushed stone to the designated subgrade elevation.

1.03-5 STORAGE AND DISPOSAL

Excavated material, which is suitable and approved for backfill and fill shall be placed ins storage piles unless or until it can be placed in the work. It shall not be placed close to the sides of excavations, where the weight of the material could create a surcharge on such sides, whether sheeted or not.

Unsuitable material, or material in excess of that required for fill, backfill or other purposes, including any stored surplus, shall be disposed of away from the sewer construction site.

1.03-6 BRIDGING TRENCHES

The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings where required for the accommodation of travel and to provide access to private property during construction and shall remove said structures thereafter.

1.03-7 REMOVAL OF WATER AND PROTECTION FROM FLOODING

The contractor shall remove all water from the excavation promptly and continuously throughout the progress of the work and shall keep the excavation dry at all times by approved methods such as sumps, under drains, or well points until the

structures to be built therein are completed. Pumping shall be continuous where ordered by the Engineer to protect the work and/or to maintain satisfactory progress.

Precautions shall be taken to protect uncompleted work from flooding during storms or from other causes. All pipelines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected.

1.03-8 SHEETING AND BRACING

Where necessary, particularly to prevent disturbance, damage or settlement of adjacent structures, pipelines, utilities, improvements or paving, excavation shall be adequately sheeted.

Attention is directed to various stipulations relative to sheeting and bracing ordered left in place.

Any damage to new or existing structures occurring through settlement, water or earth pressure or other causes due to inadequate bracing, or through negligence or fault of the Contractor in any other manner, shall be repaired by the Contractor at his own expense.

Sheeting shall be designed by a Professional Engineer and shall meet all O.S.H.A. Standards and conform to the requirements of the "Construction Safety Code" of the Bureau of Engineering and Safety of the New Jersey Department of Labor and Industry.

ROCK EXCAVATION

1.03A-1 GENERAL

Rock excavation shall consist of the removal of bounders and masses of concrete and existing rock fragments more than 1/2 cubic yards in volume and such rock that cannot be removed by means of a 1-1/2 yard power shovel, in good condition and properly operated, without continuous drilling and blasting.

All excavation shall be unclassified. The Contractor shall make excavations in such manner and to such widths as will give suitable room for building the structures or laying and jointing pipe; and shall furnish and place all sheeting, bracing, and supports.

The work to be performed in excavation shall include removal of all water to a point at least twelve (12") inches below the invert of any pipe laid by complete dewatering of the trench, including stone or gravel used for control of water in the trench. Payment of stone used to dewater the trench shall be included in the price bid per linear foot of pipe.

1.03A-2 CHARACTER OF MATERIAL

According to Article 1.03-2 of the technical Specifications.

1.03A-3 EXTENT OF EXCAVATION

The width of the trench at the elevation of the top of the pipe shall not exceed the permissible widths shown on the miscellaneous detail plan sheet. If the Contractor exceeds this permissible width, he shall replace the specified pipe with pipe of greater crushing strength or install pipe in a higher class bedding, or both, as directed by the Engineer, at no increase in cost to the Owner.

In all excavations for pipe; bounders, rock, masonry, or other similar materials shall be excavated to a level at least six inches below the invert of the pipe, and carefully refilled with tamped earth or other approved material. Rock or bounders shall be removed form sides of trenches to a plane 12 inches outside the inside wall of the pipe, unless permission to do otherwise is expressly given.

1.03A-4 UNAUTHORIZED EXCAVATION

According to Article 1.03-4 of the Technical Specifications.

1.03A-5 STORAGE AND DISPOSAL

According to Article 1.03-5 of the Technical Specifications.

1.03A-6 BRIDGING OF TRENCHES

According to Article 1.03-6 of the Technical Specifications.

1.03A-7 REMOVAL OF WATER AND PROTECTION FROM FLOODING

According to Article 1.03-7 of the Technical Specifications.

1.03A-8 SHEETING AND BRACING

According to Article 1.03-8 of the Technical Specifications.

1.03A-9 BLASTING

No blasting will be permitted at locations near existing structures or near water, sewer, drain, oil, gas, cable or other utilities. Where blasting is permitted, the Contractor shall take every precaution to protect all portions of the work already constructed or being constructed and shall use small charges and give ample notice so as not to endanger persons or property.

The Contractor, in addition to observing all of the requirements set forth and all municipal ordinances and State laws relative to the transportation, storage, handling and use of explosives, shall also conform to any further regulations which the Engineer may deem necessary in this respect. The Contractor shall be liable for all damage to persons or property caused by blast or explosion, and shall have adequate insurance to cover any claims arising from same.

The Contractor shall procure and maintain liability and property damage insurance protecting the subdivider, the Township and the Utilities Authority from all claims for personal injury, including death, and all claims for destruction of or property, arising out of or in connection with the construction of the subdivision improvements, whether such operation be by the prime contractor or by a subcontractor. Insurance shall specifically cover all blasting operations and shall include the explosion, collapse and underground property damage hazards. The minimum amount of insurance shall be as specified in Section 3.16 of "N.J.A.C. 12:193, Governing the Use of Explosives".

SUITABLE AND UNSUITABLE BACKFILL MATERIAL

1.04-1 ELIMINATION OF UNSUITABLE BACKFILL

If, in the opinion of the Engineer, the material AT OR BELOW grade to which excavation would normally be carried is unsuitable for foundation, it shall be removed in such widths and depths as the Engineer may direct according to the item entitled, "Other Earth Excavation", and be replaced with sand, gravel, or crushed stone, all as specified and paid for under the item entitled, "Sand, Gravel or Crushed Stone Backfill Below Subgrade".

If, in the opinion of the Engineer, the material from any other part of the sewer trench is suitable for backfill, it shall be replaced at no additional cost to the Owner with suitable surplus material excavated form other parts of the contract as specified below.

If suitable surplus material is not available from other parts of the contract, then the Contractor shall furnish suitable material when and where directed by the Engineer. The cost of the suitable material will be included and paid for under the item entitled, "Sand backfill above pipe bedding and pipe". The cost of Placing sand used in backfill above the pipe bedding and pipe will be included in the price bid per linear foot of pipe.

1.04-2 DISPOSAL OF UNSUITABLE SURPLUS MATERIAL

The Contractor shall note that all unsuitable backfill material shall be separated from suitable material prior to disposal.

Except as otherwise directed, the Contractor shall dispose of unsuitable surplus excavated materials promptly at locations selected by him without additional compensation.

1.04-3 DISPOSAL OF SUITABLE SURPLUS MATERIAL

It is expressly understood that no excavated materials shall be removed from the site of work or disposed of by the Contractor except as directed or approved by the Engineer.

All suitable surplus material is to be stockpiled in areas separate from the unsuitable material. Where required, suitable surplus excavated material shall be used for fill or backfill on other parts of the work to replace unsuitable material. Surplus material used under pipe for replacement of unsuitable material below subgrade will be paid for under the item entitled, "Sand Gravel or Crushed Stone Backfill Below Subgrade". No additional payment will be made for use of suitable surplus material from the contract area over or around the pipe.

Suitable surplus material not used as backfill shall be neatly deposited so as to flatten side slopes, fill depressions or for other uses as the Engineer may direct within the limits of the project area, without additional compensation.

SHEETING AND BRACING

1.05-1 GENERAL

Timber sheeting shall be straight and sound, free from shakes, cracks, large or loose knots and other defects impairing its strength and durability. It shall be squared to the required dimension, throughout its entire length. Matched and grooved sheeting shall have one planed side.

Sheeting and bracing shall be used where required by law, or where necessary to prevent caving or where, in the opinion of the Engineer, it is necessary to protect the pipe and appurtenances and/or adjacent structures or utilities, the Contractor shall furnish, put in place, and maintain such sheeting and bracing, etc., as may be required to support the sides of the excavation and to prevent any movement of earth which could in any way diminish the width of the excavation below that necessary for proper construction, or otherwise injure the sides of the trench, delay the work or endanger adjacent structures.

Whenever possible, sheeting shall be driven ahead of the excavation to avoid loss of material from behind the sheeting. If it is necessary to excavate below the sheeting, care shall be taken to avoid trimming behind the face along which the sheeting will be driven. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled with sand and compacted.

