

**Item No. 120
Utility Trenching and Backfill**

120.1 Description

This item shall consist of labor, equipment and/or materials for excavating, bedding, backfilling, compacting, testing, grading and other appurtenant work, prescribed under this item and in accordance with the provisions of Chapter 213 of the Texas Administrative Code as it related to work over the Edwards Aquifer recharge zone, and New Braunfels Water and Wastewater Design Criteria Manual. This item shall include any pumping, bailing, drainage and Item No. 121, "Trench Safety Systems" for trench walls, when indicated or applicable. Unless otherwise provided, this item shall consist of the removal and disposition of trees, stumps and other obstructions, old structures or portions thereof such as house foundations, old sewers, masonry or concrete walls, the plugging of the ends of abandoned piped utilities cut and left in place and the restoration of existing utilities damaged in the process of excavation, cutting and restoration of pavement and base courses, the furnishing and placing of select bedding, backfilling and cement or lime stabilized backfill, the hauling and disposition of surplus materials, bridging of trenches and other provisions for maintenance of traffic or access as indicated.

120.2 Standards

The applicable provisions of the following standards shall apply as if written here in their entirety:

A. American Society for Testing and Materials (ASTM) Standards:

ASTM C33	Standard Specification for Concrete Aggregates
ASTM C125	Terminology Relating to Concrete and Concrete Aggregates
ASTM D448	Standard Classification for Size of Aggregate for Road Bridge Construction

B. Texas Department of Transportation (TxDOT)

Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade, Embankment Soils, and Backfill Material
Tex-115-E	Field Method For Determining In-Place Density Of Soils And Base Materials
Tex-129-E	Measuring the Resistivity of Soil Material
Tex-406-A	Material Finer than 75 µm (No. 200) Sieve in Mineral Aggregates (Decantation Test For Concrete Aggregates)
Tex-410-A	Abrasion of Coarse Aggregate Using the Los Angeles Machine

120.3 Materials

A. Standard Bedding Materials

USE / PIPE MATERIAL	Cement Stabilized Backfill	Natural or Mf'd Sand	Stone Screenings	Pea Gravel	Course Aggregate
WATER					
Service Tubing 1" to 2"		X	X	X	
WATER and WASTEWATER (PVC)					
Up to 15 Inch ID		X	X		
Larger Than 15 Inch ID			X	X	
WATER and FORCEMAINS (DUCTILE IRON)					
Up to 15 Inch ID			X	X	X
Larger Than 15 Inch ID				X	X
WASTEWATER (FRP)					
Larger Than 30 Inch ID			X		

1. General requirements and limitations governing bedding selection.
 - a. Crushed gravel or crushed stone shall not be used with polyethylene tubing or polyethylene film wrap.
 - b. Pea Gravel or bedding stone shall be used in blasted trenches.
2. Requirements to prevent particle migration.

Bedding material shall be compatible with the materials in the trench bottom, walls and backfill so that particle migration from, into or through the bedding is minimized. The Engineer may require one or more of the following measures to minimize particle migration: use of impervious cut-off collars; selected bedding materials, such as pea gravel or bedding stone mixed with sand; filter fabric envelopment of the bedding; cement stabilized backfill; or other approved materials or methods. Measures to minimize particle migration will be shown on the Drawings or designated by the Engineer, and, unless provisions for payment are provided in the contract documents, the cost of these measures shall be agreed by change order. The following limitations shall apply.

- (a) Sand, alone, shall not be used in watercourses, in trenches where groundwater is present, or in trenches with grades greater than 5 percent.
- (b) Pea gravel or bedding stone, alone, shall not be used in the street right-of-way within 5 feet of subgrade elevation in trenches that are 3 feet or wider.
- (c) Each gravel or bedding stone, alone, shall not be used where the trench bottom, sides, or backfill is composed of non-cementitious, silty or sandy soils having plasticity indices less than 20, as determined by the Engineer.

B. Concrete

Concrete shall conform to TxDOT Standard Specifications Item No. 421, "Hydraulic Cement Concrete".

C. Foundation Rock

Foundation rock shall be well graded coarse aggregate ranging in size from 2 to 8 inches.

D. Flexible Base

Flexible base shall conform to TxDOT Standard Specifications Item No. 247, "Flexible Base".

