Item No. 601
Salvaging and Placing Topsoil

601.1 Description

This item shall govern the removal, storage and placement of approved topsoil to the depths and area shown on the Drawings or as directed by the Engineer or designated representative.

601.2 Submittals

The submittal requirements of this specification item shall include the test results and soil classification necessary for approval of material as suitable topsoil.

601.3 Materials

A. Topsoil

The topsoil shall be a clean, friable, fertile soil with a relatively high erosion resistance, free of objectionable materials including roots and rocks larger than 1 1/2 inches and readily able to support the growth of planting, seeding and sodding.

B. Water

Water shall be furnished by the Contractor and shall be clean and free from industrial wastes and other objectionable matter.

601.4 Sources

The topsoil may be obtained from the right-of-way at sites of proposed excavation or embankment when shown on the Drawings or identified by the Engineer or designated representative. The approximate quantity of acceptable topsoil to be salvaged from the project will be shown on the Drawings. The topsoil may also be obtained from approved sources, which are located outside the right-of-way and have been secured by the Contractor.

601.5 Construction Methods

Precautions will be maintained at all times to protect all trees in the area of construction. Where removal of trees is indicated on the Drawings, they shall be marked as directed by the Engineer or designated representative.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings and/or specified in the Contract Documents. Topsoil materials shall not be placed within the drip line of trees until tree wells are constructed that conform to, "Preservation of Trees and Other Vegetation". The source and stockpile areas shall be kept drained, insofar as practicable, during the period of topsoil removal

The existing topsoil shall be removed from the area indicated on the Drawings, stockpiled in a windrow along the right of way or spread over an area that is ready for topsoil application in accordance with the Drawings or as directed by the Engineer or designated representative.

Trash, wood, brush, stumps, rocks over 1 1/2 inches in size and other objectionable material encountered shall be removed and disposed of as directed by the Engineer or designated representative prior to beginning of work required by this item. Grass and other herbaceous plant materials may remain. Large clumps shall be broken up.

After the grading has been completed to the required alignment, grades and cross-sections and prior to the spreading of the salvaged topsoil, any clay or tight soil surfaces shall be scarified by plowing furrows approximately 4 inches deep along horizontal slope lines at 2 foot vertical intervals. The spreading of the salvaged topsoil shall be undertaken as soon as the grading has been completed. The topsoil shall be spread so as to form a cover of uniform thickness indicated. After the topsoil has been placed and shaped, it shall be sprinkled and rolled to provide a suitable seed bed.

601.6 Measurement and Payment

Salvaging, removal and/or placing topsoil materials will not be measured for payment, but shall be considered subsidiary to other items of work.

End

Item No. 602
Sodding for Erosion Control

602.1 Description

This item shall govern planting of Bermuda grass; St. Augustine or other acceptable grass sod at locations indicated on the Drawings or as directed by the Engineer or designated representative in accordance with this Standard Specification Item.

602.2 Submittals

The submittal requirements for this specification item shall include the identification of the type and source of sodding, the type of mulch, type of tacking agent and type and rate of application of fertilizer.

602.3 Materials

A. Block and Mulch Sod

The sod shall consist of live, growing Bermuda Grass, St. Augustine grass, when shown on the Drawings, or other acceptable grass sod indicated on the Drawings secured from sources that are approved by the Engineer or designated representative. Bermuda Grass sod, St. Augustine sod or other grass sod as shown on the Drawings shall have a healthy, virile root system of dense, thickly matted roots throughout the soil of the sod for a minimum thickness of 1 inch. The thickness measure does not include grass. The sod shall be cut in rectangular pieces with its shortest side not less than 12 inches. The Contractor shall not use sod from areas where the grass is thinned out nor where the grass roots have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted.

The sod shall be substantially free from noxious weeds, Johnson grass or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. Unless the area has been closely pastured, it shall be closely mowed and raked to remove all weeds and long standing stems. Sources from which sod is to be secured shall be approved by the Engineer or designated representative.

Care shall be taken at all times to retain the native soil of the roots of the sod during the process of excavating, hauling and planting. Sod material shall be kept moist from the time it is dug until it is planted. The sod existing at the source shall be watered to the extent required by the Engineer or designated representative prior to excavating.

B. Fertilizer

Fertilizer and the rate of application shall conform to the requirements of Standard Specification Item No. 606S, "Fertilizer".

C. Mulch

Straw mulch shall be oat, wheat or rice straw. Hay mulch may be substituted for straw mulch and shall be Prairie Grass; Bermuda grass or other hay approved by the Engineer or designated representative. The hay or straw mulch shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be molded or rotted.

D. Water

Water shall be furnished by the Contractor and shall be clean and free of industrial wastes and other substances harmful to the growth of sod or to the area irrigated.

E. Tacking Agents

Tacking agents for straw or hay mulch shall be as shown on the Drawings.

602.4 Planting Season

All planting shall be done between April and November except as specifically authorized in writing by the Engineer or designated representative.

602.5 Construction Methods

A. General

After the designated areas have been completed to the lines, grade and cross sections indicated on the Drawings, the surface shall be worked to a depth of not less than 4 inches with a disc, tiller or other equipment approved by the Engineer or designated representative. Fertilizer nutrients shall be applied and tilled. Areas that become crusted shall be reworked to an acceptable condition before sodding. Sodding of the type specified shall conform to the requirements of this Specification Item. The Contractor shall give continuous care to the sodded area until the sod is accepted.

B. Placement

The sod shall be placed on the prepared surface with the edges in close contact and alternate courses staggered. In ditches the sod shall be placed with the longer dimension perpendicular to the flow of water in the ditch. On slopes, starting at the bottom of the slope, the sod shall be placed with the longer dimension parallel to the contours of the ground. The exposed edges of sod shall be buried flush with the adjacent soil. On slopes exceeding 3:1 or where the sod may be displaced, the sod shall be pegged with not less than 4 stakes or ground staples per square yard with at least 1 stake or ground staple for each piece of sod.

