CONSTRUCTION DOCUMENTS AND SPECIFICATIONS

Prepared for:

DAVID KAUFFMAN

549 Beaver Dam Rd.
Honeybrook, PA 19344

Honeybrook Township
Chester County, PA

April 18, 2024

Prepared by Robert Sweppenheiser II, PE

TeamAg Incorporated

120 Lake Street Ephrata, PA 17522

Telephone: (717) 721-6795 Fax: (717) 721-9275 Email: teamag@teamaginc.com

USDA
United States Department of Agriculture

Fact Sheet #9

January 2016

Agriculture Construction Safety

Compliance with safety regulations on agricultural projects is required by OSHA and by all construction insurance/ liability companies. The contractor is to maintain a safe working environment for themselves, their employees, subcontractors, and others who must have access to the site. Detailed knowledge and implementation of safety regulations is their responsibility. Those with more than ten employees must have written safety procedures and document implementation.

Imminent danger situations (hazards that could cause death or serious physical harm) require immediate action, including work stoppage. When NRCS and/or partner personnel observe or become aware of an imminent danger on the work site they will alert the contractor and landowner. They will also advise the landowner that funding and/or technical assistance will be withdrawn if the situation is not corrected. Work may continue after the imminent danger is resolved.

Effective January 1, 2015, all employers must report work-related fatalities, hospitalizations, amputations, and losses of an eye. They can contact the 24-hour OSHA hotline at 1-800-321-OSHA (6742) or their regional OSHA office. See OSHA standards 29 CFR 1904.39 for more information.

Soil Cave-In Protection

- Applies to all excavation over five feet in depth.
- OSHA has regulations set forth in Standards 29 CFR 1926 -Subpart P.
- Options include: sloping, shoring, or working from a safe distance.
- See "Fact Sheet" – SOIL CAVE IN – A FATAL SLIP for general information.

Fall Protection

- This applies to all areas where an individual could fall six feet or more.
- OSHA regulations in 29 CFR Parts 1910 for General Industry and 1926 for the Construction Industry apply to agricultural construction.
- OSHA 29 CFR 1926 subpart L deals with scaffolds and 29 CFR 1926 Subpart M deals with overall fall protection, including but not limited to cast-in-place concrete work, leading edge work, pre-cast concrete erection, tying reinforcement steel, truss installation, and roof construction.
- Options include: warning line system, safety monitors, mechanical equipment, controlled access area, covers, safety nets, scaffolding, guardrail system, and personal fall arrest.
- Selected method(s) shall be implemented at the start of construction.

Underground and Overhead Utility Protection

- Contractor is required to do their own utility check via PA-ONE Call system (811).
- Landowner and/or contractor shall contact any overhead utilities and prepare a procedure to avoid contact and/or schedule work with utility oversight.
- Landowner is to mark and locate any known private buried utilities within the work area.

NOTE: Critical safety measures may be highlighted in the Project Drawings and Specifications.

USDA United States Department of Agriculture

Fact Sheet #4

August 2016

Agricultural Waste System Safety Signs

It is the RESPONSIBILITY of the CONTRACTOR/INSTALLER to provide safety signs as shown below or equal. One shall be located at each entrance/access point where access can result in a fatality due to manure gases and/or drowning. Several signs are specified for larger facilities. Multiple signs are required to cover different hazards. Bilingual operations should consider using both types.

Deadly Manure Gases Possible – Place one sign at each entrance/access point to a below-ground manure storage pit, covered ground-level storage, a covered above-ground storage, and all manure hoppers and reception pits

Example locations: Collection hoppers, agitation point for slatted pits, septic tanks that hold milking center and manure wastes and any other confined space where waste is collected.

Drowning Hazard - Keep of Surface – Place one sign at each entrance/access point of a manure storage pond, in-ground uncovered storage structure or on each accessible side of a storage pond.

Example Locations: Open storage tanks, earthen storage ponds, and HDPE lined ponds.

During Agitation, Deadly Gases Possible – Place one sign at each entrance/access used for agitation or transfer at a manure storage pond, manure storage structure, and all reception and transfer facilities. Place one where visitors or children might congregate.

Example locations: All agitation/pump out locations of manure storages and reception pits. Any areas where visitors or children might tend to congregate such as at the end of the access road near the manure storage.

Never Dump Over Fence – Place sign(s) on manure storage safety fence at locations adjacent to a concrete heavy use area and/or stacking facility. Operators avoid designated push-offs when manure is frozen or heavily bedded and must be reminded of the danger.

Example locations: Manure storage safety fence adjacent to a heavy use area or manure stacking facility.

Sources:

- U.S. Municipal Supply, Inc. 1-800-222-1980
- Local Extension Service
- Self-Made Equal
- Local Conservation District
- Local Sign Making Company

IMPORTANT! Safety signs are designed to serve as a reminder of a hazard and consequences; the signs do not replace or substitute for original product warnings or labels, equipment safety literature, or specific safety training associated with manure systems and handling equipment. Owner/operators shall consult their site specific engineering designs, safety plans, and operation/maintenance plans for additional safety requirements. If no information is found, or more is needed, additional information can also be received from equipment manufacturers and distributors, county extension offices, private consultants, and NRCS offices..

NRCS-PA-ENG-FS-04

Fact Sheet

SOIL CAVE IN-A FATAL SLIP

United States Department of Agriculture

Natural Resources Conservation Service

Cause of Cave Ins

Cave ins in pits and ditches cause the death of construction workers every year. Most deaths have occurred in trenches dug for utility lines. However, soil slippage can occur anywhere soil is excavated. Landslides in clay soils kill more people each year than those in sandy soils.

Most workers are careful around sand because they know it moves easily. However, many believe a thick, tough clay soil will not slip. Yet, most clay soils shrink and crack open when dry and swell when wet. This shrinkage and swelling cause slick areas to develop beneath the surface.