1.05-2 SHEETING AND BRACING NOT TO BE LEFT IN PLACE

Where sheeting and bracing is not to be left in place, it shall be placed in such a manner as to facilitate removal. All sheeting and bracing not to be left in place shall be carefully removed in such a manner as not to endanger the construction or other structures. All voids left or caused by withdrawal of sheeting shall be immediately backfilled with approved materials and compacted by ramming with tools especially adapted to that purpose, by watering, or otherwise as may be directed.

The cost of all sheeting and bracing required and/or ordered as described above, and to be left in place, shall be included in the unit price bid for the appropriate size of pipe.

1.05-3 SHEETING AND BRACING TO BE LEFT IN PLACE

The Contractor shall leave in place to be embedded in the backfill or concrete all sheeting, bracing, etc., the removal of which might endanger adjacent structures, property or work. Additional payment for sheeting left in place shall be made under the item Timber Sheeting or Steel Sheet Piling, and shall be limited to that sheeting left in place with the written consent or by written order of the Engineer.

The Engineer may direct that timber used for sheeting and bracing, and not already noted on the drawings to be left in place, be cut off to any specified elevations.

1.05-4 TIMBER NOT TO BE PAID FOR

No separate payment will be made for timber used for scaffolds, fences, guard rails, sheeting which is withdrawn, or used for other temporary service, such as temporary bridges, or supports, but payment therefore, will be deemed to be included in the unit prices for the excavation of other items in connection with which such timber is used.

1.05-5 TIMBER TO BE PAID FOR

Timber to be paid for under this item will be that actually left in the work by written order of the Engineer, and the amount will be the number of board feet of the nearest commercial size of sheeting and bracing actually necessary to properly sheet the trench or other use to which it is permanently placed.

Timber left in place shall be cut off at least two (2) feet below the surface. Payment for matched and grooved sheeting will be made in each case for the length of trench occupied by such sheeting, with no allowance for wastage due to tongues and splines respectively. In the case of timber, no thickness of sheeting over two (2) inches, and no other lumber exceeding the size customarily used, shall be paid for unless the use of such larger sizes shall have been agreed upon with the Engineer in writing. Whenever

the sheeting is of sufficient length to permit the saving of a minimum length of several (7) feet of plant, it shall be cut off as directed by the Engineer, and the portion left in place will be paid for. Where a minimum length of seven (7) feet cannot properly be cut off, the entire length of plant will be paid for.

Where timber sills are ordered placed to provide support and improved foundation for pipe, payment for furnishing and placing such sills will be made under this item.

Backfilling around existing structures shall be as specified in Section 1.17, Backfilling In Open Trench.

1.06-4 RELOCATION OF EXISTING STRUCTURES

The Contractor shall, insofar as possible, determine in advance of excavating by trenching machines, the location of all utilities and other subsurface structures and facilities and shall accurately mark same so that they may be avoided by the machine.

Where existing utilities or other subsurface facilities adjacent to the trench or crossing through the trench, require temporary support or protections, the work shall be done under this item without additional payment.

Where definite physical interference would be unavoidable in the final work and necessitates the removal, alteration, replacement of extension of existing utilities, the contractor shall make all excavations for such work under this item and shall cooperate with other forces engaged in the work.

The labor, pipe and other material necessary for removing, altering, replacing, or extending such utilities, other than for excavation will, unless otherwise ordered, be done by the respective utility companies or other owners involved. In specific cases the contractor may be ordered to perform such work, in which event payment will be made under pertinent unit prices, or in accordance with the provisions of Article XXXI of the Contract.

Whenever the contractor encounters pipes, wires, or other structures not otherwise provided for on the drawings or in these specifications, which are located so near and parallel to or actually in the excavation, that, in the opinion of the Engineer, satisfactory construction cannot proceed until they have been removed, the Contractor shall, as directed, remove and change, relocate, or later restore such portions thereof as the Engineer shall order in writing, and such work shall be paid for as Extra Work. Relocation of existing pipe shall be paid for at the agreed price, per inch of internal diameter per linear foot of pipe, except when such pipe can be classified under one of the items in the proposal. The agreed price, per inch diameter per foot shall include the cost of excavation, installing the new pipe and fittings, connections to existing pipe, removing abandoned pipe in the way of construction, plugging or filling abandoned pipe as directed

by the Engineer and backfill and restoration of surface. Backfilling around relocated structures shall be as specified in Section 1.17 Backfilling in open trench.

When fences interfere with the contractor's operations, he shall remove and, unless otherwise specified, later restore them to at least as good condition as that in which they were found immediately prior to the start of the work, all without additional compensation. Restoration of fences shall be done as promptly as possible and shall not be left until the end of construction period.

BEDDING PIPE

1.07-1 BEDDING

All backfill and fill under pipes and all structures shall consist of suitable approved foundation material. All other backfill and fill, unless otherwise specified or required, shall consist of a suitable selected and approved earth or sand generally from storage of approved suitable excavated material, free from rejected organic matter, boggy, peaty humus or other unsuitable material such as unconsolidated silt, rubbish, waste, ashes, or cinders and with less than 15% of size 200 sieve material. If sufficient suitable material for backfill is not available from the excavated material, as determined by the Engineer, the Contractor shall procure elsewhere a sufficient quantity of suitable bank run sand gravel and shall furnish and place such material. No frozen earth shall be used for backfill, and all stones more than 6 inches in the largest dimension shall be removed from acceptable earth for fill.

Backfills and fills shall be made to the slopes, grades, and elevations shown on the contract drawings. Backfills shall be compacted, as herein under specified, to a density at least equal to that of the adjacent undisturbed soil, so as to avoid future unequal settlement.

No backfill shall be placed until the structure has been inspected in place and approved. Backfilling shall be carried out as soon as possible after such approval.

1.07-2 PLACING AND COMPACTING BACKFILL

Trenches shall be backfilled from the top of the foundation material to a depth of not less than 12 inches over the pipes using only bank run sand and gravel. Such material shall be uniformly placed on each side of the pipe in 6 inch layers, wetted as required, and firmly compacted by approved tamping machines. Care shall be taken not to damage the pipe. After a compacted coverage of 12 inches has been made, the remainder of the trench shall be compactly filled in an approved manner.

For plastic or truss pipe, the bank run sand or gravel must be specifically compacted with mechanical tampers, after sprinkling with water to obtain optimum

moisture content. Final in-place density must be at least 90 percent of the maximum density obtainable with the material used, as determined by AASTHO Designation T 99 compaction and density tests, using Method "C".

1.07-3 FOUNDATION MATERIAL

Foundation material used for pipe bedding, from a distance of 6 inches below the pipe invert to a point 12 inches above the pipe shall be stone dust or stone mix. Crushed stone or gravel shall not be used as foundation material for truss pipe or polyvinyl chloride pipe.

Bank run sand and gravel shall conform to the requirements of the New Jersey State Highway Department, Standard Specifications, Latest Revisions, for Type 1, Class A bank run sand and gravel, while crushed stone shall conform to the requirements of the New Jersey State Highway Department Standard Specifications, Division 8, Section 8.1, Type 1, Class B. Frozen and lumpy material shall not be used.

All foundation material shall be placed and compacted as directed and approved by the Engineer.

1.08 SEWER PIPE MATERIAL - GENERAL

1.08-1 GENERAL

Sewer pipe shall be of the materials set forth in the Proposal, meeting the appropriate specifications in the Sections which follow. The contractor shall note that alternates for sewer pipe materials, when included in the Proposal, will be selected at the option of the Owner, unless noted otherwise.

When required by field conditions, as determined by the Engineer, or by local or State Authorities, the Contractor shall substitute Cast Iron pipe for sewer pipe, at the unit prices set forth in the Proposal. Cast iron pipe shall be as specified in Section 1.16.

Where indicated or required, the Contractor shall install watertight bulkheads. Bulkheads to be installed in gravity sewers shall include a 4 inch C.I. flanged nipple and a 4 inch gate valve with invert matching that of the sewer, suitable for dewatering the pipe. The cost of furnishing, installing and removing these bulkheads shall be included in the unit price bid for gravity sewers.

1.08 – 2 SHOP DRAWINGS

As required by the General Specifications and before fabrication of the pipe and adapters is begun, the Contractor shall submit, for approval, drawings showing the pipe lengths, joint details and other details, all in complete accordance with the requirements

given on the drawings an din the specifications. All pipe furnished under the contract shall be fabricated only in accordance with the approved drawings.

1.08-3 INSTALLATION SPECIFICATIONS

All pipes shall be laid, jointed, and backfilled according to the manufacturer's installation specifications, having been approved by the Engineer, and all of which are made a part of these specifications. IN the event the manufacturer has not issued any installation specifications, then the installation specifications of a reputable manufacturer of the pipe shall be used, also upon approval by the Engineer.