Pegs shall be of wood lath or similar material, pointed and driven with the flat side against the slope, 6 inches into the ground, leaving approximately 1/2 inch of the top above the ground. Ground staples shall not be less than 13 inches in length and shall be constructed of No. 11 gage wire that is bent to form a "U" approximately 1 inch in width.

C. Watering

Immediately after the area is sodded, it shall be watered with a minimum of 5 gallons of water per square yard and at 10 day intervals as needed and as directed by the Engineer or designated representative. Subsequent to the initial application water shall be applied at a minimum rate of 3 gallons per square yard, as required on the Drawings or as directed by the Engineer or designated representative until final acceptance by the City or until the grass uniformly reaches a height of 2 1/2 inches.

D. Finishing

Where applicable, the shoulders, slopes and ditches shall be smoothed after planting has been completed and shaped to conform to the desired cross sections shown on the Drawings. Any excess soil from planting operations shall be spread uniformly over adjacent areas or disposed of as directed by the Engineer or designated representative so that the completed surfaces will present a neat appearance. All sodded areas shall be rolled after the initial watering application, when sufficiently dry.

602.6 Block Sodding

At locations indicated on the Drawings or where directed by the Engineer or designated representative, sod blocks shall be carefully placed on the prepared areas. The fertilizer shall then be applied in accordance with the applicable provisions of Item No. 606S, "Fertilizer" and thoroughly watered. When sufficiently dry, the sodded area shall be rolled or tamped to form a thoroughly compacted, solid mat. Any voids left in the block sodding shall be filled with additional sod and tamped. Surfaces of block sod which, in the opinion of the Engineer or designated representative may slide due to the height and slope of the surface or nature of the soil, shall be pegged with wooden pegs driven through the sod blocks into firm earth sufficiently close to hold the block sod firmly in place. Edges along curbs and drives, walkways, etc., shall be carefully trimmed and maintained until the sodding is accepted.

602.7 Mulch Sodding

The sod source shall be disked in 2 directions cutting the sod thoroughly to a depth of not less than 4 inches. Sod material shall be excavated to a depth of not more than 2 inches below the existing root system, being careful to avoid having soil containing no grass roots. The disked sod may be windrowed or otherwise handled in a manner satisfactory to the Engineer or designated representative. The material shall be rejected if not kept in a moist condition.

Prior to placement of mulch sod, the cut slopes shall be scarified by plowing furrows 4 inches to 6 inches deep along horizontal slope lines at 2 foot vertical intervals. Excavated material from the furrows shall not protrude more than 3 inches above the original surface of the cut. Fertilizer shall be distributed uniformly over the area in accordance with the applicable provisions of, "Fertilizer". The sod shall then be

deposited upon the prepared area and spread uniformly to the thickness indicated on the Drawings.

Any section that is not true to lines and cross sections shall be remedied by the addition of sod material or by reshaping the material to meet the requirements of "Finishing". After the sod material has been spread and shaped, it shall be thoroughly wetted and compacted with a corrugated roller of the "Cultipacker" type. All rolling of slope areas shall be on the contour.

602.8 Measurement

Work and acceptable material for "Sodding for Erosion Control" will be measured by the square yard complete in place with a minimum of 95 percent growth with a 2 1/2 inch stand of grass.

602.9 Payment

Work performed under this item will be considered subsidiary to other items of work unless a sperate bid item is provided in the contract documents, then work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price for Bermuda Block Sodding", "St. Augustine Block Sodding", "Bermuda Mulch Sodding" or "Other Approved Grass Sodding". The prices shall each represent full compensation for completion of the work including all water applications, rolling, pegging and fertilizer as indicated on the Drawings.

Payment will be made under one of the following:

Pay Item:	Bermuda Block Sodding -	Per Square Yard.
Pay Item:	St. Augustine Block Sodding -	Per Square Yard.
Pay Item:	Bermuda Mulch Sodding -	Per Square Yard.
Pay Item:	Grass Sodding -	Per Square Yard.

End

Item No. 604
Seeding for Erosion Control

604.1 Description

This item shall consist of preparing a seed bed to the lines and grades indicated, sowing of seeds, fertilizing, mulching with straw, asphalt, cellulose fiver, wood fiber and other management practices along and across such areas as are indicated or as directed by the Engineer/Architect/Landscape Architect.

604.2 Submittals

The submittal requirements for this specification item shall include:

A. Identification of the type, source, mixture, PLS and rate of application of the seeding.

B. Type of mulch.

C. Type of tacking agent.

D. Type and rate of application of fertilizer.

604.3. Materials

A. **Seeds**. All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing pure live seed (PLS), name and type of seed. The seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within nine months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Engineer or designated representative.

   The amount of seed planted per acre (hectare) shall be of the type specified in sections 604.5 and 604.6.

B. **Water**. Water shall be clean and free of industrial wastes and other substances harmful to the growth of grass or the area irrigated.

C. **Top Soil**. Topsoil shall conform to Standard Specification, "Borrow".

D. **Fertilizer**. The fertilizer shall conform to Standard Specification, "Fertilizer". The fertilizer used shall have an analysis of 15-15-15, homogeneous 13-13-13 or the analysis indicated.

E. **Straw Mulch or Hay Mulch**. Straw Mulch shall be oat, wheat, or rice straw. Hay mulch shall be prairie grass, Bermuda grass, or other hay approved by the Engineer or designated representative. The straw or hay shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be molded or rotted.

F. **Tacking Agents**. The tacking agent shall be a biodegradable tacking agent, approved by the Engineer or designated representative.