Some clay soils contain water-tight layers called fragipans. Water accumulating on the impervious layer lubricates the soil, increasing the probability of slippage. When a ditch or pit is dug in a soil with a fragipan or in a soil with a high shrink-swell potential, the soil will often slip, resulting in a dangerous cave in. This becomes even more likely WHEN THE SOIL IS WET.

Prevention

Occupational Safety and Health Administration (OSHA) regulations require protective action on all worker-occupied excavations unless the cut is made in stable rock, or the cut is less than five feet deep and there is no potential for a cave in to occur. Protection can be accomplished with sloping and benching, support systems, or shield systems which conform to OSHA regulations.

Sloping the sides of the excavation is the simplest protection against a cave in. If soil properties in the excavation are unknown, the excavation slopes should be no steeper than 1-1/2 horizontal to 1 vertical. If the soil can be classified as a Type A or Type B material according to the OSHA classification system (see back side), you can use a steeper slope, as shown in Figures 1 through 5.

Consult OSHA regulations when more than one soil type is exposed in an excavated slope, or when benched slopes are used. The regulations also provide details on support and shield requirements. Complete requirements are found in OSHA's safety and health standards (29 CFR 1926, Subpart P).

Soils Information

Soil survey publications are available for most counties. This information is useful to engineers, builders, contractors and others interested in construction hazards. The publication identifies soils with fragipans and high shrink-swell potential. Other potential construction problems, such as water table, bedrock and corrosiveness, are also contained in the reports as well as information on engineering properties of soils.

Copies of soil survey reports and other soils information are available from the local office of the USDA, Natural Resources Conservation Service, or write Soils, USDA, Natural Resources Conservation Service, Suite 340, One Credit Union Place, Harrisburg, PA 17110-2993.

February 1995

NRCS-PA-ENG-FS-01
(EFH Notice PA-17, 4/10/03)

OSHA Soils Classification for Excavated Slopes

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or
(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
(iii) The soil has been previously disturbed; or
(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of 4H:1V or greater; or
(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf; or
(ii) Granular, cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam; or
(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil; or
(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
(v) Dry rock that is not stable; or
(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than 4H:1V, but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf or less; or
(ii) Granular soils including gravel, sand, and loamy sand; or
(iii) Submerged soil or soil from which water is freely seeping; or
(iv) Submerged rock that is not stable; or
(v) Material in a sloped, layered system where the layers dip into the excavation ona slope of four 4H:1V or steeper.

MAXIMUM ALLOWABLE SLOPES

Figure 1. Type A Soil
Simple Slope, General

Figure 2. Type A Soil
Simple Slope, Short Term

Figure 3. Type A Soil
Unsupported, Vertically Sided Lower Portion, Maximum 8 Feet in Depth

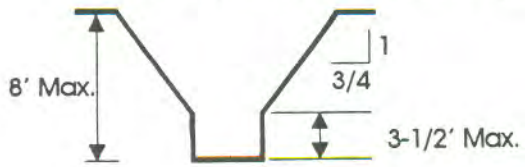

Figure 4. Type A Soil
Unsupported, Vertically Sided Lower Portion, Maximum 12 Feet

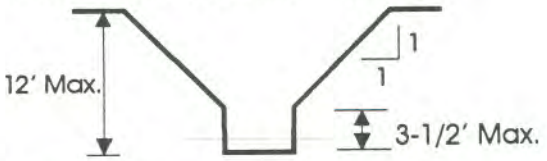

Figure 5. Type B Soil
Simple Slope

Figure 6. Type C Soil
Simple Slope

Practice Specification
Waste Storage Facility (Code 313)
Structure

1. SCOPE

The work shall consist of furnishing materials and installing all components of the waste storage structure as outlined in this specification and the drawings.

Construction work covered by this specification shall not be performed between December 1 and the following March 15 unless the site conditions and/or the construction methods to be used have been reviewed and approved by the Engineer or his/her designated Representative.

2. MATERIALS

All materials used shall conform to the quality and grade noted on the drawings, set forth in Section 9, or as otherwise listed below:

PORTLAND CEMENT shall be Type I, IA, II or IIA and conform to ASTM-C150, unless otherwise set forth in Section 9. If Type I or II is used, an air-entrainment agent shall be used.

CONCRETE AGGREGATE shall meet the requirements and gradation specified in ASTM-C33. Coarse aggregate shall meet the gradation for size numbers 57 or 67.

WATER used in mixing or curing concrete shall be clean and free from injurious amounts of oil, acid, salt, organic matter or other deleterious substances.

REINFORCEMENT BARS shall be grade 40 or higher, and shall conform to ASTM- A615, A616, or A617. Welded wire fabric reinforcement shall conform to ASTM-A185 or A497. Reinforcement shall be free from loose rust, oil, grease, curing compound, paint or other deleterious coatings.

CONCRETE ADMIXTURES shall conform to ASTM-C260 for air-entrainment, and ASTM- C494, type A, D, F or G, for water- reduction and set-retardation, and type C or E for non- corrosive accelerators.

POZZOLAN shall conform to ASTM-C618, Class F, except loss of ignition shall not exceed 3.0 percent.

CURING COMPOUND shall meet the requirements of ASTM-C309, Type 2, Class A or B or as otherwise required in Section 9.

MASONRY COMPONENTS shall meet the requirements of ASTM-C90 & C270 and placed in accordance with ACI-530.

PRECAST CONCRETE units shall comply with ACI-525 and 533.

PREFORMED EXPANSION JOINT FILLER shall conform to the requirements of ASTM- D1752, Type I, II, or III, unless bituminous type is specified, in which case it shall conform to ASTM-D994 or D1751.