The Contractor shall furnish each of his foremen or supervisors copies of these approved specifications and they shall have them in their possession at all times. Any conflicts between these manufacturer specifications and those contained herein shall be resolved by the Engineer.

1.08-4 FITTINGS AND SPECIALS

Beveled pipes, elbows and tees and other special pipes shall conform to the specifications for straight pipe, insofar as such specifications are applicable. Where special design or construction is necessary for such pipe the design and construction shall be subject to the approval of the engineer.

When the radius of curvature of the line is less than the minimum specified by the manufacturer for laying straight lengths of pipe, elbows of the proper deflection shall be used.

All fittings, specials and adapters shall be included in the price bid per linear foot, including the connection to the receiving manhole or gravity sewer.

1.08-5 PIPE STORAGE

Pipe sections shall not be stored on areas over pipelines which might be damaged by the superimposed load, and storage of sections shall be restricted to approved or permitted areas, out of traveled areas.

1.08-6 INSPECTION AND REJECTION OF PIPE

The quality of all materials, the process of manufacturer, and the finished pipe shall be subject to inspection and approval by the Engineer. Such inspection may be made at the place of manufacture or on the work after delivery, or at both places, and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements even though sample pipes may have been accepted as satisfactory at the place of manufacture.

The Engineer shall have the right to order cores cut from such pieces of finished concrete pipe as he desires for such inspection and tests as he may wish to apply. Holes

left by the removal of cores shall be filled in an approved manner by and at the expense of the manufacturer of the pipe.

The Engineer shall also have the right to take samples of concrete for concrete pipe after it has been mixed, or as it is being placed in the forms or molds, and to make such inspection and tests thereof as he may wish.

Any pipe which has been damaged after delivery will be rejected and, if such pipe is already laid in the conduit line, it shall be acceptably repaired, if permitted, or removed and replaced, and made good solely at the Contractor's expense.

1.08-7 CONCRETE CRADLES, SUPPORTS, REACTION OR THRUST BLOCK

Concrete Cradles, Supports, Reaction or Thrust Blocking shall be applied at all fittings, plugs, caps and at joints deflecting 22 -1/2 degrees or more and elsewhere as indicated on the drawings and in the contract documents or as required for the completion of the work.. Thrust Block shall be of concrete as specified in Section 10.01-7 CONCRETE. Concrete shall be of Class B having a strength of 3500 or more. Blocking shall be placed between solid ground and the fitting to be anchored.

The area of bearing of pipe and ground for proper anchorage shall, in each instance, be as required by the Engineer. Unless otherwise directed, the blocking shall be so placed that the joints.

No direct payment will be made for concrete cradles, supports, reaction or thrust blocking. Construction of such items as required by the contract documents, or as required for the completion of the work shall be considered as a subsidiary item and shall be included in the contract unit price bid per linear foot for all sewers and force main pipe construction.

POLYVINYL CHLORIDE PIPE

1.10-1 POLYVINYL CHLORIDE PIPE (PVC)

Plastic pipe shall be polyvinyl chloride sewer pipe with bell and spigot ends with 0-ring rubber gasketed joints and conforming to ASTM D-3212. Plastic pipe and fittings for mains and laterals shall conform to ASTM D-3034 (latest revision) with a minimum wall thickness designation of SDR 35 for pipe 4 to 15 inches in diameter, with a uniform wall thickness.

The plastic material from which the pipe and fittings are extruded shall be high impact types of PVC, unplasticized having high mechanical strength and maximum chemical resistance conforming to Type I, Grade 1, of the specification for rigid polyvinyl chloride compounds, ASTM D-1784.

Pipe shall be free from defects, bubbles and other imperfections in accordance with accepted commercial practice.

Rubber ring gaskets shall be manufactured as per ASTM D-477. The gasket shall be the sole element dependent upon to make a watertight joint.

The pipe shall be installed as specified in ASTM D-2321. In no case shall less than Select Material No. 6 (NJDOT Gradation 1-2) be used for bedding and haunching material unless approved by writing by the Authority. Particular attention shall be given to the special requirements for installing pipe in unstable soil or in excessive groundwater.

Trench dimensions and maximum depths shall be in accordance with the manufacturer's recommendations and as a minimum shall conform to the information shown on the Standard Construction Details located in the Appendix.

BACKFILLING IN OPEN TRENCH

1.17-1 GENERAL

All lumber, rubbish and brace shall be carefully removed from behind walls or other structures, unless ordered left in place by the Engineer. Backfill under the pipe haunches, around the pipe, and up to a cover of at least 18 inches over the top of the pipe shall be placed by hand in 6-inch layers, each layer to be thoroughly compacted by mechanical tampers of an approved type.

Compaction and tamping shall be as directed to the end that the pipe shall be securely bedded and protected at the end of each day's operation. Unless otherwise specified, all trenches or excavations shall then be backfilled up to the original surface of the ground or up to such grades as shall be directed. The backfilling shall be done as completely as possible in such manner as to prevent after-settlement around all structures and pipelines. No heavy stones or bounders shall be allowed to drop into the trench. The trenches and excavations shall be wet down as required to obtain optimum density while the backfilling is being carried out.

At all street intersections, backfill between a plane 18" above the top of the pipe and the finished surface grade shall be placed in successive layers of not over 6 inches compacted thickness. Each layer shall be thoroughly compacted using approved tamping machines.

In rights of way and paper streets, backfill between a plane 18 inches above the top of the pipe and the finished surface grade need not be placed in successive layers, however, the contractor shall attempt to keep settlement to a minimum and shall promptly restore to proper grade such settlement that might occur.

whatever method of compacting or consolidating backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine materials.

No stone or rock fragment weighing over 50 lbs. shall be backfilled into the trench nor shall large masses of backfilling material be dropped, as from a grab bucket, into the trench in such a manner as to endanger the pipe. If necessary, a timber grillage shall be used to break the fall of backfill dropping from a height exceeding 5 feet.

All voids left by removal of sheeting shall be completely backfilled with suitable materials, thoroughly compacted as specified.

Pieces of bituminous pavement shall be excluded form the backfill unless expressly permitted by the Engineer, in which case they shall be broken up as directed.

1.17-2 BACK FILLING AROUND AND OVER PIPE

In the case of 18" and smaller pipes, the space between the pipe and the sides of the trench above the cradle shall be packed full by hand shovel with selected earth free from large lumps and stones having any dimension greater than 2" and thoroughly compacted with a tamper as fast as placed, up to the level above the top of the pipe as shown on the "Bedding Details" on the sheet entitled "Miscellaneous Details". Care shall be taken not to displace or damage the pipe. In the case of larger pipes, selected earth shall be deposited and compacted in layers not to exceed 6" in thickness, in a manner that will not disturb or injure the pipe and up to the level shown above the top of the pipe. Each layer shall be leveled and thoroughly compacted to a relative density of ninety-five percent (95%) by tamping or, where the material is sufficiently granular in nature and approval is given by the Engineer, by puddling or water jetting, before the next horizontal layer is deposited in the trench. In all cases the filling shall be carried up evenly on both sides of the pipe.

1.17-3 BACKFILLING REMAINDER OF TRENCH

Where the pipe is in a dedicated street or way, or any place where the paving is to be replaced as part of the work under this contract, the remainder of the trench above the level shown on the sheet entitled, "Miscellaneous Details" shall be filled and consolidated or compacted by water jetting, puddling, Hydrohammer, or tamping to obtain a relative density of ninety-five percent (95%). Either water jetting or puddling may be used wherever the material does not contain too much clay or loam to prevent satisfactory drying.

When the trench is not in or across a dedicated street or way, or any place where the paving is to be replaced under this contract, the backfill shall be consolidated or compacted to obtain a density equal to the density of the adjacent undisturbed soil.

1.17-4 DENSITY AND TESTING

The densities referred to above shall be based upon "Tests for Moisture - Density Relations of Soils", ASTM Designation D698, latest revision. Density control in the field shall be based on "Test for Density of Soil in Place by the Sand-Cone Method" ASTM Designation D1556, latest revision. Testing when required shall be made by an independent testing laboratory, as provided for under the General Specifications, Section .04, SERVICES OF TESTING LABORATORY.