E. Pipe Bedding

1. Coarse Aggregate

- a. Pipe bedding stone shall be clean gravel, crushed gravel or crushed limestone, free of mud, clay, vegetation or other debris, conforming to ASTM C33 for stone quality. Size gradation shall conform to Grade 6 Coarse Aggregate as defined in TxDOT Standard Specifications Item No. 421, "Hydraulic Cement Concrete".
- b. Course aggregate shall not exceed 35% loss as determined by the Los Angeles Abrasion test per TxDOT Test Method Tex-410-A.

2. Fine Aggregate

a. Concrete and Mortar Sand

Shall conform to fine aggregate as defined in TxDOT Standard Specifications Item No. 421, "Hydraulic Cement Concrete".

b. Bedding Sand

Sand for use as pipe bedding shall be clean, granular and homogeneous material composed mainly of mineral matter, free of mud, silt, clay lumps or clods, vegetation or debris. The material removed by decantation TxDOT Test Method Tex-406-A, plus the weight of any clay lumps, shall not exceed 4.5 percent by weight.

The resistivity shall not be less than 3000 ohms-cm as determined by TxDOT Test Method Tex-129-E. Size gradation of sand for bedding shall be as follows:

GRADATION TABLE	
SIEVE SIZE	% RETAINED BY WEIGHT
1/4"	0
#60	75-100
#100	95-100

c. Stone Screenings

Stone screenings shall be washed and screened natural sands or sands manufactured by crushing stones complying with the requirements and tests of ASTM C33.

Screenings shall be free of mud, clay, vegetation or other debris, and shall conform to the following Table:

SIEVE SIZE	% PASSING
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

Stone screenings shall have not more than 45 percent passing any sieve retained on the next consecutive sieve of those shown above, and its fineness modulus, as defined in ASTM C125, shall not be less than 2.3 nor more than 3.1.

3. Pea Gravel

Pea gravel bedding shall be clean washed material, hard and insoluble in water, free of mud, clay, silt, vegetation or other debris. Stone quality shall meet ASTM C 33. Size gradation shall be as follows:

SIEVE SIZE	% RETAINED BY WEIGHT
3/4"	0
1/2"	0-25
1/4"	90-100

Pea Gravel shall not exceed 35% loss as determined by the Los Angeles Abrasion test per TxDOT Test Method Tex-410-A.

4. Select Backfill or Borrow

This material shall consist of borrow or suitable material excavated from the trench. It shall be free of stones or rocks over 6 inches and shall have a plasticity index of less than 20. The moisture content at the time of compaction shall be within 2 percent of optimum as determined by TxDOT Test Method Tex-114-E. Sandy loam borrow will not be allowed unless shown on the Drawings or authorized by the Engineer.

All suitable materials from excavation operations not required for backfilling the trench may be placed in embankments, if applicable. All unsuitable materials that cannot be made suitable shall be considered surplus excavated materials as described in 510.3(M). The Contractor may, if approved by the Engineer, modify unsuitable materials to make them suitable for use. Modification may include drying, removal or crushing of over-size material, and lime or cement treatment.

5. Cement Stabilized Backfill

When indicated or directed by the Engineer, all backfill shall be with cement-stabilized backfill rather than the usual materials. Unless otherwise indicated, cement stabilized backfill material shall consist of a mixture of the dry constituents described for Class J Concrete. The cement and aggregates shall be thoroughly dry mixed with no water added to the mixture except as may be directed by the Engineer.

F. Backfill Materials

The Engineer may approve any of the following well graded materials:

1. Select trench material
2. Sand
3. Crushed rock cuttings
4. Rock cuttings
5. Foundation rock
6. Blasted material with fines and rock
7. Cement stabilized material
8. Borrow

Within the 100-year flood plain, sand will not be permitted for backfilling. The Engineer will approve the topsoil for areas to be seeded or sodded.

120.4 Construction Methods

A. General

Prior to commencing this Work, all erosion control and tree protection measures required shall be in place and all utilities located and protected as set forth in "General Conditions". Clearing the site shall conform to TxDOT Standard Specifications Item No. 100, "Preparing ROW". Maintenance of environmental quality protection shall comply with all requirements of "General Conditions" and TxDOT Standard Specifications Item No. 560, "Temporary Erosion, Sedimentation, and Environmental Controls."