JOINT SEALERS shall conform to the requirements for ASTM-C920, Federal Specification SS-S-210A, or Federal Specification TT-S-227, as appropriate for the specific application. WATERSTOPS. Vinyl-chloride polymer types shall be tested in accordance with Federal Test Method Standard No. 601 and shall show no sign of web failure due to brittleness at a temperature of -35 degrees Fahrenheit. Colloidal (bentonite) waterstops shall be at least 75 percent bentonite in accordance with Federal Specification SS- S-210A. Non-colloidal waterstops shall only be used if approved by the Engineer.

METALS shall conform to the following standards:

Structural steel - ASTM-A36

Carbon steel - ASTM-A283, grade C or D; or A611, grade D; or A570, grade C or D

Aluminum alloy - ASTM-B308, B429, B221, B210, B211, or B209

Bolts - ASTM-A307; zinc coating shall conform to ASTM-A153, B633 (cond. SC3), A165 (type TS).

Screws - wrought iron or medium steel Split or tooth-ring connectors - hot-rolled, low carbon steel conforming to ASTM- A711, grade 1015

WOOD shall be graded and stamped by an agency accredited by the American Lumber Standards Committee as meeting the required species, grade, and moisture content. In the absence of such a stamp, the Contractor or material supplier shall provide written certification that the wood products meet the designated quality criteria.

MANUFACTURED TRUSSES shall be certified as having been designed and built to Truss Plate Institute standards.

PRESSURE TREATED WOOD PRODUCTS shall be Douglas Fir, Southern Yellow Pine, or as otherwise specified on the drawings or in Section 9. They shall be treated with preservatives in accordance with the American Wood Preservers Association (AWPA) Standard C16, “Wood Used on Farms, Pressure Treatment.” Each piece shall bear the AWPA stamp of quality. In the absence of such a stamp, the Contractor or material supplier shall provide written certification that the pressure treated wood meets the designated quality criteria.

FASTENERS for wood structures shall be stainless steel, galvanized, or otherwise protected from corrosion due to contact with moisture, manure and associated gasses.

3. FOUNDATION PREPARATION AND CONDITIONS

All trees, brush, fences, and rubbish shall be cleared within the area of the structure, including any appurtenances, and borrow areas. All material removed by clearing and excavation operations shall be disposed of as directed by the Owner or his/her Representative. Sufficient topsoil shall be stockpiled in a convenient location for spreading on disturbed areas. All structures shall be set on undisturbed soil or non-yielding compacted material. Over excavation must be corrected as noted on the drawings or as directed by the Engineer or his/her designated Representative.

In addition to uniformity, the existing subgrade material must have sufficient strength to support the structure and its associated loads. Organic soils shall be removed. A base course (a layer of granular material placed on the subgrade prior to placement of concrete) may be used to improve the stability of the foundation. In addition, geosynthetics may be used, if approved by the Engineer, to further separate and/or stabilize the foundation.

Surface and subsurface drainage systems shall be installed and operating adequately to remove water from the foundation to allow for proper structure placement.

Drainfill upon which concrete is to be placed shall be covered with a geosynthetic that has an AOS between 20 and 100, inclusive.

Concrete shall not be placed until the subgrade, forms and steel reinforcements have been inspected and approved by the Engineer or his/her designated Representative. Notification shall be given far enough in advance to provide time for the inspection.

Prior to placement of concrete, the forms and subgrade shall be free of chips, sawdust, debris, standing water, ice, snow, extraneous oil, mortar or other harmful substances or coatings.

Earth surfaces against which concrete is to be placed shall be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill or frozen subgrade will not be permitted.

4. CAST-IN-PLACE CONCRETE STRUCTURES

a. Concrete Forms

Forms shall be of wood, plywood, steel, or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours.

Form surfaces shall be smooth and essentially free of holes, dents, sags, or other irregularities. Forms shall be coated with form oil before being set into place.

Care shall be taken to prevent form oil from coming in contact with steel reinforcement.

b. Concrete Mix

Concrete for structures shall have a 28-day compressive strength of at least 4000 psi, unless otherwise specified on the drawings or in Section 9. The Contractor shall be responsible for the design of the mix and certification of the necessary compressive strength. Current certification of the design mix by Penn DOT may be accepted in lieu of additional testing.

The slump shall be 3 to 6 inches (without superplasticizers, if any); the air content by volume shall be five to seven percent of the volume of the concrete. Admixtures such as superplasticizers, water-reducers and set-retarders may be used provided they are approved by the Engineer prior to concrete placement and are used in accordance with the manufacturer's recommendations. Superplasticizers (ASTM C494, Type F or G) may be added to concrete that has a 2 to 4-inch slump before the addition, and that is not warmer than 95° F. The slump shall not exceed 7½ inches with the addition of superplasticizer.

c. Mixing and Handling Concrete

In general, concrete shall be transported, placed, and consolidated in accordance with ACI- 304, of which some specific interpretations are set forth below.

The supplier shall provide a batch ticket to the Owner or Technician with each load of concrete delivered to the site. The batch ticket shall state the class of concrete, any admixtures used, time out, and the amount of water that can be added at the site and still be within the design mix limits.

Concrete shall be uniform and thoroughly mixed when delivered to the job site. The Contractor shall test slump and air entrainment as necessary to insure that the concrete meets the requirements of this specification. Variations in slump of more than one inch within a batch will be considered evidence of inadequate mixing and shall be corrected or rejected. No water in excess of the amount called for by the job design mix shall be added to the concrete.

For concrete mixed at the site, the mixing time after all cement, aggregates and water are in the mixer drum shall be at least 1-1/2 minutes.

Concrete shall be conveyed from the mixer to the forms as rapidly as practical by methods that will prevent segregation of the aggregates or loss of mortar. Concrete shall be placed in the forms within 1-1/2 hours after the introduction of cement to the aggregate unless an approved set-retarding admixture is used in the mix. In hot weather or under conditions contributing to quick stiffening of the concrete, or when temperatures of the concrete is 85oF or above, the time between the introduction of the cement to the aggregates and completion of truck discharge shall not exceed 45 minutes.

Concrete shall not be dropped more than 5 feet vertically unless special equipment is used to prevent segregation.