G. **Cellulose Fiber Mulch (Natural Wood)**. Cellulose Fiber Mulch shall be natural cellulose fiber mulch produced from grinding clean whole wood chips. The mulch

shall be designed for use in conventional mechanical planting, hydraulic planting of seed or hydraulic mulching of grass seed, either alone or with fertilizers and other additives. The mulch shall be such, that when applied, the material shall form a strong, moisture-retaining mat without the need of an asphalt binder.

H. **Recycled Paper Mulch**. Recycled paper mulch shall be specifically manufactured from post-consumer paper and shall contain a minimum of 85% recycled paper content by weight, shall contain no more than 15% moisture and 1.6% ash, and shall contain no growth inhibiting material or weed seeds. The recycled paper mulch shall be mixed with grass seed and fertilizer for hydro-seeding/mulching, erosion control, and a binder over straw mulch. The mulch, when applied, shall form a strong, moisture-retaining mat of a green color without the need of an asphalt binder.

604.4 Construction Methods

A. **Preparing Seed Bed**. After the designated areas have been rough graded to the lines, grades and typical sections indicated in the Drawings or as provided for in other items of this contract and for any other soil area disturbed by the construction, a suitable seedbed shall be prepared. The seedbed shall consist of a minimum of either 4 inches of approved topsoil or 4 inches of approved salvaged topsoil, cultivated and rolled sufficiently to reduce the soil to a state of good tilth, when the soil particles on the surface are small enough and lie closely enough together to prevent the seed from being covered too deeply for optimum germination. The optimum depth for seeding shall be 1/4 inch. Water shall be gently applied as required to prepare the seedbed prior to the planting operation either by broadcast seeding or hydraulic planting. Seeding shall be performed in accordance with the requirements hereinafter described.

B. **Watering**. All watering shall comply with City Ordinances. Broadcast seeded areas shall immediately be watered with a minimum of 5 gallons of water per square yard or as needed and in the manner and quantity as directed by the Engineer or designated representative. Hydraulic seeded areas and native grass seeded areas shall be watered commencing after the tackifier has dried with a minimum of 5 gallons of water per square yard or as needed to keep the seedbed in a wet condition favorable for the growth of grass.

Watering applications shall constantly maintain the seedbed in a wet condition favorable for the growth of grass. Watering shall continue until the grass is uniformly 1 1/2 inches in height and accepted by the Engineer or designated representative. Watering can be postponed immediately after a 1/2 inch or greater rainfall on the site but shall be resumed before the soil dries out.

604.5 Non-Native Seeding

A. **Method A - Broadcast Seeding**. The seed or seed mixture in the quantity specified shall be uniformly distributed over the prepared seedbed areas indicated on the Drawings or where directed by the Engineer or designated representative. If the sowing of seed is by hand, rather than by mechanical methods, the seed shall

be sown in two directions at right angles to each other. If mechanical equipment is used, all varieties of seed, as well as fertilizer, may be distributed at the same time, provided that each component is uniformly applied at the specified rate. After planting, the planted area shall be rolled with a corrugated roller of the "Cultipacker" type. All rolling of the slope areas shall be on the contour.

Seed Mixture and Rate of Application for Broadcast Seeding:

From September 15 to March 1, seeding shall be with a combination of unhulled Bermuda Grass at a rate of 2 pounds per 1000 square feet and winter rye at a rate of 7 pounds per 1000 square feet that has a PLS (pure live seed or purity x germination) of 0.83.

From March 1 to September 15, seeding shall be with hulled Bermuda Grass at a rate of 2 pounds per 1000 square feet with a PLS = 0.83. Fertilizer shall be applied and shall conform, "Fertilizer".

B. **Method B - Hydraulic Planting**. The seedbed shall be prepared as specified above and hydraulic planting equipment, which is capable of placing all materials in a single operation, shall be used.

March 1 to September 15

Hydraulic planting mixture and minimum rate of application pounds per 1000 square feet:

Hulled Bermuda Seed (PLS=0.83)	Fiber Mulch		Soil Tackifier
	Cellulose	Wood	
1 Lbs/1000 ft^2	45.9 Lbs/1000 ft^2		1.4 Lbs/1000 ft^2
		57.4 Lbs/1000 ft^2	1.5 Lbs/1000 ft^2

Water soluble fertilizer shall be added at a rate of 15 lbs. per 1000 square feet.

September 15 to March 1

Add 7 pounds per 1000 square feet of winter rye with a PLS = 0.83 to above mixture. The fertilizer shall conform to Standard Specification, "Fertilizer".

604.6 Native Grass Seeding

The seedbed shall be prepared as specified above. The seed mixture and the rate of application shall be as follows:

Description	Application rates Lbs/1000 $feet^2$
Lometa Indiangrass	0.1
PremierSideoats grama	0.2

Green spangletop	0.1
Buffalo Grass	0.2
Little Bluestem	0.2
Blue grama grass	0.2
Total Seeding Rate	1.0

Species substitution as necessary due to availability shall be approved by the Engineer or designated representative. Watering and fertilizer application shall follow procedures outlined above or as otherwise specified on the Drawings.

Seed shall be applied by broadcast or drill method and shall be distributed evenly over the topsoiled areas. Mulching shall immediately follow seed application.

604.7. Mulch

A. **Straw Mulch**

Straw mulch shall be spread uniformly over the area indicated or as designated by the Engineer or designated representative at the rate of 2 to 2 1/2 tons of straw per acre. The actual rate of application will be designated by the Engineer or designated representative. Straw may be hand or machine placed and adequately secured.

B. **Fiber Mulch**

Cellulose and wood fiber mulch shall be spread uniformly over the area indicated or as designated by the Engineer or designated representative at the rate of 45 to 80 lbs. per 1000 square feet.

C. **Recycled Paper Mulch**

Recycled paper mulch shall be spread over the area indicated on the Drawings or as designated by the Engineer or designated representative at a rate that will provide 100% coverage.