The Contractor shall conduct his Work such that a reasonable minimum of disturbance to existing utilities will result. Particular care shall be exercised to avoid the cutting or breakage of all existing utilities. If at any time the Contractor damages the utilities in place through his operations, the Contractor shall immediately notify the owner of the utility to make the necessary repairs. When active wastewater sewer lines are cut in the trenching operations, temporary flumes shall be provided across the trench while open and the lines shall be restored when the backfilling has progressed to the original bedding lines of the sewer so cut.

The Contractor shall inform utility owners sufficiently in advance of the Contractor's operations to enable such utility owners to reroute, provide temporary detours or to make other adjustments to utility lines in order that the Contractor may proceed with his Work with a minimum of delay and expense. The Contractor shall cooperate with all utility owners

concerned in effecting any utility adjustments necessary and shall not hold New Braunfels Utilities liable for any expense due to delay or additional Work because of conflicts arising from existing utilities.

The Contractor shall do all trenching in accordance with the provisions and the directions of the Engineer as to the amount of trench left unfilled at any time. All excavation and backfilling shall be accomplished as indicated and in compliance with State Statutes.

Where excavation for a pipe line is required in an existing City street, a street cut permit is required and control of traffic shall be as indicated in accordance with the Texas Manual on Uniform Traffic Control Devices.

Wherever existing utility branch connections, sewers, drains, conduits, ducts, pipes or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated or reconstructed by the Contractor through cooperation with the owner of the utility, structure or obstruction involved. In those instances where their relocation or reconstruction is impractical, a deviation from line and grade will be ordered by the Engineer and the change shall be made in the manner directed.

Adequate temporary support, protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the Work shall be furnished by the Contractor, at his expense and as approved by the Engineer.

Where traffic must cross open trenches, the Contractor shall provide suitable bridges. For trenches less than 2 feet in width, sheet steel plates having a minimum thickness of 1/2 inch shall be used. For trenches up to 4 feet in width, sheet steel plates having a minimum thickness of 3/4 inches shall be used. In all cases, the plates shall overlay the top of the trench a minimum of 18 inches on both sides and secured by asphalt. Adequate provisions shall be made for the flow of sewers; drains and watercourses encountered during construction and any structures, which may have been disturbed, shall be satisfactorily restored upon completion of Work.

When rainfall or runoff is occurring or is forecast by the U.S. Weather Service, the Contractor shall not perform or attempt any excavation or other earth moving Work in or near the flood plain of any stream or watercourse or on slopes subject to erosion or runoff, unless given specific approval by the Engineer. When such conditions delay the Work, an extension of time for working day contracts will be allowed in accordance with "General Conditions".

B. Trench Excavation

1. General

Underground piped utilities shall be constructed in an open cut in accordance with Federal regulations, applicable State Statutes conforming to Item No. 121, "Trench Safety Systems" and with a trench width and depth described below. When pipe is to be constructed in fill above the natural ground, Contractor shall construct embankment to an elevation not less than one foot above the top of the pipe, after which trench is excavated. Required vertical sides shall be sheeted and braced as indicated to maintain the sides of the required vertical excavation throughout the construction period. Adequacy of the design of sheeting and bracing shall be the responsibility of the Contractor's design

professional. The Contractor shall be responsible for installation as indicated. After the pipe has been laid and the backfill placed and compacted to 12 inches above the top of the pipe, any sheeting, shoring and bracing required may be removed with special care to insure that the pipe is not disturbed. As each piece of sheeting is removed, the space left by its removal must be thoroughly filled and compacted with suitable material and provisions made to prevent the sides of the trench from caving until the backfill has been completed. Any sheeting left in place will not be paid for and shall be considered subsidiary to the pipe item bid.

2. Trench Width

Trenches for water and wastewater lines shall have a clear width on each side beyond the outside surfaces of the pipe bell or coupling of not less than 6 inches nor more than 12 inches.

If the trench width within the pipe zone exceeds this maximum, the entire pipe zone shall be refilled with approved backfill material, thoroughly compacted to a minimum of 95 percent of maximum density as determined by TxDOT Test Method Tex-114-E and then re-excavated to the proper grade and dimensions. Excavation along curves and bends shall be so oriented that the trench and pipe are approximately centered on the centerline of the curve, using short lengths of pipe and/or bend fittings if necessary.