Superplasticized concrete shall not be dropped more than 12 feet unless special equipment is used to prevent segregation.

Slab concrete shall be placed at the design thickness in one layer. Formed walls shall be placed in layers not more than 24-inches high, unless superplasticizer is used, in which case the maximum layer shall be 5 feet. Each layer shall be consolidated to insure a good bond with the preceding layer.

Immediately after placement, concrete shall be consolidated by spading and vibrating, or by spading and hand tamping. It shall be worked into corners and angles of the forms and around all reinforcement and embedded items in a manner that prevents segregation or in the formation of "honeycomb." Excessive vibration that results in segregation of materials will not be allowed. Vibration must not be used to make concrete flow in forms, slabs, or conveying equipment.

If the surface of a layer in place will develop its initial set, i.e., will not flow and merge with the succeeding layer when vibrated, a construction joint shall be made. Construction joints shall be made by cleaning the hardened concrete surface to exposed aggregate by sandblasting, air/water jetting, or hand scrubbing with wire brush, and keeping the concrete surface moist for at least one hour prior to placement of new concrete.

Concrete surfaces do not require extensive finishing work; however, the surface shall be smooth and even with concrete paste worked to the surface to fill all voids. The concrete surface must be watertight. Careful screeding (striking-off) and/or wood float finishing shall be required, unless otherwise shown on the drawings. Exposed edges shall be chamfered, either with form molding or molding tools.

The addition of dry cement or water to the surface of screeded concrete to expedite finishing is not allowed.

d. Reinforcing Steel Placement

Reinforcement shall be accurately placed and secured in position in a manner that will prevent its displacement during the placement of concrete. In forms, this shall be accomplished by tying temperature and shrinkage steel or special tie bars (not stress steel) to the form “snap ties” or by other methods of tying. In slabs, steel or wire shall be supported by precast concrete bricks (not clay bricks), or metal or plastic chairs. Concrete bricks supporting steel and wire must be full and not broken (unless bricks are manufactured with creases or indentations meant to be broken). Except for dowel rods, placing steel reinforcement into concrete already in place shall not be permitted.

The following tolerances will be allowed in the placement of reinforcing bars shown on the drawings:

1. Maximum reduction in cover: from formed and exposed surfaces – ¼ inch from earth surfaces - ½ inch
2. Maximum variation from indicated spacing: 1/12th of indicated spacing

Splices of reinforcing bars shall be made only at the locations shown on the drawings, unless otherwise approved by the Engineer. Unless otherwise required, welded wire fabric shall be spliced by overlapping sections at least one full mesh dimension plus two inches. All reinforcement splices shall be in accordance with ACI 318.

Reinforcing steel shall not be welded, unless approved by the Designer. The ends of all reinforcing steel shall be covered with at least 1-1/2 inches of concrete.

e. Curing

Concrete shall be prevented from drying for at least seven days after it is placed. Exposed surfaces shall be kept continuously moist during this period by covering with moistened canvas, burlap, straw, sand or other approved material unless they are sprayed with a curing compound. Wooden forms left in place during the curing period shall be kept wet.

Concrete, except at construction joints, may be coated with a curing compound in lieu of continuous application of moisture. The compound shall be sprayed on moist concrete surfaces as soon as free water has disappeared but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. Concrete shall be wet cured or remain in forms until immediately before patching, repairs, or finishing is performed. Curing compound shall not be allowed on any rebars.

Curing compound shall be applied in a uniform layer over all surfaces requiring protection at a rate of not less than one gallon per 150 square feet of surface. Surfaces subjected to heavy rainfall or running water within three hours after the curing compound has been applied, or otherwise damaged, shall be resprayed.

Any construction activity which disturbs the curing material shall be avoided during the curing period. If the curing material is subsequently disturbed, it shall be reapplied immediately.

Steel tying or form construction adjacent to new concrete shall not be started until the concrete has cured at least 24 hours.

Vehicles, overlying structures, or other heavy loads shall not be placed on new concrete slabs for at least three days, unless the concrete strength can be shown to be adequate to support such loads.

f. Form Removal and Concrete Repair

Forms for walls and columns shall not be removed for at least 24 hours after placing the concrete. When forms are removed in less than seven days, the exposed concrete shall be sprayed with a curing compound or be kept wet continuously for the remainder of the curing period. Forms which support beams or covers shall not be removed for at least seven days, or 14 days if they are to support forms or shoring.

Forms shall be removed in such a way as to prevent damage to the concrete. Forms shall be removed before walls are backfilled. Columns shall be at least seven days old before any structural loads are applied.

Where minor areas of the concrete surface are “honeycombed,” damaged or otherwise defective, the area shall be cleaned, wetted and then filled with a dry-pack mortar. Dry-pack mortar shall consist of one-part Portland cement and three parts sand with just enough water to produce a workable paste.

g. Concreting in Cold Weather Concreting in cold weather shall be performed in accordance with ACI-306R-16. In addition, the contractor shall provide a written plan at least 24 hours in advance of placing concrete in cold weather and shall have the necessary equipment and materials on the job site before the placement begins.

h. Concreting in Hot Weather

Concreting in hot weather shall be performed in accordance with ACI 305, of which some specific interpretations are set forth below.

The supplier shall apply effective means to maintain the temperature of concrete below 90 degrees Fahrenheit during mixing and conveying. Exposed surfaces shall be continuously moistened by means of fog spray or otherwise protected from drying during the time between placement and finishing and during curing. Concrete with a temperature above 90 degrees Fahrenheit shall not be placed.

i. Backfilling New Concrete Walls

Backfilling and compaction of fill adjacent to new concrete walls shall not begin in less than 14 days after placement of the concrete, except that walls that can be backfilled on both sides simultaneously may be done so within seven days.

Heavy equipment shall not be allowed within three feet of a new concrete wall. Provide compaction near the wall by means of hand tamping or small, manually-directed equipment.