D. **Shredded Brush Mulch**

Small brush or tree limbs except Juniper, which have been shredded, may be used for mulching Native Grass seeding.

604.8 Measurement

Work and acceptable material for "Seeding for Erosion Control" will be measured by the square yard (meter: 1 meter equals 1.196 square yards) or by the acre (hectare: 1 hectare equals 2.471 acres), complete in place, with a minimum of 95 percent coverage with no bare areas exceeding 16 square feet (1.5 square meters) and a 1 1/2 inch (40 millimeters) stand of grass. Bare areas shall be reprepared and reseeded as required to develop an acceptable stand of grass.

604.9 Payment

The work performed and materials furnished and measured will be paid for at the unit bid price for "Seeding for Erosion Control" of the method specified on the Drawings and type of mulch. The unit bid price shall include full compensation for furnishing all materials, including all topsoil, water, seed, tackifier, fertilizer, or mulch and for performing all operations necessary to complete the work.

All fertilizer will be measured and paid for conforming to, "Fertilizer".

Payment will be made under one of the following:

Pay Item: Non-Native Seeding for Erosion Control Method, _____ Mulch Per Sq Yard.
Pay Item: Non-Native Seeding for Erosion Control Method, _____ Mulch Per Acre.
Pay Item: Mulch, Per Square Yard.
Pay Item: Mulch, Per Acre.

End

Item No. 605
Soil Retention Blanket

605.1 Description

This item shall govern the provision and placement of wood, straw or coconut fiber mat, synthetic mat, paper mat, jute mesh or other material as a soil retention blanket for erosion control on slopes or ditches or short-term or long-term protection of seeded or sodded areas indicated on the Drawings or as specified by the Engineer or designated representative.

605.2 Submittals

The submittal requirements for this specification item shall include the soil retention blanket material type and sample, evidence that the material is listed on TxDoT/TTI Approved Products List, one (1) full set of Manufacturer's literature and installation recommendations, and any special details necessary for the proposed application.

605.3 Materials

A. Soil Retention Blankets

All soil retention blankets must be listed on TxDoT Approved Products List or approved by the Engineer or designated representative.

The soil retention blanket shall be one (1) of the following classes and types as shown on the Drawings:

1. Class 1. "Slope Protection"
   (a) Type A. Slopes 1:3 or flatter - Clay soils
   (b) Type B. Slopes 1:3 or flatter - Sandy soils
   (c) Type C Slopes steeper than 1:3 - Clay soils
   (d) Type D Slopes steeper than 1:3 - Sandy soils
2. Class 1. "Flexible Channel Liner"
   (a) Type E Short-term duration (Up to 2 years)
   Shear Stress (t_d) < 1 pound per square foot [psf]
   (b) Type F Short-term duration (Up to 2 years)
   Shear Stress (t_d) 1 to 2 psf
   (c) Type G Long-term duration (Longer than 2 years)
   Shear Stress (t_d) >2 to <5 psf
   (d) Type H Long-term duration (Longer than 2 years)
   Shear Stress (t_d) $\geq$ 5 psf

B. Fasteners

The fasteners shall conform to the recommendations of the manufacturer for the selected soil retention blanket.

605.4 Construction Methods

A. General

The soil retention blanket shall conform to the class and type shown on the Drawings. The Contractor has the option of selecting an approved soil retention blanket conforming to the class and type shown on the Drawings which is included on the Approved Products List published by TxDoT/TTI Hydraulics and Erosion Control Laboratory.

B. Site Preparation:

Prior to placement of the soil retention blanket, the seedbed area to be covered shall be relatively free of all clods and rocks over 1 1/2 inches in maximum dimension and all sticks or other foreign matter that will prevent close contact of the preparation mat with the soil surface. The area shall be smooth and free of ruts and other depressions. If the prepared seedbed becomes crusted or eroded as a result of rain or if any eroded places, ruts or depressions exist for any reason, the Contractor shall be required to rework the soil until it is smooth and to reseed or resod the area at the Contractor's own expense. After the area has been properly prepared, the blanket shall be laid out flat, even and smooth, without stretching or crimping the material.

C. Installation

The Soil Retention Blanket, whether installed as slope protection or as flexible channel liner in accordance with the TxDoT/TTI Approved Products List, shall be placed within 24 hours after seeding or sodding erosion control operations have been completed, or as approved by the Engineer or designated representative. The soil retention blanket shall be installed and anchored in accordance with the Manufacturer's recommendations. The Contractor shall contact the Engineer or designated representative three (3) days prior to the installation of the soil retention blanket to allow for inspection of the installation by New Braunfels Utilities personnel.

605.5 Measurement

This work and acceptable material for "Soil Retention Blanket" will be measured by the square yard of surface area covered, complete in place.

605.6 Payment

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit bid price for "Soil Retention Blanket" of the class shown on the Drawings or approved by the Engineer or designated representative. The unit price shall include full compensation for furnishing all materials, labor, tools, equipment and incidentals necessary to complete the work. Anchors, checks, terminal and wire staples will not be paid for directly, but will be considered as subsidiary to this Item.

Payment will be made under the following:

Pay Item: Soil Retention Blanket Class___; Type __- Per Square Yard.

End

Item No. 606
Fertilizer

606.1 Description

This item shall govern the provision and distribution of fertilizer in accordance with these specifications.

606.2 Materials

All fertilizer used on site shall be delivered in bags or containers, which are clearly labeled and show the analysis. The fertilizer may be subject to testing by the State Chemist in accordance with the Texas Fertilizer Law. A pelleted or granulated fertilizer shall be used with an analysis indicated below. The figures in the analysis represent the percent of nitrogen, phosphoric acid and potash nutrients, respectively, as determined by the methods of the Association of Official Agricultural Chemists. Fifty percent or greater of the Nitrogen required shall be in the form of Nitrate Nitrogen ($N0_3$). The remaining Nitrogen required may be in the form of Urea Nitrogen [$CO(NH_2)_2$].