1.17-5 TOP OF BACKFILL

Where the pipe is in a dedicated street or way, or and place where paving is to be replaced as part of the work under this contract, the contractor shall, after backfilling the trench and compacting the subgrade as specified, place a temporary pavement consisting of 6" compacted thickness of type RR-Stockpile Base Stone Mix, spread and rolled with a ten ton roller. This material shall become an integral part of the final pavement.

With the approval of the Engineer, the contractor may use stabilized base bituminous concrete in place of RR-Stockpile Base Stone Mix between April 1st and October 31st. At no time shall the amount of unpaved trench within the Contract limits exceed 2000 linear feet.

Preparation of trench and edges of existing paving, and placing Stockpile base shall all be as specified in Section 1.20 REPLACEMENT OF ROADWAYS AND PAVING SIDEWALKS, CURBING AND DRIVEWAYS.

In roads where the existing pavement consists of gravel, cinders or road stone, the temporary replacement shall be 6" of thoroughly compacted gravel, cinders or road stone as the case may be, and shall become an integral part of the final pavement.

Where the trench is excavated in unpaved areas the top of the trench shall be finished as specified under Section 1.21, CARE AND RESTORATION OF PROPERTY AND ENVIRONMENT.

1.19 TEMPORARY PAVEMENT MAINTENANCE

1.19-1 TEMPORARY PAVEMENT MAINTENANCE

During the Interval between completion of backfill with stockpile base course, and the time of replacement of permanent paving, all pavement, drives, and sidewalk areas shall be maintained in a safe and satisfactory condition. The Contractor shall keep the pavement clean and shall sweep, hose down and otherwise maintain the streets in a safe and satisfactory condition for traffic.

The Contractor shall replace, from time to time at no additional cost to the Owner, the stockpile base course, road stone, compacted gravel or cinders, regarding and rerolling as required until the temporary replacement becomes an integral part of the final pavement.

On busy roads, as directed by the Engineer, the Contractor shall paint white or yellow lines on the temporary pavement.

If the Contractor fails to maintain his trench in a safe and satisfactory condition, and following failure to remedy these conditions after written notice, the Owner of Engineer may repair these streets or take the necessary safety measure and the cost will be deducted from the Contractor's monthly estimate based upon the unacceptable footage at the minimum unit costs for the sewer pipe and manhole.

1.19-2 DUST CONTROL

It is the obligation of the Contractor to keep all working areas free from dust during construction. Pavement areas shall be swept clean to the trench at the end of each days work. Suitable chemicals such as calcium chloride or curing oils such as emulsified curing oils shall be furnished and applied as required to confine dust producing materials to the trench area. The method used shall be approved by the officials having jurisdiction.

Dust control shall, in all respects, be the obligation of the Contractor and the costs, thereof, shall be included in the price bid for the various items in the Proposal.

REPLACEMENT OF ROADWAYS AND PAVING, SIDEWALKS, CURBING AND DRIVEWAYS

1.20.1 GENERAL

The contractor shall include, in the prices bid under the respective items of this contract, the cost of road openings permanent replacement or repair of all roadways and paving, sidewalks, curbing and driveways, removed, damaged or disturbed during the course of construction. In general, replacement shall be similar type as the original construction, with the exception of all roads constructed with bituminous material owned by the Municipality.

The contractor shall employ mechanical, hydro-tampers or high speed vibro-tampers to consolidate the backfill as soon as practicable following trench backfilling. If the soil is pervious and suitable for consolidation by flooding or jetting, the contractor shall immediately puddle all trenches to obtain maximum consolidation as soon as practicable.

Work of temporary pavement placement shall be started not later than two (2) weeks after trenches have been backfilled. During the interval between completion of backfill and the time of placement of temporary paving, all pavement, drives, sidewalk areas shall be maintained in a safe and satisfactory condition for normal traffic use.

After the trench has been backfilled and thoroughly compacted by puddling or mechanical consolidation, a hydra-hammer shall be used to compact the top of the trench approximately nine (9) inches prior to placement of sub-base.

The Contractor shall then place and compact by a 10-ton roller a 4-inch thick compacted course of 2-1/2 inch quarry blend crushed stone. The stone shall then be thoroughly dusted and the entire layer shall be rolled until a satisfactory temporary surface is obtained. The contractor shall then place a 4 inch compacted course of bituminous stabilized base course (mixture No. 1). The finish surface of this course shall be one inch below the existing pavement so as to provide for the surface (permanent) course. This temporary pavement and permanent stone, sub-base shall be maintained for one (1) year in place and usable condition by placement of bituminous stabilized base course as required for settlement wear or erosion, with no additional payment.

If the contractor fails to maintain his trench and pavements in a safe and satisfactory condition and following failure to remedy these conditions after written notice, the Owner may repair these streets at his own expense and the cost will be deducted from the payment due the contractor.

All replacement or repair of roadways and paving shall conform to Municipal, County, or State ordinances and applicable requirements of the "Standard Specifications for Road and Bridge Construction", of the New Jersey State Highway Department, latest revision.

The Contractor shall obtain the approval of the Township County or State Authorities having jurisdiction over the permanent replacement or repair of roadways and paving prior to final acceptance by the Owner of the replacement or repair done under this contract.

After paving operations have been completed, the Contractor shall paint white or yellow lines on roads, at least equal to the original lines of the roads, unless otherwise directed. Paint shall be as approved by the engineer. On busy roads, as directed, the Contractor shall paint white and yellow lines on temporary pavement.

The following paragraphs set forth minimum specifications for pavement replacement. If existing pavement is of greater thickness, the pavement replaced must at least equal in thickness to that removed.

If the government agency having jurisdiction over the replacement or repair of roadways requires materials of a higher quality or bedding or pavement of greater thickness than specified herein, then the governmental agency's requirements shall govern.

Where the Municipal, State of County Rules and Regulations either do not apply or are not in existence, the provisions for replacement of roadways, curbing and driveways as contained in Sections 1.20-1 through 1.20-6 shall apply.

Prior to excavation, the Contractor shall cut the pavement ahead of the excavation by means of pneumatic jackhammers, saws, or other suitable tools in an approved manner to provide a clean uniform edge with minimum disturbance of remaining pavement.

After the backfilled trenches have had adequate time to consolidate, the Contractor shall cut back and trim the existing pavement edges to restore a uniform edge, and shall excavate the material in the trench to the grade of the bottom of the finished pavement. All loose or damaged material in the existing paving shall be removed and the edges trimmed or cut back on either side of the trench in an approved manner to produce a straight and clean line. Where required, a mat of salt hay sufficiently thick to stabilize the soil shall be used. The trench shall then be thoroughly consolidated with a 10 ton roller until there is no visible creeping or settlement under the roller.

In all cases, the Contractor shall insure that, prior to paving operations, all manhole rims are installed to the proper grade elevations for final paving.

Permanent Bituminous Pavement Replacement In Municipal Roads

Where pavement replacement is to be made in municipally owned roads, the contractor shall place the permanent pavement after the temporary pavement has been in place and maintained by the contractor for a period of not less than twelve (12) months.

The Contractor shall obtain the approval of the Township, County or State Authorities having jurisdiction over the permanent replacement or repair of roadways and paving prior to final acceptance by the Owner of the replacement or repair done under this contract.

After paving operations have been completed, the contractor shall paint white and yellow lines on roads, at least equal to the original lines of the roads, unless otherwise directed. Paint shall be as approved by the Engineer. On busy roads, as directed, the Contractor shall paint white or yellow lines on temporary pavement.

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In all cases, the Contractor shall insure that, prior to paving operations, all manhole rims are installed to the proper grade elevations for final paving.

Permanent Bituminous Pavement Replacement In Municipal Roads

Where pavement replacement is to be made in municipally owned roads, the contractor shall place the permanent pavement after the temporary pavement has been in place and maintained by the contractor for a period of not less than twelve (12) months.

All excavation required in connection with the permanent pavement replacement operations shall be made neatly so as to minimize damage to the existing pavement. No extra payment will be made for this excavation other than the unit price bid for pavement replacement.

Rubber tired equipment shall be employed, and extreme care shall be taken to prevent damage to or marking up of the existing pavement. If the existing pavement is disturbed, the contractor shall be ordered to repair and seal coat any damaged sections without additional payment. Pavements disturbed by the construction, but no in the trench area, shall be replaced or repaired as directed by the Engineer. Such replacement or repairs shall be done by, and at the expense of the contractor without additional payment.