5. WOOD STRUCTURES

All framing shall be true and exact. Timber and lumber shall be accurately cut and assembled to a close fit and shall have even bearing over the entire contact surfaces.

Nails and spikes shall be driven with just sufficient force to set the heads flush with the wood surface. Deep hammer marks in the wood shall be considered evidence of poor workmanship and may be sufficient cause for rejection of the work.

Holes for lag screws shall be bored with a bit not larger than the body of the screw at the base of the thread. Holes for bolts shall be bored with a bit no more than 1/16” larger than the bolt diameter to achieve a snug fit without forcibly driving the bolt.

Washers shall be used in contact with all bolt heads and nuts that would otherwise be in contact with wood.

All joints shall be fastened with the number, type, and size of fasteners specified, at the locations or spacing specified.

If field cuts of pressure-treated wood expose untreated interior wood, the untreated surfaces shall be covered with two coats of a liquid preservative, as approved by the Engineer.

Roof trusses shall be handled, installed and braced according to the Truss Plate Institute's BCSI-B1-06, "Handling, Installing and Bracing MPC Wood Trusses."

Wood structures shall be backfilled within the limits shown on the drawings by placing material in uniform lifts not to exceed nine inches. Compaction within three feet of walls shall be accomplished by means of hand tamping or small manually-directed equipment.

6. STRUCTURES INSTALLED ACCORDING TO STANDARD DETAIL DRAWINGS PREPARED BY OTHERS

Commercially available structures shall be installed as shown on the drawings provided to and concurred in by NRCS. All materials furnished and installed shall conform to the quality and grade noted on the drawings. A site-specific set of construction drawings shall be at the site during construction.

Modification of the structure outside limits shown on the drawings shall not be made without prior review and approval by the Engineer with appropriate approval authority. The Supplier or Contractor who submitted the original standard detail drawings shall be responsible for making any changes. Sufficient design documentation to allow an adequate review of the proposed modification shall accompany any request for a change.

Within thirty (30) days of the completion of construction of the structure, the Contractor or Supplier shall furnish written certification to the Engineer that all aspects of the installation are in conformance with the requirements of the drawings and specifications.

7. BURIED TANKS

a. Tank Condition

Tanks, whether steel or fiberglass/plastic, shall have sufficient strength to withstand design loads, be watertight, and be protected from corrosion. New tanks shall have a manufacturer's certification to this effect.

Used tanks must be inspected for pitting, corrosion, and cracks that could impair the strength or water tightness. Tanks which originally stored leaded fuels may have tetraethyl lead deposits and scale on the inside. This material should be detached from the tank's interior, pumped out, and disposed of in a manner which will not pollute ground or surface waters. Also, if welding, handling, etc. is done, safety precautions should be taken to avoid ingesting or inhaling the lead or its fumes. (These tanks may have gasoline fumes or vapors in them and may explode from a spark, welding arc or torch.)

A tank that has been bent or dented will not be accepted unless adequate repairs have been made to restore the strength, water tightness, and corrosion protection. When inlet or outlet pipes or other type of openings are to be cut into one of these tanks, the reduced strength must be considered when the tank is put into use. The Steel Tank Institute's sti- P3 certification procedure shall be used to evaluate the structural integrity and assure the corrosion protection of steel tanks which have been repaired or modified.

b. Installation

Underground tanks shall be handled and installed according to the manufacturer's recommended procedures.

At a minimum, all tanks shall be set on a firm earth foundation or a full-length concrete slab covered with six inches of clean sand. The tank shall be surrounded by clean sand or well- tamped earth, free from stones and other debris. The use of saddles or "chock blocks" of any sort interferes with the proper distribution of the backfill loads and shall not be permitted.

The excavation shall be dewatered during installation and backfill operations. The backfill shall be well compacted, particularly under the tank, to provide adequate support.

Tanks shall be covered with a minimum of two feet of earth, or with not less than one foot of earth on which is placed a reinforced concrete slab not less than four inches thick.

Tank installations, which will be subjected to traffic, shall have adequate strength to withstand the anticipated overload. Tanks shall be protected against damage from vehicles passing over them by at least three feet of earth cover or by 18 inches of well- tamped earth plus either eight inches of asphaltic paving or six inches of reinforced concrete. The paving or concrete shall be placed to extend at least one foot horizontally in all directions beyond the outline of the tank.

Tanks shall not be filled or even partially filled during their installation and backfilling.

Unless high ground water levels are not expected, the site shall have a drain system to prevent ground water from flooding around the tank. Where a tank may become buoyant due to a rise in the level of the water table or due to location in an area subjected to flooding, applicable precautions shall be taken to anchor the tank in place or dewater the site.

Openings on all underground tanks must be properly located and maintained in place during backfilling.

8. PIPES

Excavation for pipes shall be made to the grades and lines shown on the drawings or as indicated by construction stakes. Care should be taken not to excavate below the depths specified. Excavation below grade shall be corrected by placing firmly compacted layers of moist earth to provide a good foundation. If rock or boulders are exposed in the bottom of the excavation, they shall be removed to a minimum depth of eight inches below the invert grade of the pipe and any appurtenances and replaced with firmly compacted earth to the specified grade.

Pipes shall be backfilled with horizontal lifts of moist earth not to exceed four inches in thickness, or with other material as specified in Section 9 or in the drawings.

Each lift shall be compacted by hand tampers or other compaction equipment, however at no time shall driven equipment tires or tracks be within two feet of pipes or appurtenances.

All connections between pipes and structure walls and floors shall be water tight and capable of withstanding the expected operating pressures.

9. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Critical Area Planting (Code 342)

1. SCOPE

The work shall consist of furnishing and planting the plant materials as set forth in the drawings and/or Section 7.