In the event it is necessary to substitute a fertilizer of a different analysis, it shall be a pelleted or granulated fertilizer with a lower concentration. The total amount of nutrients furnished and applied per acre shall equal or exceed that specified for each nutrient.

606.3 Construction Methods

Pelleted or granulated fertilizer shall be applied uniformly over the area specified to be fertilized and in the manner directed for the particular item of work. The fertilizer shall be dry and in good physical condition. Fertilizer that is powdered or caked will be rejected. Distribution of the fertilizer for the particular item of work shall meet the approval of the Engineer.

Unless otherwise indicated, fertilizer shall be applied uniformly at the following rate:

FERTILIZER APPLICATION

USE	TYPE	NEW CONSTRUCTION POUND PER ACRE	FERTILIZING ANALYSIS NEW PLANTING	MAINTENANCE
Broadcast Seeding	Any	400	15-15-15	15-10-5
Hydraulic Planting	Water Soluble	653	15-15-15	15-10-5
Sodding	Any	300	15-15-15	15-10-5
Trees	Any	—	16-8-0	15-15-15
Damaged Trees	Any	—	16-8-0	15-15-15
Shrubs and Plants	Any	—	16-8-0	15-15-15

Maintenance fertilizing shall be applied every 6 months after the new sod or grass is placed or until the work is accepted by the City.

606.4 Measurement

Work and acceptable material for "Fertilizer" will be measured by the normal ton of 2,000 pounds or by the 100 pounds as determined by approved scales or guaranteed weight of sacks shown by the manufacturer.

606.5 Payment

The work performed and materials furnished and measured as provided under "Measurement" will be considered subsidiary to other items in the contract unless shown in the Bid as a Pay Item, in which case it will be paid for at the unit price bid for "Fertilizer" of the analysis specified, which price shall be full compensation for furnishing all materials and performing all operations necessary to complete the work.

When fertilizer is specified on the Drawings as a pay item, the work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price for "Fertilizer" of the analysis specified on the Drawings. The unit bid price shall include full compensation for furnishing all materials and performing all operations necessary to complete the work.

Payment, when specified, will be made under one of the following:

Pay Item No. 606-A:	Fertilizer	Per Ton.
Pay Item No. 606-B:	Fertilizer	Per 100 Pounds.

End

Item No. 610
Preservation of Trees and Other Vegetation

610.1 Description

This item shall govern the proper care and treatment of all trees and other vegetation in the vicinity of any development activity.

610.2 Submittals

The submittal requirements for this specification item shall include:

A. Identification of the location, type of protective fencing (i.e. A, B or C), materials of construction and installation details;

B. Proposed tree dressing;

C. Type, location and construction details for proposed tree wells;

D. Location, type, materials of construction and installation details for permeable paving;

E. Type and rate of application of fertilizer;

610.3 Materials

A. Protective Fencing

Protective fencing is designated as the materials used to protect the root zones of trees as illustrated in New Braunfels Utilities (NBU) Standard Detail 510. Three basic types of protective fencing materials are allowed. Type A and Type B are typical applications and shall be installed where damage potential to a tree root system is high, while Type C shall be installed where damage potential is minimal. The specific type of protective fencing for the work shall be as indicated on the Drawings. Type C fence materials shall be subject to approval by the Engineer or designated representative. Type C fencing shall be replaced by Type A or Type B fencing as directed by the Engineer or designated representative if it fails to perform the necessary function.

1. Type A Chain Link fence (Typical Application-high potential damage)

   Type A protective fencing shall be installed in accordance with NBU Standard Detail 510 and 511 and shall consist of a minimum five-foot high chain link fencing with tubular steel support poles or "T" posts.

2. Type B Wood Fence (Typical Application-high potential damage)

   Type B protective fencing shall be installed in accordance with NBU Standard Detail 510 and 512 and shall consist of any vertical planking attached to 2x4-inch horizontal stringers which are supported by 2x4-inch intermediate vertical supports and a 4x4-inch at every fourth vertical support.

3. Type C Other Materials (Limited Application-minimal potential damage)

   The following materials may be permitted as alternates for limited or temporary applications (3 days or less) where tree damage potential is minimal (as determined by the Engineer or designated representative of NBU):

(a) High visibility plastic construction fencing.

The fabric shall be 4 feet in width and made of high density polyethylene resin, extruded and stretched to provide a highly visible international orange, non-fading fence. The fabric shall remain flexible from -60°F to 200°F and shall be inert to most chemicals and acid. The fabric pattern may vary from diamond to circular with a minimum unit weight of 0.4 lbs./Ft.

The fabric shall have a 4 foot width minimum tensile yield strength (Horizontal) of 2000 psi, ultimate tensile strength of 2680 psi (Horizontal) and a maximum opening no greater than 2 inches.

(b) Other approved equivalent restraining material.

The fencing materials, identified in (a) and (b) above, shall be supported by steel pipe, tee posts, U posts or 2" x 4" timber posts that are a minimum of 5-1/2 feet in height and spaced no more than 8 feet on centers. The fabric shall be secured to post by bands or wire ties.

B. Trunk Protection (Limited Application)

When indicated on the Drawings or directed by the Engineer or designated representative for NBU, tree trunk protection shall be provided. Tree trunk protection shall consist of any 2 x 4-inch or 2 x 6-inch planking or plastic strapping.

C. Tree Dressing

Tree dressing of any damaged areas shall be accomplished using any approved asphaltic tree wound paint, immediately after damage occurs.