The temporary pavement, if in satisfactory condition, shall remain in place and become a part of the permanent pavement. The temporary surface shall first be broom swept free of direct and debris. A bituminous concrete surface course of Type a-1 (Plant Mix) shall be placed thereon, adequately crowned to provide drains. Immediately previous to placing this surface course, the trench edges of the base course shall be cut back a minimum of six (6) inches and the surface course 12" on each side to produce straight and clean edges, and then alone with the existing temporary pavements surface, shall receive a tack coat of asphalt oil, grade RC-0 or emulsified asphalt, grade RS-1. The surface course shall then be placed and rolled even with the existing pavement.

Where the temporary pavement has become unstable it, as well as all unsatisfactory material, shall be removed. The excavation shall then be backfilled with compacted bank run sand and gravel to within 8 inches of finish grade. The contractor shall then reconstruct the base course as outlined under paragraph for temporary pavement in municipal roads. Upon completion of this work permanent pavement may then be installed as previously outlined.

The contractor shall maintain the permanent surface course until such time as the final seal coat is ordered placed by the Engineer. Any sections of the trench which settle shall be properly restored to required final grade with Type A-1 (Plant Mix). Any sections which are defective shall be cut out completely and the sub-base retaped and restored and the pavement as herein before specified.

After an adequate period of time following the placing of the permanent pavement, the contractor shall place the seal coat. The surface to be seal coated shall first be swept clean. The seal coat shall consist of a minimum application of 1/3 gallon per square yard of RT-8 or RT-9 (hot applied) and covered with 3/8" stone at the rate of 30 to 40 pounds per square yard, and rolled. Final pavement replacement and resurfacing shall be such as to bind the new pavement with the existing in appearance, elevation and grade and create a homogeneous effect. The seal coat shall be to the full width of the road, i.e., from curb to curb and from original edge of pavement to the opposite original edge of pavement where curbing is non-existent.

Pavement Replacement in County Roads

The Contractor shall accrue all necessary permits from the County Board of Chosen Freeholders and shall comply with all rules and regulations governing road openings in County Roads.

All excavation required for preparing subgrades and for removing temporary pavement shall be included under this item.

General

All pavement replacement shall be done in strict accordance with the requirements of the County.

After the width of the trench has been determined, the outlines shall be marked on the pavement. A pavement cutter shall then be used to cut through the pavement before the trench digging machinery shall operate.

The backfill above a plane 18 inches over the top of the pipe shall be placed in layers not over twelve (12") inches in depth and each successive layer shall be thoroughly compacted by a power operated tamper.

All work in the replacement of permanent pavement shall be deferred until, in the opinion of the County Engineer or Road Supervisor, the backfill in the trenches has adequately settled to insure permanent line and grade for the restored surfaces.

Excavation required after backfill has settled, prior to placing the base, shall be made neatly so as to minimize damage to the existing pavement. No extra payment will be made for removal of the temporary pavement, including surfacing and base, prior to permanent pavement replacement.

Prior to placement of the permanent pavement, the existing pavement shall be cut to a sharp line 1-1/2 feet back from the edge of the excavated trench, using a pavement saw. The face of the edge of the pavement cut, manholes, and other projections, shall be painted with hot asphalt cement.

Any damage to the portion of the pavement outside the limits of the pavement pay width, which in the opinion of the Engineer, has been caused by negligence on the part of the contractor or any of his workmen or agents, shall be repaired in a manner satisfactory to the Engineer, by and at the expense of the contractor.

The contractor shall be responsible for fulfilling all of the County requirements for road openings and pavement replacement as set forth in the resolution entitled, "A Resolution to Protect County Roads, Streets, Highways and Bridges and Providing Penalties for Violations Thereof".

Shoulder Replacement

Where the sanitary sewer is installed within the limits of an existing stabilized shoulder, restoration shall be under this items.

When the trench has been backfilled to within ten inches of the existing grade, the remainder of the trench after properly preparing and rolling the subgrade, shall be filled with six inches of 1-1/2" quarry blend crushed stone, filling all voids with stone dust and a surface course of four inches of shoulder stone, each operation being thoroughly rolled. During the maintenance period if further settlement occurs, it shall be brought to grade with additional shoulder stone and rolled.

Where the trench is in grassed areas the surface shall be topsoiled and seeded with payment included under Item 1.

Temporary Pavement Replacement

After properly preparing and rolling the subgrade, a base of eight (8"0 inches of 1-1/2 inch quarry blend crushed stone shall be placed and rolled dusted with stone dust to fill all voids, and rerolled. The surface shall consist of a two inch compacted thickness course of bituminous concrete, FABC, thoroughly compacted and finished to grade. Upon any settlement, the trench shall be brought to grade by adding more bituminous concrete, Type FABC and maintained to grade at no additional cost until permanent pavement is placed.

Permanent Pavement Replacement

Prior to placement of the permanent pavements, the pavement on all sides of the opening shall be cut back 1-1/ feet and all material within these limits shall be removed to a depth of ten inches. No additional payment will be made for this excavation other than the payment included under this item.

After the subgrade has been properly graded and compacted using a roller whenever possible, eight inches of bituminous stabilized base shall then be placed in two 4-inch thick courses, each course shall be thoroughly rolled. Upon this base there shall

then be constructed two inches of bituminous concrete, Type FABC, surface course, the same to be thoroughly rolled, the finished surface to be neither higher or lower than the existing pavement and produce a homogeneous effect.

1.20-2 REINFORCED CONCRETE PAVEMENT

Reinforced concrete pavement shall be cut in a manner approved by the authorities having jurisdiction. Unless specific approval otherwise is obtained by the Contractor from authorities having jurisdiction, the Contractor shall cut the concrete pavement leaving the transverse steel reinforcement bars intact on each side of the trench for typing back into the new concrete surface.

Concrete pavement shall conform to the thickness of pavement removed plus 2 inches. The concrete shall be reinforced and air entrained and shall meet the applicable New Jersey State Highway Department Specifications for Reinforced Concrete pavement (air entrained).

1.20-3 BITUMINOUS CONCRETE BASE COURSE

Between April lst and October 31st, the Contractor may use, with the approval of the Engineer, a base course, compacted to a 6 inch thickness of bituminous concrete stabilized base Mix No. 14 as specified in New Jersey State Highway Department Standard Specifications for Road and Bridge Construction, Latest Revision.

1.20-4 SURFACE BITUMINOUS CONCRETE COURSE

The finish course shall be a minimum of two inches of FABC bituminous concrete, Mix No. 5, as specified in the New Jersey State Highway Department Standard Specifications for Road and Bridge Construction, Latest Revision. The two inch thickness shall be applied over the trench area and extend 12" past the edges of the undisturbed pavement where the thickness may be reduced to one inch. Manhole frames and covers shall be raised to final grade prior to paving. The final pavement shall be rolled to a finished smoothness having no depressions or hummocks.

The face of the edge of cut pavement, manholes and other projections shall be painted with hot asphalt cement, before bituminous surface is applied.

1.20-5 SINGLE SURFACE TREATMENT

Single surface treatment shall include the furnishing and placing of bituminous and cover materials on road surfaces and incidental work as specified in New Jersey State Highway Department Standard Specification Section 6 and as hereinafter described.

Material shall be as follows:

- Broken stone in accordance with New Jersey State Highway Department standard specifications, Article 8.5.5.

- Washed gravel in accordance with New Jersey State Highway Department Standard Specifications, Article 8.5.6.

- Asphaltic oil in accordance with New Jersey State Highway Department Standard Specifications, Article 8.1.7.

- Bituminous materials shall be applied by means of motor driven pressure distributing trucks of modern design, in good mechanical condition of not less than 600 gallon capacity equipped as specified in New Jersey State Highway Department Standard Specifications, Article 3.6.3.

Previously treated surfaces shall be thoroughly swept with mechanical seepers, and shall be completely dry prior to application of any paving materials. Where existing paving or subgrade has failed in the sewer trench or elsewhere on the paved surface, excavation shall be made to the depth as directed by the Engineer. Existing paving shall be cut so as to form square openings with straight sides, properly cleaned out and painted with asphaltic oil or tar, then filled with bituminous stabilized base sub-base material, as specified. Patches shall be brought to grade and thoroughly rolled prior to application of single surface treatment materials.

Asphaltic oil shall be grade RC 250 or RC 800, applied at temperatures as specified in the New Jersey State Highway Department Standard Specifications, Article 3.6.3. Asphaltic oil shall be applied at a rate of about 0.3 gallons per square yard. Asphaltic oil shall be covered immediately with fine aggregate cover material at the rate of about 25 pounds per square yard.