For all utilities to be constructed in fill above natural ground, the embankment shall first be constructed to an elevation not less than 1 foot above the top of the utility after which excavation for the utility shall be made.

3. Trench Depth and Depth of Cover

All pipe and in-line appurtenances shall be laid to the grades indicated. The depth of cover shall be measured from the established finish grade, natural ground surface, subgrade for staged construction, street or other permanent surface to the top or uppermost projection of the pipe.

Where not otherwise indicated, all water piping shall be laid to the following minimum depths:

- a. Water piping installed in natural ground in easements or undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 48 inches of cover.
- b. Water piping installed in existing or proposed streets, roads or other traffic areas shall be laid with at least 48 inches of cover below finished grade.

Where not otherwise indicated, all wastewater piping shall be laid to the following minimum depths:

- (a) Wastewater piping installed in natural ground in easements or other undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 48 inches of cover.
- (b) Wastewater piping installed in existing or proposed streets, roads or other traffic areas shall be laid with at least 48 inches of cover below finished grade.

4. Classification of Excavation

Excavation will not be considered or paid for as a separate item of Work, so excavated material will not be classified as to type or measured as to quantity. Full payment for all excavation required for the construction shall be included in the various unit or lump sum Contract prices for the various items of Work installed, complete in place. No extra compensation, special treatment or other consideration will be allowed due to rock, pavement, caving, sheeting and bracing, falling or rising water, working under and in the proximity of trees or any other handicaps to excavation.

5. Dewatering Excavation

Underground piped utilities shall not be constructed or the pipe laid in the presence of water. All water shall be removed from the excavation prior to the pipe placing operation to insure a dry firm granular bed on which to place the underground piped utilities and shall be maintained in such unwatered condition until all concrete and mortar is set. Removal of water may be accomplished by bailing, pumping or by a well-point installation as conditions warrant.

In the event that the excavation cannot be dewatered to the point where the pipe bedding is free of mud, a seal shall be used in the bottom of the excavation. Such seal shall consist of Class B concrete, conforming to TxDOT Standard Specifications Item No. 421, "Hydraulic Cement Concrete", with a minimum depth of 3 inches.

6. Trench Conditions

Before attempting to lay pipe, all water, slush, debris, loose material, etc., encountered in the trench must be pumped or bailed out and the trench must be kept clean and dry while the pipe is laid and backfilled. Where needed, sump pits shall be dug adjoining the trench and pumped as necessary to keep the excavation dewatered.

Backfilling shall closely follow pipe laying so that no pipe is left exposed and unattended after initial assembly. All open ends, outlets or other openings in the pipe shall be protected from damage and shall be properly plugged and blocked watertight to prevent the entrance of trench water, dirt, etc. The interior of the pipeline shall at all times be kept clean, dry and unobstructed.

Where the soil encountered at established footing grade is a quicksand, saturated or unstable material, the following procedure shall be used unless other methods are indicated:

- a. All unstable soils shall be removed to a depth of a minimum 2 feet below bottom of piped utility or as required to stabilize the trench foundation. Such excavation shall be carried out for the entire trench width.
- b. All unstable soil so removed shall be replaced with a concrete seal, foundation rock or coarse aggregate materials placed across the entire trench width in uniform layers not to exceed 6 inches, loose measure and compacted by mechanical tamping or other means which shall provide a stable foundation for the utility.

Forms, sheathing and bracing, pumping, additional excavation and backfill required in unstable trench conditions shall be subsidiary to pipe bid.

7. Blasting

All blasting shall conform to the provisions of the "General Conditions" and/or "Public Safety and Convenience".

8. Removing Old Structures

When out of service masonry structures or foundations are encountered in the excavation, such obstructions shall be removed for the full width of the trench and to a depth of 1 foot below the bottom of the trench. When abandoned inlets or manholes are encountered and no plan provision is made for adjustment or connection to the new sewers, such manholes and inlets within the construction limits shall be removed completely to a depth 1 foot below the bottom of the trench. In each instance, the bottom of the trench shall be restored to grade by backfilling and compacting by the methods provided above. Where the trench cuts through storm or wastewater sewers which are known to be abandoned, these sewers shall be cut flush with the sides of the trench and blocked with a concrete plug in a manner satisfactory to the Engineer. When old structures are encountered, which are not visible from the existing surface and are still in service, they shall be protected and adjusted as required to the finished grade.