D. Tree Wells for Raised Grades

When existing grades are raised by more than 6 inches, the tree root system shall be protected by the installation of tree wells. Native stone, railroad ties or equivalent timber shall be used for the separator wall of the well and PVC conforming to ASTM D-2729, SDR-35 shall be used for the aeration systems in fill areas.

E. Permeable Paving

Permeable segmented pavers in conjunction with PVC pipe aeration system or concrete on gravel base with cored holes shall be used to protect existing tree root zones when indicated on the Drawings or directed by the Engineer or designated representative.

F. Fertilizer

Fertilizer shall conform to NBU Standard Specification, "Fertilizer".

610.4 Construction Methods

A. Protective Fencing

All trees and shrubs in the proximity of the construction site shall be carefully checked for damage prior to initiation of any development activity.

All individual trees, shrubs, and natural areas scheduled for preservation shall be protected during construction with temporary fencing as indicated on the Drawings or directed by the Engineer or designated representative.

Protective fences shall be installed prior to the start of any site preparation work (clearing, grubbing, or grading), and shall be maintained in functioning condition throughout all phases of the construction project.

Protective fence locations in close proximity to intersecting streets or drives shall adhere to the sight distance and desirable sight triangle.

1. Protective fences shall be constructed at the locations (typically the outer limits of the Critical Root Zone) and with materials indicated on the Drawings to prevent the following:

   (a). Soil compaction in the root zone area resulting from vehicular traffic or storage of equipment or materials.

   (b). Root zone disturbances due to grade changes [greater than 6" cut or fill] or trenching not reviewed and authorized by Engineer or designated representative.

   (c). Damage to exposed roots, trunks or limbs by mechanical equipment.

   (d). Other activities detrimental to trees such as chemical storage, concrete truck cleaning, and fires.

2. Exceptions to the installation of protective fences at the tree drip lines may be permitted in the following cases:

   (a). Where there is to be an approved grade change, impermeable paving surface, tree well, or other such site development, the fence shall be erected approximately 2 to 4 feet beyond the area of disturbance;

   (b). When permeable paving is to be installed within a tree drip line, the fence shall be erected at the outer limits of the permeable paving area (prior to any site grading so that this enclosed area is graded separately to minimize root damage);

   (c). When trees are located close to a proposed building or other construction activity, the fence shall be erected to allow 6 to 10 feet work space between the fence and the structure and apply organic mulch to a depth of four (4) to six (6) inches in the unprotected root zone area;

   (d). When there are street-side pedestrian walkways, fences shall be constructed in a manner that does not obstruct safe passage;

   (e). When there are severe space constraints due to tract size or other special requirements, the Contractor shall contact the Engineer or designated representative to discuss alternatives.

   When any of the exceptions listed above will result in a fence being located closer than five (5) feet to a tree trunk, the Contractor shall also protect the trunk with strapped-on planking to a height of 8 feet (or to the limits of lower branching) in addition to the reduced fencing required.

B. Repair of Damage

Tree roots scarred by equipment shall be cut cleanly and covered with topsoil. When tree roots are pruned, a comparable portion of selected branches shall be cut from the tree on the opposite side. Limb pruning shall be made at the branch collar as indicated on the Drawings. All limbs greater than 1 inch in diameter shall be precut in accordance with ANSI 300 pruning methods to prevent splitting. All cut limbs shall be treated with an approved tree dressing. Tools shall be disinfected with alcohol or 5 ppm chlorine solution between repairs to trees to prevent the transmission of diseases from one tree to another.

All trees damaged during construction shall receive an application of fertilizer within the drip line conforming to Standard Specification, "Fertilizer" at the rate of 4 pounds per caliper inch.

C. Cutting and Filling Around Trees

When the depth of an excavation or embankment exceeds 6 inches within the drip line of any tree with a diameter greater than 8 inches, a tree well shall be constructed to protect the tree as indicated on the Drawings.

D. Paving Around Trees

Where paving within the dripline of any tree greater than a 6 inch diameter is necessary, a permeable pavement and aeration system must be installed as indicated on the Drawings, except for street construction.

E. Tree Removal

Any trees which are indicated on the Drawings for removal or which may interfere with the construction shall be removed subject to the approval of the Engineer or designated representative. Trees with diameters that exceed 19 inches as measured 4 1/2 feet above the existing ground shall require review by Engineer or designated representative prior to removal. When a tree or shrub is scheduled for removal, it shall be cut to a depth of 12 inches below the surrounding ground line. After removal, soil shall be placed in the hole to a depth matching the existing grade. The tree shall be cut into sections that can be managed, removed from the site and disposed of. All work shall be conducted in such a manner as to protect all facilities, improvements and vegetation in the work area.

All damage resulting from tree removal or pruning shall be repaired at the Contractor's own expense.

F. Final Cleanup

All temporary tree and shrub preservation and protection measures shall be removed when the construction has been completed.

610.5 Measurement and Payment

No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this item, but shall be considered subsidiary to the particular items required by the bid.

End

Item No. 620
Filter Fabric

620.1 Description

This item shall govern the furnishing of materials and for placement of filter fabric as indicated on the Drawings or directed by the Engineer or designated representative. Filter Fabric shall have the capability for allowing the passage of ground water through it without transporting the soil placed around the filter fabric.

620.2 Submittals

The submittal requirements of this specification item include:

A. catalog cuts,
B. samples of material selected,
C. testing results,
D. manufacturer's recommended installation procedures, and
E. manufacturer certification of compliance with this specification.

620.3 Materials

A. General

The fabric shall be constructed exclusively of synthetic thermoplastic fibers and may be either woven or non-woven to form a mat of uniform quality. Fabric fibers may be either continuous or discontinuous and oriented in either a random or an aligned pattern throughout the fabric. The fabric shall be mildew resistant, rot proof and shall be satisfactory for use in a wet soil and aggregate environment. The fabric shall contain ultraviolet stabilizers and shall have non-raveling edges.