Critical area planting specifications are divided into four subsections based on the type of vegetation to be established:

Temporary cover

Permanent cover – seeding grasses and legumes

Permanent cover – sod establishment

Permanent cover – trees & shrubs

2. TEMPORARY COVER

A. MULCHING – Unless otherwise set forth in Section 7, use if the period of soil exposure without permanent vegetation will be less than two months, temporary vegetation is not feasible, or where seeding is delayed because of weather conditions. Follow the specification for Mulching (PA484).

B. ANNUAL GRASS or CERAEL GRAIN – Unless otherwise set forth in Section 7, use on all sediment producing areas where the period of soil exposure will be more than two months, but less than 12 months.

1. Site Preparation
   a. Install all required water control measures (temporary and permanent) prior to cover application.
   b. Perform all cultural operations at right angles to the slope on slopes 3:1 or flatter.
   c. Apply agricultural lime according to the soil test. If no test results are available when ready to seed, apply at the rate of 8000 pounds per acre (200 pounds per 1000 square feet) on a 100 percent calcium carbonate equivalent basis as a preliminary application. Apply the balance recommended by the test when the results are received. If lime is to be worked into a depth of five inches or deeper, use the amount full recommended in the soil test report. Apply no more than 8000 pounds per acre at one time if the limestone is to be worked into less than five inches. Apply the balance of the recommendation as the lime dissolves and infiltrates into the soil.

      Where pH levels are extremely low, it may not be feasible or practical to apply the lime all at once. In these cases, apply 6,000 pounds per acre (150 pounds per 1,000 square feet) on a 100 percent calcium carbonate equivalent basis for the temporary cover, and the balance of the test recommendation with the permanent cover.

   d. Apply fertilizer according to the soil test. If the test results are not available prior to seeding, apply 40 pounds each of actual N. P_2O_5, and K_2O per acre (1 pound each per 1000 square feet) as a preliminary application. Apply any balance recommended by the test when the results are received.
2. Materials
   a. Seed using the species or mixtures for the appropriate site type in **Table 1 Temporary Cover or Nurse Crop** unless otherwise set forth in Sections 7.
   b. All seed shall conform to the certifications of the PA Dept. of Agriculture and in addition, be labeled in accordance with the USDA Federal Seed Act in effect at the time of planting.
   c. No seed will be accepted with a test date more than 9 months before delivery to the site. Seed that is moldy or otherwise damaged will not be accepted.

3. Establishment

   a. Seeding rates shall be at the rates set forth in **Table 1 Temporary Cover or Nurse Crop**, unless otherwise set forth in Section 7.

   b. Cover grass seeds with ¼-inch, and small grains with 11/2-inches of soil by drilling, cultipacking, harrowing, or other suitable method when the site conditions permit; cultipack or track hydroseeded area where slopes will allow safe equipment operation.

   c. Mulch all seeded areas according to the construction specification for Mulching (PA484).

3. PERMANENT COVER – SEEDING GRASSES AND LEGUMES

A. SITE PREPARATION

1. Install all required water control measures (temporary and permanent) prior to cover application.
2. Perform all cultural operations at right angles to the slope on slopes 3:1 or flatter.
3. Where site conditions permit, prepare a seedbed by loosening the soil to a depth of 2 to 6 inches with suitable equipment. Where site conditions do not permit such normal seedbed preparation, loosen the soil surface by dragging a heavy chain or other suitable devices over the area to be seeded. Where possible on mined land, the surface should be left furrowed (as typically left by ripper teeth spaced 12 to 18 inches apart) when seeding herbaceous plants.
4. Apply agricultural lime according to the soil test. If no test results are available when ready to seed, apply at the rate of 8000 pounds per acre (200 pounds per 1000 square feet) on a 100 percent calcium carbonate equivalent basis as a preliminary application. Apply the balance recommended by the test when the results are received. If lime is to be worked into a depth of five inches or deeper, use the amount full recommended in the soil test report. Apply no more than 8000 pounds per acre at one time if the limestone is to be worked into less than five inches. Apply the balance of the recommendation as the lime dissolves and infiltrates into the soil.

   Where pH levels are extremely low, it may not be feasible or practical to apply the lime all at once. In these cases, apply the lime in increments of 6,000 pounds per acre (150 pounds per 1,000 square feet) on a 100 percent calcium carbonate equivalent basis and incorporate it before the next increment.

5. Apply nitrogen only when the plants will be actively growing during the period immediately following the application (March to May and August to October for cool- season grasses, June to August for warm- season grasses). On remote sites with poor access for standard fertilization (e.g., mine reclamation), apply all nitrogen as slow release compounds (e.g. ureaformaldehyde, sulfur-coated urea, other slow release formulation, animal manure, or sewage sludge), and at a rate of not greater than 80 pounds of actual nitrogen per acre (2 pounds per 1000 square feet) in any one application. On sites with good access (e.g. agricultural fields), apply 40% of the required nitrogen as slow release compounds, and no more than 40 pounds of actual nitrogen per acre (1 pound per 1000 square feet) in any one application.
6. Apply fertilizer according to a soil test. If test results are not available prior to seeding, apply as follows:

   a. Where a seedbed can be, prepared, apply 100 pounds each of actual P_20_5 and K_20 per acre (2.5 pounds each per 1OOO square feet) during seedbed preparation and at time of seeding. Apply 100 pounds of actual P_20_5 and 100 pounds actual K_20 per acre (2.5 pounds of actual P_20_5 and 2.5 pounds of actual K_20 per 1,000 square feet) as a preliminary application.

   Apply 40 pounds of actual N per acre (1 pound per 1,000) square feet) during the first period of active growth following the seeding. (Cattle manure or sewage sludge can be used to meet the nutrient requirements and will add needed organic matter when they can be incorporated into the soil. Heavy metal content of sewage sludge should not exceed that allowed on agricultural lands.) Test the soil before application and apply any balance recommended by the test when the results are received. Apply maintenance fertilizer the following growing season according to a soil test.

b. Where seedbed cannot be prepared, 80 pounds of actual P_20_5 and K_20 per acre (2 pounds of actual P_20_5 and 2 pounds of actual K_20 per 1,000 square feet) at time of seeding. Apply 40 pounds of actual N per acre (1 pound per 1,000 square feet) during the first period of active growth following the seeding.

c. If legumes are hydroseeded alone or in a mixture, use four times the normally recommended amount of inoculants to the slurry just before seeding, and apply lime and fertilizer by any method that will provide a uniform distribution.