9. Lines and Grades

Grades, lines and levels shall be as indicated on the Construction Drawings. Any damage to the above by the Contractor shall be re-established at the Contractor's expense. The Contractor shall furnish copies of all field notes and "cut sheets" to New Braunfels Utilities.

The location of the lines and grades indicated on the Construction Drawings may be changed only by direction of the Engineer and it is understood that the Contractor will be paid on the basis of his unit Contract prices bid for such Work actually performed and shall make no claim for damages or loss of anticipated profits due to the change of location or grade.

The Contractor shall furnish, at his expense, all necessary batter boards or electronic devices for controlling the Work. Batter boards shall be of adequate size material and shall be supported substantially. The boards and all location stakes must be protected from possible damage or change of location. The Contractor shall furnish good, sound twilled lines for use in achieving lines and grades and the necessary plummets and graduated poles.

The Contractor shall submit to the Engineer at least 6 copies of any layout Drawings from the pipe manufacturer for review and approval. The Contractor shall submit the layout Drawings at least 30 days in advance of any actual construction of the project. The Engineer will forward all comments of the review to the Contractor for revision. Revisions shall be made and forwarded to the Engineer for his acceptance. Prior to commencement of the Project, reviewed layout Drawings will be sent to the Contractor marked for construction.

Should the Contractor's procedures not produce a finished pipe placed to grade and alignment, the pipe shall be removed and relayed and the Contractor's procedures modified to the satisfaction of the Engineer. No additional compensation shall be paid for the removal and relaying of pipe required above.

10. Surplus Excavated Materials

Excess material or material which cannot be made suitable for use in embankments will be declared surplus by the Engineer and shall become the property of the Contractor to dispose of off site at a permitted fill site, without liability to the NBU or any individual. Such surplus material shall be removed from the Work site promptly following the completion of the portion of the utility involved.

C. Pipe Bedding Envelope

Pipe shall be installed in a continuous bedding envelope of the type shown on the drawings or as described herein. The envelope shall extend the full trench width, to a depth of 6 inches below the pipe and to 12 inches above water and wastewater pipe.

D. Laying Pipe

No pipe shall be installed in the trench until excavation has been completed, the bottom of the trench graded and the trench completed as indicated.

E. Concrete Encasement, Cradles, Caps and Seals

Where called for by the Engineer, or when trench foundation is excessively wet or unstable or installation of water or wastewater pipe will result in less than 48 inches of cover, Contractor shall notify Engineer. Engineer may require Contractor to install a concrete seal, cradle, cap, encasement or other appropriate action.

All concrete cap, etc., shall be continuous and begin and end within 6 inches of pipe joints. Concrete cap, cradle and encasement shall conform to NBU Standard Detail No. 421, "Concrete Trench Cap". The pipe shall be well secured to prevent shifting or flotation while the concrete is being placed.

F. Anchorage Bulkheads

Concrete bulkheads keyed into the undisturbed earth shall be placed as indicated to support and anchor the pipe and/or backfill against end thrust, slippage on slopes, etc. Concrete material and placement shall be Class A, TxDOT Item No. 421, "Hydraulic Cement Concrete".

G. Trench Caps, Concrete Rip-Rap and Shaped Retards

Where called for by the Contract or as directed by the Engineer, concrete trench caps, concrete rip-rap and/or shaped retards shall be placed as detailed by the Drawings as protection against erosion. Concrete material and placement shall be Class B as defined in TxDOT Item No. 421, "Hydraulic Cement Concrete".

H. Backfilling and Compaction

1. General

Special emphasis is placed upon the need to obtain uniform density throughout the backfill material. The maximum lift of backfill shall be determined by the compaction equipment selected and in no case shall it exceed 18 inches, loose measurement.

No heavy equipment, which might damage pipe, will be allowed over the pipe until sufficient cover has been placed and compacted. All internal pipe bracing installed or recommended by the manufacturer shall be kept in place until the pipe bedding and trench backfill have been completed over the braced pipe section. Testing of the completed backfill in streets and under and around structures shall meet the specified density requirements. Initial testing shall be at the Contractor's expense and conform to the "General Conditions."