B. Physical Requirements

The fabric shall meet the requirements of table 1, when sampled and tested in accordance with the methods indicated in the table below.

All material shall be shipped with suitable wrapping to protect the fabric during shipping and storage at the job site.

620.4 Construction Methods

The submittal requirements shall be completed before any materials are ordered.

The "Filter Fabric" shall be installed in accordance with the manufacturer's recommendations, as indicated on the Drawings or as directed by the Engineer or designated representative. When lapping is required, it shall be in accordance with the manufacturer's recommendations. Backfilling around the Filter Fabric shall be done in such a manner that the Filter Fabric material will not be damaged during the placement.

TABLE 1: FILTER FABRIC REQUIREMENTS		
Original Physical Properties	**Test Method**	**Requirements**
Fabric weight (mass), on an ambient temperature air-dried tension free sample, expressed in oz/ sq. yd	TxDoT Tex-616-J*	Underdrains/Slope Stabilization 4.0 minimum
		Gabions and Revet Mattresses 6.0 minimum
Water flow rate by falling head method, 7.9 inches to 3.9 inches on 2 inch ID cylinder with 1 inch diameter orifice, with flow rate expressed in gal/sq.ft/minute	TxDoT Tex-616-J*	80 minimum
Breaking load in either machine or cross-machine direction, expressed in pounds	ASTM D-1682 grab method G**	100 minimum
Equivalent opening size for US Standard (SI) sieves.	CW-02215***	70 to 100 (212 to 150μm)
"Apparent elongation" at breaking load in either machine or cross-machine direction, expressed as percent	ASTM D-1682 grab method G**	100 maximum

* TxDoT Tex-616-J, "Testing of Construction Fibers

** ASTM D 1682 grab method G, "Test Methods for Breaking Load and Elongation of Textile Fabrics"* as modified by TxDoT Test Method Tex-616-J

*** CW-02215, US Army Corps of Engineers, Civil Works Construction Guide Specification "Plastic Filter Fabric".

620.5 Measurement

Work and acceptable material for "Filter Fabric" will be measured by the square yard complete in place.

620.6 Payment

All work performed by this item will be considered subsidiary to other bid items unless it is included as a separate bid item in the contract documents then all work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering; and all tools, equipment and incidentals necessary to complete the work. Payment will not be made for unauthorized work.

End

Item No. 632
Storm Inlet Sediment Trap

632.1 Description

This item governs the construction of a temporary silt basin around a drainage structure, the maintenance of the trap, the removal of silt accumulations until the trap is no longer required, the restoration of the area to the final grade and the re-vegetation of the disturbed area.

632.2 Submittals

The submittal requirements for this specification item shall include:

A. Locations and Types of inlet traps (yard or curb drain).

B. Seeding

1. Identification of the type, source, mixture, pure Live Seed (PLS) and rate of application,
2. Type of mulch,
3. Type of tacking agent, and
4. Type and rate of application of fertilizer.

632.3 Materials

A. Seeding

Seeding for re-vegetation shall conform to Standard Specification, "Seeding for Erosion Control".

B. Embankment

Embankment shall conform to Standard Specification, "Embankment".

632.4 Construction Methods

The area under the embankment shall be cleared, grubbed and stripped of any vegetation and root material in conformance with Standard Specification, "Clearing and Grubbing".

Construction operations shall be carried out in such a manner that erosion and water pollution shall be minimized.

Sediment shall be removed and the trap shall be restored to its original dimensions when the sediment has accumulated to 1/2 the design depth of the trap. The sediment, that is removed, shall be deposited in an approved area and in such a manner that it will not erode.

The structure shall be inspected monthly and after each rain and repairs made as needed by the Contractor throughout the duration of this contract or until the Engineer or designated representative provides written permission to remove the structure.

When the trap is no longer required, the Contractor shall remove the silt accumulation and backfill the trap in accordance with Standard Specification, "Borrow" or Standard

Specification, "Embankment". Any material placed shall be compacted in 8-inch lifts, loose measure and compacted to the required density by mechanical means.

The temporary Storm Inlet Sediment Trap shall be removed, when directed by the Engineer or designated representative, and the area leveled off and protected by erosion control measures appropriate for the terrain as indicated on the Drawings and/or Standard Detail, "Storm Inlet Sediment Trap". Permanent Storm Inlet Sediment Traps shall be seeded and comply with all the requirements for, "Seeding for Erosion Control".

632.5 Measurement

Acceptable work performed as prescribed by this item will be measured by the cubic foot of sediment trap complete in place.

632.6 Payment

All work performed by this item will be considered subsidiary to other bid items unless it is included as a separate bid item in the contract documents then all work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering; and all tools, equipment and incidentals necessary to complete the work. Payment will not be made for unauthorized work

End

Item No. 639
Rock Berm

639.1 Description

This item shall govern the construction of a temporary berm of open graded rock that is installed at the toe of a slope on the perimeter of a developing area. The purpose of a rock berm is to intercept sediment-laden water from unprotected areas, to retain the sediment and to release the water in sheet flow. This item shall also govern the removal of the "Rock Berm" and re-vegetation of the area.

639.2 Submittals

The submittal requirements for this specification item shall include:

A. Function (stream flow or other) and dimensions of the rock berm

B. Source, type and gradation of rock

C. Re-vegetation program, including:

1. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.
2. Type of mulch.
3. Type of tacking agent.
4. Type and rate of application of fertilizer.

639.3 Design Criteria

A rock berm shall be constructed near the perimeter of a disturbed site within the development area. It is not to be constructed outside the property lines without obtaining an easement or written permission from the affected adjacent property owners.