After each application and during the curing process the surface shall be dragged with an approved drag two or three times a week, as the Engineer may direct. When the oil comes to the surface before the acceptance of the project, additional cover material shall be spread so as to keep the surface in proper condition.

TESTS

1.22-1 INFILTRATION AND EXFILTRATION TESTS

Upon completion of the sewer and manholes, and other appurtenances, the Contractor shall dewater the sewer and conduct a satisfactory test to measure infiltration for at least 8 hours. The rate of infiltration shall not exceed 100 gallons per mile per 24 hour per inch of diameter of sewer. There shall be no gushing or spurting streams entering the sewer. The Contractor shall be held responsible for the satisfactory water-

tightness of the line, and sufficiently watertight, and then shall make additional tests of the infiltration, until the infiltration conforms to the requirements given herein.

The tests shall be conducted on sections of sewers of a maximum of 2000 linear feet of street mains, trunks or interceptors, as determined by the Engineer. The rate of infiltration for each section shall not exceed the unit rates given above.

In the event that the groundwater level is lower than the top of the pipe, exfiltration tests shall be substituted for infiltration.

The exfiltration test shall be conducted between manholes on sections of sewers a maximum of 2,000 linear feet in length. The pipe is to be filled and additional water introduced into the manhole to raise the level two feet above the top of the pipe in the upstream manhole. The Contractor shall furnish all water required for exfiltration tests. The quantity of water to maintain this level is to be measured. The test shall be maintained for an 8 hour period. The rate of exfiltration shall not exceed 100 gallons per inch of inside diameter per mile of pipe per twenty-four hours. There shall be no gushing or spurting stream leaving the sewer. The Contractor shall be held responsible for the satisfactory water tightness of the line and shall satisfactorily repair all joints or other parts not sufficiently watertight, and then shall make additional tests of the exfiltration, until the exfiltration conforms to the requirement given herein.

1.22-1 LOW PRESSURE AIR TEST

With approval of the Engineer, a low pressure air test may be used in lieu of the above tests. After completing backfill of a section of wastewater line, the Contractor shall, at its expense, conduct a Line Acceptance Test using low pressure air. The Contractor shall furnish all labor, material and equipment necessary for the testing. The test shall conform to the Uni-Bell Plastic Pipe Association Recommended Practice UNI-B-6, “Low Pressure Air Testing of Installed Sewer Pipe.”

All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 PSIG. The sealed pipe shall be pressurized to 5 PSIG. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 PSIG. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 PSIG greater than the average back pressure of any groundwater that nay be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 PSIG minimum pressure in the pipe) the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable" if the elapsed time in minutes for the pressure to decrease from 3.5 to 2.5 PSIG (greater than the average back pressure of any groundwater that nay be over the pipe) is equal to or greater than the time shown in the referenced Recommended Practice UNI-B-6, "Low Pressure Air Testing of Installed Sewer Pipe."

In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately 10" long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the groundwater level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feel of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the required air pressure in the sewer for the air test. (For example, if the height of water is 11-1/2 feet, then the additional air pressure required due to the presence of groundwater will be 5 PSIG. This increases the test pressure from 3.5 PSIG to 8.5 PSIG. The allowable drop of one pound and the timing remain the same.

If the sewer line fails the air test, the Contractor shall, at its own expense, determine the source of leakage. He shall then repair or replace all defective materials and/or workmanship.

1.22-2 INSPECTION

Prior to tests for infiltration and exfiltration, the sewer will be inspected from manhole to manhole by the Engineer before final acceptance. The Contractor shall furnish two men to assist the Engineer in making this inspection. It is a condition of acceptance that all sewers be laid straight from manhole to manhole unless ordered in writing or shown differently by the Engineer. If, in the opinion of the Engineer, the sewer is not acceptable for reasons such as poor alignment, leaks or cracks in pipes or manholes, excessive deposits are noted, the Contractor will be required to flush such sections of sewers or to otherwise remove the foreign material from the pipes. The flushing will be done between two manholes at a time, with a plug inserted in any section previously cleaned to prevent foreign material from entering this pipe section or active sewers. All water used to flush lines shall be pumped from the lines and disposed of by the Contractor. The Engineer shall have the right to order the removal of any pipe or pipes laid contrary to his instructions. Upon completion of cleaning operations, repairs or replacement of sewer pipes and appurtenances, the affected portion of the system shall be reinspected by the Engineer with the assistance of the Contractors as specified above. No gravity sewers shall be certified for final payment until they have satisfactorily passed this manhole to manhole test.

If an inspection of the completed sewer or any part thereof shows any manholes, pipes, or joints which allow the infiltration of water in a noticeable stream or jet, the defective work or material shall be replaced or repaired as directed.

After the sewers have been laid and otherwise completed, a leakage test shall be made to demonstrate that the line will satisfactorily meet the conditions prevailing in place with leakage not in excess of the following:

Infiltration	100 gallons per inch of internal diameter per mile of pipe per 24 hours.
Exfiltration	100 gallons per inch of internal diameter per mile of pipe per 24 hours.

Rates of infiltration shall be determined by means of V-notch weirs or pipe spigot in an approved manner and at such times and locations as may be directed by the Engineer during the progress and at the completion of the work. The Contractor shall provide and install weir plates or other materials required and at such times and locations as may be directed by the attention of the Contractor is directed to the strict requirements relative to permissible rates of infiltration and to the importance of these specifications relative to tight joints required.

For short stretches, less than five hundred feet in length, rates of one hundred percent in excess of the above figures may be permitted, providing and total infiltration in the sewer does not exceed the above specified limits.

The Contractor shall notify the Engineer and the New Jersey State Department of Environmental Protection one (1) week prior to the time the system or any part thereof is ready for testing and/or final inspection. Copies of all test and final inspection reports are to be forwarded to the New Jersey State Department of Environmental Protection.

Reinspection of the sewer, or any portion thereof, may at the Owner's option, be repeated at any time prior to the release of the Maintenance bond. Any deficiencies disclosed in such reinspection shall be immediately repaired or replaced by the Contractor to the satisfaction of the Owner and the Engineer as a condition precedent to the release of said Maintenance Bond.

1.22-3 DEFLECTION

After all polyvinyl chloride pipe has been laid and trenches backfilled, a deflection test shall be performed on each section of pipeline between manholes. The maximum allowable deflection shall be 7% and the device for testing shall be a properly sized “go, no go” mandrel provided by the Applicant’s contractor. The test shall be conducted a minimum of thirty (30) days after installation.

The deflection devise or mandrel for checking the deflection shall be provided by the applicant's contractor. Details of the deflection device or mandrel shall be submitted to the WMUA's engineer for approval, prior to its use and shall be fabricated and based on the following table:

Pipe Size	Mandrel Size (in.)	I.D. (in.)	O.D. (in.)
8"	7.48	7.92	8.400
10"	9.40	9.90	10.500
12"	11.19	11.78	12.500
15"	13.70	14.42	15.000
18"	16.53	17.62	18.701
21"	19.60	20.78	22.047
24"	22.21	23.38	24.803

The deflection device shall be pulled through the sanitary sewer pipe using only the force of one (1) man without the aid of any devices other than the rope/chain attached to the deflection device.

The maximum allowable deflection shall be applied to the base inside diameter of the pipe in determining the minimum permissible diameter. The base inside diameter shall be derived by substrating a statistical tolerance package from the pipe's average inside diameter. The following formulas shall be used:

Avg. Inside Diameter – Avg. Outside Diameter= (1.06)t
Tolerance Package = $(A_2 + B_2 + B_2 + C_2)$ 1/2

Where:
A = Outside Diameter Tolerance (ASTM 3034), in.
B = Excess Wall Thickness Tolerance = 0.061t, in.
C = Out-of-Roundness Tolerance =
0.015 (Avg. Outside Diameter) = in.
t = Minimum Wall Thickness (ASTM 3034), in.

Should the deflection on any section of pipe line be greater than 7%, the Contractor shall, at his own expense, repair such pipe until specified criteria are met.

MANHOLES

2.01-1 GENERAL

Precast Concrete Manholes.

Manholes shall be precast concrete and constructed of precast concrete riser sections, and eccentric conical or flat slab top section, and a base section as shown or required, and shall be equal to International Pipe and Ceramics Corp. or Armco Steel Corp. precast concrete manholes. Where required, eccentric reducing sections shall be used to join riser sections of different diameters. Manufacture shall be by a wet, monolithic process.