Backfill shall be free of debris, roots, organic matter, rock or gravel larger than 6 inches in any dimension, or any other harmful matter.

2. Backfill in Street Right of Way

Placement of backfill under existing or future pavement structures and within 2 feet of any structures shall be compacted to the required density using any method, type and size of equipment, which will give the required compaction without damaging the pipe or bedding. Placement of backfill greater than 2 feet beyond structures in Right of Way shall be conform to (6.) below. The depth of layers, prior to compaction, shall depend upon the type of sprinkling and compacting equipment used and the test results thereby obtained. Prior to and in conjunction with the compaction operation, each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept level to insure uniform compaction over the entire layer. Testing for density shall be in accordance with Test Method Tex-114-E and Test Method Tex-115-E.

Each layer of backfill must provide the density as required herein. Swelling soils (soils with plasticity index of 20 or more) shall be sprinkled as required to provide not less than optimum moisture nor more than 2 percent over optimum moisture content and compacted to the extent necessary to provide not less than 98 percent nor more than 102 percent of the density as determined in accordance with Test Method Tex-114-E. Non-swelling soils (soils with plasticity index less than 20) shall be sprinkled as required and compacted to the extent necessary to provide not less than 98 percent of the density as determined in accordance with Test Method Tex-114-E.

After each layer of backfill is complete, tests may be made by the Engineer. If the material fails to meet the density indicated, the course shall be reworked as necessary to obtain the indicated compaction and the compaction method shall be altered on subsequent Work to obtain indicated density.

At any time, the Engineer may order proof rolling to test the uniformity of compaction of the backfill layers. All irregularities, depressions, weak or soft spots that develop shall be corrected immediately by the Contractor.

Should the backfill, due to any reason, lose the required stability, density or finish before the pavement structure is placed, it shall be recompacted and refinished at the sole

expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling, sealing or covering with a subsequent backfill layer or granular material. Excessive loss of moisture shall be construed to exist when the subgrade soil moisture content is more than 4 percent below the optimum of compaction ratio density. Backfill shall be placed from the top of the bedding material to the existing grade, base course, subgrade or as indicated. The remainder of the street backfill shall be Flexible Base, Concrete or Hot Mix Asphalt Concrete as indicated or be replaced in kind to the surface removed to construct the pipe.

3. Backfill in County Street or State Highway Right of Way

All Work within the right of way shall meet the requirements of (2.) above, as a minimum and shall meet the requirements of the permit issued by the County when their requirements are more stringent. Prior to the start of construction, the Contractor shall be responsible for contacting the appropriate TxDOT office or County Commissioner's Precinct Office and for coordinating his activities with the operating procedures in effect for utility cut permits and pavement repair under their jurisdiction. Approval for all completed Work in the State or County right of way shall be obtained from the appropriate Official prior to final payment by the Owner.

4. Backfill in Railroad Right of Way

All Work within the railroad right of way shall meet the requirements of (3.) above, as a minimum and shall meet the requirements of the permit issued by the Railroad Owner when their requirements are more stringent. Approval for all completed Work in the railroad right of way shall be obtained from the Railroad prior to Final Completion.

5. Backfill in Easements

Where not otherwise indicated, Contractor may select whatever methods and procedures may be necessary to restore entire Work area to a safe, useful and geologically stable condition with a minimum density of 95 percent or a density superior to that prior to construction.

In and near flood plain of all streams and watercourses, under or adjacent to utilities, structures, etc. all backfill shall be compacted to a density of not less than 95 percent conforming to TxDOT Test Method Tex-114-E, unless otherwise directed by Engineer.

All soil areas disturbed by construction shall be covered with top soil and seeded conforming to TxDOT Item No. 164, "Seeding for Erosion Control". All turf, drainways and drainage structures shall be constructed or replaced to their original condition or better. No debris shall remain in the drainways or drainage structures.

I. Quality Control Testing.

The Contractor shall be responsible for compaction in accordance with the appropriate Specification. Compaction tests may be done at one location point randomly selected or as indicated by the NBU Inspector, per each 12 inch loose lift per 400 linear feet. These tests shall be performed by a nationally-accredited, independent testing laboratory. Payment for

such tests shall be the responsibility of the Contractor, including the material proctor tests and density tests.