A detailed design is not required for the installation of a rock berm; however, the following criteria shall be observed:

Drainage area	-	less than 5 acres.
Height	-	18 inches minimum height, measured vertically from the top of the existing ground at the upslope toe to the top of the berm.
Top width	-	2 feet minimum.
Side slopes	-	2:1 or flatter.
Grade	-	Berms will be built along a contour as near possible to a 0 percent grade.

639.4 Materials

Surplus rock excavated from utility trenches or from other excavations may be used in construction of these berms. In general, the rocks shall be sound with a minimum of 3

inches in smallest dimension and shall weigh between 10 and 30 pounds each. Seeding for re-vegetation shall conform to, "Seeding for Erosion Control".

Use only open-graded rock of the size indicated on Standard Detail, with most of the fines removed.

639.5 Construction Methods

All trees, brush, stumps and objectionable material shall be removed and disposed in a manner that will not interfere with the construction of the berm.

A trench shall be excavated to a minimum depth of 4 inches below existing grade for placement of the rock as indicated on Standard Detail and the Drawings. The rocks shall be placed in interlocking layers with close joints starting at the base. Open joints shall be filled with rock-spalled materials as required to stabilize the berm.

The area upstream from the rock berm shall be maintained in a condition, which will allow sediment to be removed following the runoff from a rainfall event. After each rainfall event with an accumulation of 1 inch or more, an inspection of the rock berm will be made by the Contractor and the stone shall be replaced, when the structure ceases to function as intended because of silt accumulation among the rocks, washout, construction traffic damage, etc.

When the silt reaches a depth equal to 1/3 the height of the berm or 6 inches, whichever is less, the Contractor will remove the accumulated silt and dispose of it at an approved disposal site in a manner that will not contribute to additional siltation. The berm will be reshaped as needed during construction.

When the site is completely stabilized, the berm will be removed and disposed of in a manner approved by the Engineer or designated representative.

The area will be re-vegetated as required by Item, "Seeding for Erosion Control".

639.6 Measurement

Acceptable work performed and prescribed in this item will be measured by the linear foot along the centerline of top of berm.

639.7 Payment

All work performed by this item will be considered subsidiary to other bid items unless it is included as a separate bid item in the contract documents then all work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering; and all tools, equipment and incidentals necessary to complete the work. Payment will not be made for unauthorized work

End

Item No. 642
Silt Fence

642.1 Description

This item shall govern the provision and placement of a filter fabric fence including maintenance of the fence, removal of accumulated silt and removal of the silt fence upon completion of the project.

642.2 Materials

A. Fabric

1. General:

   The filter fabric shall be of nonwoven polypropylene, polyethylene or polyamide thermoplastic fibers with non-raveling edges. The fabric shall be non-biodegradable, inert to most soil chemicals, ultraviolet resistant, unaffected by moisture or other weather conditions, and permeable to water while retaining sediment. The filter fabric shall be supplied in rolls a minimum of 36 inches (0.9 meter) wide.

2. Physical Requirements:

   The fabric shall meet the requirements presented in Table 1, when sampled and tested in accordance with the methods indicated herein, on Standard Detail and/or on the Drawings.

B. Posts:

Posts shall be painted or galvanized steel Tee or Y-posts with anchor plates, not less than 5 feet in length with a minimum weight of 1.3 pounds per foot with a minimum Brinell Hardness of 143. Hangers shall be adequate to secure fence and fabric to posts. Posts and anchor plates shall conform to ASTM A-702.

C. Wire Fence:

Wire fence shall be welded wire fabric 2 x 4 - W1.0 x W1.0 and shall conform to Standard Specification, "Reinforcing Steel".

TABLE 1. Filter Fabric Requirements

Physical Properties	Method	Requirements
Fabric Weight in ounces per square yard	TEX-616-J[1]	4.5 minimum
Water Flow Rate in gallons/sq. foot/ minute	TEX-616-J[1]	40 maximum
Equivalent Sieve Opening Size: US Standard	CW-02215[2]	40 to 100
Mullen Burst Strength: lbs. per sq. inch (psi)	ASTM D-3786[3]	300 minimum
Ultraviolet Resistance; % Strength Retention	ASTM D-1682[4]	70 minimum

[1] TxDoT Test Method Tex-616-J, "Testing of Construction Fabrics".

[2] US Army Corps of Engineers Civil Works Construction Guide Specification CW-02215, "Plastic Filter Fabric".

[3] ASTM D-3786, " Test Method for Hydraulic Bursting Strength of Knitting Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method".

[4] ASTM D-1682, " Test Methods for Breaking Load and Elongation of Textile Fabrics ".

642.3 Construction Methods

The silt fence fabric shall be securely attached to the posts and the wire support fence with the bottom 12 inches of the filter material buried in a trench a minimum of 6 inches deep and 6 inches wide to prevent sediment from passing under the fence. When the silt fence is constructed on impervious material, a 12-inch flap of fabric shall be extended upstream from the bottom of the silt fence and weighted to limit particulate loss. No horizontal joints will be allowed in the filter fabric. Vertical joints shall be overlapped a minimum of 12 inches with the ends sewn or otherwise securely tied.

The silt fence shall be a minimum of 24 inches high. Posts shall be embedded a minimum of 12 inches in the ground, placed a maximum of 8 feet apart and set on a slight angle toward the anticipated runoff source. When directed by the Engineer or designated representative, posts shall be set at specified intervals to support concentrated loads.

The silt fence shall be repaired, replaced, and/or relocated when necessary or as directed by the Engineer or designated representative. Accumulated silt shall be removed when it reaches a depth of 6 inches.

642. 4 Measurement

The work performed and the materials furnished under this item will be measured by the lineal foot of "Silt Fence", complete in place.

642.5 Payment

All work performed by this item will be considered subsidiary to other bid items unless it is included as a separate bid item in the contract documents then all work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering; and all tools, equipment and incidentals necessary to complete the work. Payment will not be made for unauthorized work

END