Precast manhole sections shall be manufactured in accordance with ASTM Designation C478-64T. The minimum compressive strength of the concrete for all sections shall be 4000 lbs. per square inch. The maximum allowable absorption of the concrete shall not exceed 8% of the dry weight. Tests shall be similar to those described in ASTM C76. The circumferential reinforcement in the walls of all sections shall be a minimum of 0.12 sp. in. per linear feet for inside diameters up to and including 54 in., and 0.17 sq. in per linear ft. for the larger sizes. Reinforcement in flat slab top sections shall be designated for the load to be supported. Additional reinforcement shall be provided at all openings larger than 6 inches.

Rubber “O” ring gaskets for joints shall conform to the requirements for rubber gaskets, as specified under the latest ASTM Designation C-443, and shall be made with round rubber gaskets and shall be installed in accordance with the manufacturer’s recommendations. Joints shall be watertight.

Base sections shall be furnished by the manufacturer with either embedded couplings or bells, or stubbed bells and spigots, of the same type joint as the adjoining pipe. Approved alternatives will include manholes with a compressible rubber ring as manufactured by Omega, or with a flexible manhole sleeve as manufactured by Interpace. Waterways shall be constructed in the field after the manhole has been installed, and shall conform to the shape and size of connecting pipes as shown on the "Standard Details: or ordered. Special care shall be taken to form channels with curved shapes that will provide the best hydraulic conditions for smooth flow. Benches shall be entirely of monolithically poured concrete and shall be sloped to drain to the waterways. Concrete used in forming waterways shall be a stiff, rich mix, as specified and shall be given a steel trowel finish.

Manholes, prior to being placed in final location, shall have cast-in place flexible rubber manhole sleeve or boot for jointing sewer pipe to the manhole. PVC pipe to manhole seal shall be by a rubber gasket conforming to latest ASTM C-443, cast integrally in manhole wall. Gasket shall be “A-lok” rubber gasket, as manufactured by A-lok Corporation, or equal. Connection of PVC pipe to manhole by grouting shall not be permitted.

Connections to existing manholes shall be made by coring an opening in the manhole wall with an approved core drilling machine. A flexible pipe to manhole connector shall be installed in the cored opening. Connector shall be Century Line Sleeve as manufactured by Link-Seal of Houston, Texas, or equal. Channels shall be chipped and roughened, and then finished with cement mortar to provide the best hydraulic conditions for smooth flow.

A flexible joint shall be placed within four feet (4') of the manhole wall, as shown on the construction detail sheets.

Between manholes, pipe shall be straight and at uniform grade. Spacing shall not exceed 400 feet.

Riser sections, conical sections, and the undersides of flat slab top sections, shall be given a protective lining consisting of 2 shop coats of asphaltic paint equal to Inertol No. 49 to the exterior of the manhole. The total dry film thickness hall be not less than 4 mils. The lining shall be applied in accordance with the manufacturer's recommendation. Base sections, after construction of the waterways and benches, shall be given 2 field coats of protective lining as specified herein above, including waterways and benches. Foundation material under manholes shall conform to that specified in Section S1 of the Technical Specifications.

Manhole frames shall be adjusted to finished grade by building a circular brick-and-mortar collar above the precast manhole opening. Maximum height of the collar shall be 12 inches except where ordered. Brick shall be sound, hard, well-burned, sewer brick conforming to the requirements of ASTM Designation C-32, Grade MA and shall be laid radically. Mortar shall consist of 2 parts sand to 1 part cement, thoroughly mixed in the required proportions before adding water. After laying up the collar and setting the frame in a full bed or mortar, the exterior of the collar shall receive a minimum 3/4 inch thick mortar coat to provide water tightness.

Manhole frames and covers shall be of the best quality close-drained gray iron casting conforming to the requirements of latest ASTM Designation A 48, Class 30B.

Frames and covers shall be machined to insure a non-clattering fit. Manhole frames shall be set to grade on a full bed of mortar. The castings shall be free from faults, sponginess, cracks, blowholes, and other defects affecting their strength.

Standard manhole frame and cover shall be equal to Campbell Foundry Company Pattern No. 1203B with flow seal gasket or equal.

Locking type frame and cover equal to Campbell Foundry Company, Pattern No. 1487 with a flat neoprene gasket shall be provided on manholes located in easements. A watertight manhole frame and cover shall be used on manholes located within 100 year flood boundary or in areas subject to street or surface flooding. Frame and cover shall be

Pattern No. 6545 with a flat neoprene gasket as manufactured by Campbell Foundry Company or equal. Cover shall be provided with steel drop lifting handle.

At manholes located in easement areas frames shall be bolted to cone section of manhole.

Aluminum manhole rungs shall be extruded alloy of the step drop front design, equal to the Aluminum Company of America, Type 6061-T6. The rungs shall be installed in line vertically at twelve inch (12") vertical spacing.

Manhole rungs may also be constructed of copolymer polypropylene plastic with steel reinforcement equal to that manufactured by M.A. Industries, Inc., Peachtree City, GA.

2.01-2 EXCAVATION AND BACKFILL

The Contractor shall make excavations in such manner and of such widths as will give suitable room for building and structure; shall furnish and place all sheeting, bracing, and supports; shall do all coffer-damming, pumping and draining; and shall render the bottom of the excavation firm and dry and in all respects acceptable.

In no case shall the earth be plowed, scrapped or dug by machinery so near to the finished subgrade as to result in disturbance of material below said subgrade, but the last of the material to be excavated shall be removed with pick and shovel just before the placing of the masonry.

As soon as practicable after the pipes and masonry have been placed, the joints and concrete have acquired a suitable degree of hardness and other necessary work has been done, special leakage tests, if required, shall be made after which backfilling shall begin and shall thereafter be prosecuted expeditiously. The best of the excavated materials shall be used in backfilling within two feet of the structure and unequal soil pressures shall be avoided by carrying the fill up evenly. The materials shall be sufficiently compacted to prevent settlement and, if compacted by rolling or reaming, shall be deposited in suitable layers, wet if required.

Where the material can be suitably compacted by water jetting or puddling as herein before described, the Contractor shall use one of these methods.

2.01-3 CLASS A OR B CONCRETE AND CONCRETE REINFORCEMENT

For specifications covering Class A and Class B concrete and concrete reinforcement, the specifications under the item CONCRETE AND CONCRETE REINFORCEMENT shall apply.

2.01-4 BRICK, BLOCK AND MORTAR FOR MASONRY

All brick shall be sound, hard and uniformly burned brick, regular and uniform in shape and size, or compacture and satisfactory to the Engineer. Brick shall be Grade MA conforming to the ASTM Standard Specifications for Sewer Brick (made from clay or shale) Designation C32-58. Rejected brick shall immediately be removed from the work and brick satisfactory to the Engineer shall be substituted.

Concrete manhole blocks shall be radial in shape. Twenty-eight day compressive strength shall not be less than 4, 0000 psi.

Absorption of individual blocks on the basis of a 24 hour immersion test (ACI Standard Pi-c-29) shall not exceed 8%.

Mortar for block or brick masonry shall be composed of Portland cement, hydrated lime, and sand. The volume of sand shall not exceed three times the sum of the volumes of cement and lime. The proportions of cement and lime shall be as directed and may vary from 1:1/4 for dense, hard burned brick to 1:3/4 for softer brick. In general, mortar for grade MA brick shall be mixed in proportions of 1-1/2:4-1/2.

Cement shall be Type II Portland cement as specified for Class A or Class B concrete under CONCRETE AND CONCRETE REINFORCEMENT.

Hydrated lime shall be Type S conforming to the ASTM Standard Specifications for Hydrated lime for Masonry purposes, designated C207-40. "Mortaseal" made by United States Gypsum and "4 x Hydrate" made by the New England Lime Co., will normally meet this specification.

Sand shall be as specified for Class "A" or Class "B" concrete (as above) except that all sand shall pass a No. 2 sieve.

During warm weather the concrete and brick masonry shall be moistened until the units are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid. All concrete and brick masonry shall be laid with full bed and head joints of mortar including subsequent full grouting, flushing, or filling of all open joints.

2.01-5 PARGING CONCRETE MASONRY AND COATING

The outside faces of concrete and brick masonry shall be parged in two coat work with Portland cement mortar 3/8 inches thick each coat. Masonry shall be moistened prior to application of the mortar. The mortar shall be carefully trawled so that all cracks are thoroughly worked out. After hardening, the parging shall be tapped and checked for bond and soundness. Unbonded or unsound parging shall be removed and replaced.