Any failed test shall require the Contractor to remove and replace that layer of backfill to 50 feet from either side from the failed test location. The Contractor will also be required at no cost to NBU to provide two additional tests at the replaced location where the initial test failed and at one location point, randomly selected or as indicated by the NBU Inspector.

J. Cleanup and Restoration

It shall be the Contractor's responsibility to keep the construction site neat, clean and orderly at all times. Cleanup shall be vigorous and continuous to minimize traffic hazards or obstructions along the streets and to driveways. Trenching, backfill, pavement repair (as necessary), and cleanup shall be coordinated as directed by the Utility. The Engineer will regulate the amount of open ditch and may halt additional trenching if cleanup is not adequate to allow for orderly traffic flow and access.

Materials at the site shall be stored in a neat and orderly manner so as not to obstruct pedestrian or vehicular traffic. All damaged material shall be removed from the construction site immediately and disposed of in a proper manner. All surplus excavated materials become the property of the Contractor for disposal at his expense. After trenching, the Contractor shall immediately remove all excavated materials unsuitable for or in excess of, backfill requirements. Immediately following the pipe laying Work as it progresses, the Contractor shall backfill, grade and compact all excavations as provided elsewhere and shall immediately clean up and remove all unused soil, waste and debris and restore all surfaces and improvements to a condition equal or superior to that before construction began and to an appearance which complements the surroundings. The Contractor shall grade and dress the top 6 inches of earth surfaces with soil or other material similar and equal to the surrounding, fill and smooth any visible tracks or ruts, replace and re-establish all damaged or disturbed turf or other vegetation and otherwise make every effort to encourage the return of the entire surface and all improvements to a pleasant appearance and useful condition appropriate and complementary to the surroundings and equal or similar to that before construction began.

Permanent pavement replacement, if necessary, shall begin immediately after all testing of each segment of piping is satisfactorily completed.

120.5 Measurement

Work under this item shall be considered subsidiary to the Work covered under Item 510, "Pipe" unless specified as a separate bid item. The concrete seal, foundation rock or coarse aggregate when used as directed in unstable material will be paid for at the unit price bid per cubic yard, which shall be full payment for all excavation and removal of unsuitable material and furnishing, placing and compacting the foundation rock, coarse aggregate or other approved material all complete in place. Excavation and backfill, when included as a separate pay item, will be paid for by the designated Pay Item.

A. Concrete Cradles and Seals

When called for in the Bid, concrete cradles and seals will be paid for at the unit Contract price bid per linear foot for the size of pipe specified, complete in place.

B. Concrete Retards

When called for in the Bid, Concrete retards will be paid under respected bid Item, "Concrete Retards".

C. Concrete Trench Cap and Encasement

Where the distance between the top of the concrete encasement and the top of the trench cap is less than 36 inches, the concrete cap and encasement shall be poured as one unit and paid for under this bid item at the Contract price bid per linear foot. When the distance above is greater than 36 inches or when the trench cap is placed separately, the trench cap shall be paid for as a separate item, per linear foot, complete in place.

D. Cement-Stabilized Backfill

Cement-stabilized backfill will be paid for at the unit price bid per linear foot and shall be full payment to the Contractor for furnishing and installing the required material, mixed, placed and cured complete in place.

E. Concrete Encasement

When called for in the Bid, Concrete Pipe Encasement will be paid under respected bid Item, "Encasement and Encasement Pipe".

F. Trench Safety Systems

When called for in Bid, Trench Safety Systems shall conform to Item No. 121, "Trench Safety Systems".

120.6 Payment

Payment, when included as a Contract pay item, will be made under one of the following:

- Pay Item:** Pipe Excavation, ___Ft. Width Per Linear Foot.
- Pay Item:** Pipe Trench Backfill, ___Ft. Width Per Linear Foot.
- Pay Item:** Concrete Seal or Cradle, ___Dia. Pipe Per Linear Foot.
- Pay Item:** Concrete Trench Cap, ___Ft. Width Per Linear Foot.
- Pay Item:** Concrete Cap and Encasement, ___Dia. Pipe Per Linear Foot.
- Pay Item:** Cement Stabilized Backfill, ___Dia. Pipe Per Linear Foot.

End