B. MATERIALS

1. Apply seed species or mixtures as set forth in Section 7 and at the rates in **Table 2 Permanent Cover Grass and Legume Seeding Rates** for the permanent cover. Also apply a nurse crop seed mixture at the rates in **Table 1Temporary Cover or Nurse Crop** unless otherwise set forth in Section 7.
2. All seed shall conform to the certifications of the PA Dept. of Agriculture and in addition be labeled in accordance with the USDA Federal Seed Act in effect at the time of planting. No seed will be accepted with a test date more than 9 months before delivery to the site. Seed that is moldy or otherwise damaged will not be accepted.

C. ESTABLISHMENT

1. Where the seedbed is prepared:
   a. Smooth and firm the seedbed with a cultipacker or other similar equipment prior to seeding.
   b. Apply seeds uniformly by drilling, broadcasting, or hydroseeding. When broadcast or drilled, cover grass and legume seeds with ¼-inch of soil.Cultipack or track with a tracked- vehicle where slopes allow.
   c. Cultipack or track with a tracked- vehicle where slopes allow.
   d. Mulch all areas according to construction specification for Mulching (PA484).
2. Where seedbed is not prepared:
   a. Apply seed species or mixtures as set forth in Section 7 and at the rates in **Table 2 Permanent Cover Grass and Legume Seeding Rates** for the permanent cover. Also apply a nursery crop seed mixture at the rates in **Table 1 Temporary Cover and Nurse Crop**, unless otherwise set forth in Section 7.
   b. All seed shall conform to the certifications of the PA Dept. of Agriculture and in addition be labeled in accordance with the USDA Federal Seed Act in effect at the time of planting. No seed will be accepted with a test date more than 9 months before delivery to the site. Seed that is moldy or otherwise damaged will not be accepted.
   c. Apply seeds uniformly by drilling, broadcasting, or hydroseeding.
   d. Cultipack or track with a tracked- vehicle where slopes allow.
   e. Mulch all areas according to construction specification for Mulching (PA484).

4. PERMANENT COVER – ESTABLISHING SOD

A. SITE PREPARATION

1. Prepare the area, including lime and fertilizer, as set forth for Permanent Cover- Seeding in Section 3.A.
2. Till the soil surface to a depth of three inches and dampen immediately prior to laying sod.

B. MATERIALS

1. Sod shall be of the species set forth in Section 7.
2. Sod shall be grown from certified seed of adapted varieties, tested and approved by the PA Experiment Station, and under the cultural practices conducive to high quality sod that is free of any significant thatch, weeds, insects, and disease.
3. Sod shall be at least one-year old and no older than three years. Cultivated turfgrass shall be

considered ready for harvest when a cut portion of sod three feet in length and about 1-1/2 feet wide will support its own weight.

4. Cut sod of a width and length suited to the equipment and site, or as otherwise set forth in Section 7. Sod shall be cut, folded in the middle or rolled, and stacked on pallets. Folded sod shall be between 3 and 4 feet in length, unless otherwise allowed in Section 7. Sod shall be cut with a ½- to 1-inch layer of soil.
5. Have sod delivered to the site as soon as possible after harvesting. During hot weather, delivery shall be made within six hours. During cooler weather, when allowed in Section 7, delivery time may be extended up to 48 hours. Unless allowed in Section 7, sod shall not be planted during July and August, and when allowed shall be cut with at least 1-1/4 inch of soil and irrigated as necessary to ensure survival.

C. ESTABLISHMENT

1. Lay sod strips at right angles to the direction of water flow (slope), starting at the lowest elevation. Wedge the edges and ends of the sod strips together and tamp or roll. Stagger all end joints. Score the adjacent undisturbed ground so that the sod edges are flush and embedded (i.e. do not allow feathered edges).
2. On steep slopes or where required by Section 7, use wire or starch staples, fine mesh, or wooden pins and baler twine to secure the sod in place. When required in Section 7, remove wire and wooden stakes after the sod has rooted sufficiently to be secure.
3. Irrigate sod when dry conditions prevail to ensure survival. If required in Section 7, irrigate the sod to be lifted prior to harvesting.

5. PERMANENT COVER – TREES & SHRUBS ON HIGHLY DISTURBED AREAS

A. SITE PREPARATION

1. For seedings:
   a. Site preparation shall be the same as set forth in Sections 3.A. (1 through 3).
   b. Apply lime at the rate of 4000 pounds per acre on a 100-percent calcium carbonate basis over the area to be planted.
   c. Apply fertilizer at the rate of 40 pounds of actual P2O5 and 40 pounds of actual K2O per acre (1 pound per 1000 square feet) at the time of seeding. Apply 40 pounds of actual N per acre (1 pound per 1000 square feet) during the first period of active growth following the seeding. When strip-seeding, apply all of the fertilizer in the herbaceous strips.
2. For individual plantings:
   a. Prepare the area by clearing and mowing to allow access for planting and plant growth, or as otherwise set forth in Section 7.
   b. Planting pits in confined spaces or other harsh environments shall be excavated as recommended in *A guide to: Conservation Plantings in Critical Areas for the Northeast* (http://plant-materials.nrcs.usda.gov//nypmc/) unless otherwise set forth in Section 7.