Concrete and brick masonry mortar and parging shall be protected from too rapid drying, by the use of moist burlap, or by other approved means, and shall be protected from the weather and frost until mortar has set.

After parging has hardened and dried, parging shall be given two coats of bituminous waterproofing material. The material shall be "Minwax Fibrous Brush Coat" made by the Minwax Company, New York, New York; "Tremco 121 Foundation Coating" made by the Tremco Manufacturing Co., Cleveland, Ohio; "Inertol No. 7" made by the Inertol Co., Newark 5, N.J.; or approved equal. The waterproofing material shall be applied by brush in accordance with the instructions of the manufacturer. Time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no affect on the first coat.

2.01-6 MANHOLE BASES AND BARRELS

The contractor shall construct the manhole bases after completely dewatering the area in which they are to be built. The diameter of the base shall exceed the outside diameter of the manhole by one foot. The thickness of the base shall be as shown on the drawings. Class "A": concrete shall be used. All manhole bases shall be monolithically cast to the bottom section, except for new manholes on existing sanitary mains.

The entire work of constructing manholes must be carried on in a manner to insure watertight work, and any leaks in manholes shall be caulked, repaired, or the entire work shall be removed and rebuilt.

attention is particularly called to the necessity of keeping the water level below all parts of the brick or concrete foundation and walls until the cement has obtained adequate set.

Precast base sections shall be installed on a concrete foundation mat or crushed stone base, as indicated on the drawings. The bell of the manhole base shall be wiped clean, be free of all dirt and grit, and liberally soaped in preparation for receiving the riser, cone or slab top section. Prior to snapping the gasket onto the spigot groove of the riser or cone section, the gasket shall be wiped clean and well soaped. Soaping the gasket groove will also make jointing of the pipe sections easier. A screw driver or hammer handle inserted beneath the gasket and run around the pipe will insure even seating. The riser or cone section with gasket in place should then be lowered into the bell of the manhole base, taking care that no dirt gets into the joint or on the gasket. Additional riser or cone sections should be jointed in a similar manner.

All pipes or castings to be embedded in masonry work shall be accurately set, brick headers shall be laid around the pipe so embedded. Spurs or stubs for branch sewers shall be built in the manholes where shown on the plans or otherwise required by the Engineer. They shall be closed with vitrified plugs, with brick cemented in place, or with cement asbestos and caps.

Plaster shall be trawled to a smooth, hard finish, and no backfill shall be placed until mortar has thoroughly hardened. Exterior walls and joints shall be painted with one coat of bitumastic No. 50 or approved equal.

After the vertical walls of the manhole have been built to the proper height, Class "A" concrete shall be used to form the bottom of the manhole over the structural slab. A channel shall be formed by using a length of pipe cut in half, lined up with the inverts of the sewer and secured. The sides of the channel shall be raised to an elevation of three quarters of the diameter of the pipe. A pitch of two inches from the interior wall of the manhole to the top edge of the channel shall be incorporated in the construction of the top surface of the bottom.

If an additional sewer enters the manholes, the channel shall be constructed to conform to the above and provision shall be made for smooth flow to the discharging sewer.

Manhole barrels shall be constructed of precast reinforced concrete pipe, brick or concrete block. Joints between lengths of concrete pipe shall be equal to Lock-Joint Pipe Specifications SP-25.

2.01-7 DROP MANHOLES

Drop manholes shall be used when the vertical distance between the elevation of the crown of incoming pipe and the crown of the outgoing pipe exceeds two feet and shall be constructed in accordance with details as shown on the drawings and as indicated herein. If precast concrete manholes are used by the Contractor, shop drawings shall be submitted showing details of construction.

2.01-8 MANHOLE FRAMES, COVERS AND RUNGS

Manhole frames and covers shall be of the best quality close grained gray iron castings conforming to the requirements of ASTM Designation A48, Class No. 30.

Unless otherwise indicated, manhole frames and covers shall be of the circular flared type frame with round flange as manufactured by Campbell Foundry Co. All standard covers are to be Campbell Foundry Pattern No. 1203B with flow seal gasket.

Seating surfaces shall be machined. All parts shall be immersion coated with an approved asphaltic coating.

Locking devices shall be Campbell Foundry Company Pattern No. 1487 with flat neoprene gasket frames and covers where shown. Locking type covers shall also be provided with a single recessed lifting handle placed near the locking device. Lifting

handle shall be equal to that shown for Campbell Foundry Company. A key shall be supplied with each 5 locking type units.

Slab type manhole frames and covers shall be equal to Catalog No. 1730 as manufactured by Campbell Foundry Company or approved equal.

All covers shall be case with the identifying letters as approved. Letters shall be 2 inches high and embossed against a recessed background.

Manhole rungs shall be extruded aluminum alloy of the step drop front design, equal to Aluminum Co. of America or Washington Aluminum Co. of America or Washington Aluminum Co. Rungs shall be cast in the Vertical sides of the manhole sections on 12 inch centers.

Frames, covers and appurtenances manufactured by the Neenah Foundry Co., or the Flockhart Foundry Co. will be acceptable, if equal to those specified.

The Contractor shall modify existing manholes by cutting masonry, setting pipe in place and filling with non-shrink grout. Waterways shall be chipped and roughened, and then finished with cement mortar to provide a smooth hydraulic flow.

Flexible joints shall be placed at the manhole wall, and within two feet of the wall, as shown on the typical details.

2.01-9 MISCELLANEOUS METAL

Wrought iron shall conform to the ASTM Standard Specifications for Rolled Wrought Iron Shapes and Bars, Designation A207-60T.

Steel shall conform to ASTM Standard A-7; copper to ASTM designation B-72.

Aluminum manhole steps shall be of extruded aluminum ALCOA 6061-T6 Alloy, of the shapes shown on the drawings. The portion to be imbedded in the manhole wall shall be thoroughly cleaned and then shall be coated with coal tar pitch varnish or other approved material.

2.01-10 VENT PIPE FOR MANHOLE

The Contractor shall furnish and install, where indicated on the drawings, self-supporting manhole vents consisting essentially of 4-inch Yoloy pipe risers and 4-inch cast iron pipe laterals to the manholes. Pipe and fittings shall be standard wall thickness. Details of vents shall be as indicated on the drawings.

3.01-1 HOUSE CONNECTIONS

From the street sanitary sewer to the curb, the Contractor has the option of furnishing the following types of house connections:

4 Inch (4") PVC pipe, minimum thickness of 0.180 inches (0.180")

4 Inch (4") ductile iron pipe

Wye Connection shall be used at the junction of the house connection and street sanitary sewer.

Watertight plugs or caps shall be furnished at all dead ends. Plastic plugs will not be allowed unless mechanically fastened so as to permit infiltration/exfiltration tests.

Bends in house connection lines shall be made using standard fittings. A riser with cleanout at grade shall be used at the point terminating WMUA jurisdiction.

The Contractor shall mark the location of the end of each house connection in the suitable and approved permanent manner. Exact location and depth, referenced to a permanent marker shall be shown on as-built drawings for any temporary dead ends. Each location shall be checked by the Engineer, and the final as-built drawings shall be submitted to the Engineer for approval prior to final acceptance.

At locations where centerline of the house connection at the sewer main would be more than ten feet (10') below the surface, Contractor shall install deep house connection. Deep house connections shall be constructed in accordance with Standard Construction Details.

3.01-2 CLEANOUTS

Cleanouts shall be installed in accordance with the Standard Construction Detail contained herein. Cleanouts shall consist of a PVC Tee wye, a four inch (4") diameter PVC riser, a PVC cleanout adapter fitting and brass plug. The cleanout plug shall be installed with a non-setting pipe dope to facilitate testing and future removal of the plug.

CLEANING UP

4.01-1 GENERAL

During its progress, the work and the adjacent areas affected thereby shall be kept cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.

Where material or debris has washed or flowed into or been placed in watercourses, ditches, gutters, drains, catch basins, or elsewhere as a result of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, etc., kept in a clean and neat condition.

On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and over all organic matter and material containing organic matter in, under and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations, in a neat and satisfactory condition.

The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operation. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration.

4.01-2 PAVEMENT

For all work, materials, and incidentals required to accomplish the purposes set forth in the above section, the Contractor shall receive the lump sum price for this item. No part of this price shall be paid before the final estimate.

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