B. MATERIALS

1. Plant species shall be as set forth in Section 7. Plant names required under this contract shall conform to those set forth in Standardized Plant Names, 1942 Edition, prepared by the American Joint Committee on Horticulture Nomenclature. Names not included therein shall conform to names generally accepted in the nursery trade.
2. All seed shall conform to the certifications of the PA Dept. of Agriculture and in addition be labeled in accordance with the USDA Federal Seed Act in effect at the time of planting. No seed will be accepted with a test date more than 9 months before delivery to the site. Seed that is moldy or otherwise damaged will not be accepted.
3. Plant materials shall be of the size and quality set forth in the rules adapted by the American Association of Nurserymen, Inc. and conform to the “American Standard for Nursery Stock”. All

plants shall be supplied from plant hardiness zones 5 or 6, as described in Plant Hardiness Zone Map, USDA-ARS, Miscellaneous Publication No. 814.

4. All plant materials shall be full, well- branched and proportioned, particularly with respect to width and height. Plants shall have well developed branches and vigorous fibrous roots (except unrooted cuttings).Plants shall be free of defects, decay, injury, disease, insect infestation, or objectionable disfiguration.
5. The source(s) of plant materials shall be made known and available for inspection at least one week prior to planting. Plant identification and information labels shall be securely attached to each plant. Plants rejected shall be replaced with acceptable materials.

C. ESTABLISHMENT

1. Plant vegetation at the locations set forth in Section 7.
2. For seeds, where both are required, seed the herbaceous species in strips, with woody species between each strip. Orient strips on the contours, unless otherwise set forth in Section 7. Apply seeds uniformly by drilling, broadcasting, or hydroseeding. Cultipack or track with a tracked-vehicle where slopes allow.
3. For trees and shrubs, follow recommendations in *A guide to: Conservation Plantings in Critical Areas for the Northeast* (http://plant-materials.nrcs.usda.gov//nypmc/).

   Unless otherwise set forth in Section 7, plant conifers at the rate of 680 per acre, deciduous trees at the rate of 435 per acre (spacing 10’ x 10’), shrubs at the rate of 2,700 per acre (spacing 4’ x 4”).
4. For bare root plants, protect the root systems from drying by treating roots with a moisture-retaining gel immediately upon arrival at the planting site.

6. TABLES

See Attached

7. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

TABLE 1: Temporary Cover or Nurse Crop

SPECIES OR MIXTURE	SEEDING RATE (LBS/ACRE)		RECOMMENDED SEEDING DATES PLANT HARDINESS ZONE		ADAPTATION		
	TEMPORARY COVER	NURSE	4 & 5	6 & 7	DROUGHTY	POORLY DRAINED	ACIDITY pH
Redtop	5	3	3/15 – 7/01 8/01 – 9/01	3/01 – 6/15 8/15 – 9/15	X	X	4.0 – 7.5
Annual Ryegrass	40	20	3/15 – 7/01 8/01 – 9/01	3/01 – 6/15 8/15 – 9/15	X	X	5.5 – 7.5
Spring Oats	96	48	3/15 – 7/01	3/01 – 6/15	X		5.5 – 7.0
Sudangrass	40	20	7/01 – 8/01	6/15 – 8/15	X		5.5 – 7.5
Japanese Millet (*Echinochloa frumentacea*)	30	15	7/01 – 8/01	6/15 – 8/15	X		4.5 – 7.0
Winter Rye Grain	168	56	8/01 – 11/01	8/15 – 11/15	X		5.5 – 7.5
Winter Wheat	180	90	8/01 – 11/01	8/15 – 11/15	X		5.0 – 7.0

TABLE 2 - Permanent Cover Grasses and Legumes Seeding Rates
(Use a nurse crop from Table 1 selected for the site conditions)

SPECIES OR MIXTURE[1]	SEEDING RATE (LBS/ACRE)		ADAPTATION		
	PREPARED DRILLED CULTIPACKED	UNPREPARED ADVERSE SITE HYDROSEEDED	DROUGHTY	POORLY DRAINED	ACIDITY pH
1. Tall Fescue	60	75	X	X	4.0 - 8.0
2. Tall Fescue and Red Fescue or Hard Fescue	40 10	60 15	X		5.0 - 7.5
3. Tall Fescue and Birdsfoot Trefoil[2/3]	20 6	30 10	X	X	5.0 - 7.5
4. Birdsfoot Trefoil[2/3] and Hard Fescue or Red Fescue	6 20	10 30	X		5.0 - 7.5
5. Crownvetch[2] and Tall Fescue or Red Fescue or Hard Fescue or Perennial Ryegrass[4]	10 20	15 30		X	6.0 - 7.5
6. Crownvetch[2] and Birdsfoot Trefoil[2/3] and Tall Fescue	10 6 20	15 10 30	X		6.0 -7.5

TABLE 2 - Permanent Cover Grasses and Legumes Seeding Rates cont.
(Use a nurse crop from Table 1 selected for the site conditions)

SPECIES OR MIXTURE[1]	SEEDING RATE (LBS/ACRE)		ADAPTATION		
	PREPARED DRILLED CULTIPACKED	UNPREPARED ADVERSE SITE HYDROSEEDED	DROUGHTY	POORLY DRAINED	ACIDITY pH
7. Flatpea[2/6] and	20	30	X		5.0- 7.5
Tall Fescue or	20	30			
Red Fescue or					
Hard Fescue or					
Perennial Ryegrass[4]					
8. Perennial Pea2/6 and	40	60			5.0-7.5
Tall Fescue or	20	30			
Red Fescue or					
Hard Fescue or					
Perennial Ryegrass[4]					
9. Alfalfa and[2/5]	10	15			6.5 - 7.5
Tall Fescue or	10	15			
Orchardgrass or	3	5			
Timothy[8]	4	6			

SPECIES OR MIXTURE[1]	SEEDING RATE (LBS/ACRE)		ADAPTATION		
	PREPARED DRILLED CULTIPACKED	UNPREPARED ADVERSE SITE HYDROSEEDED	DROUGHTY	POORLY DRAINED	ACIDITY pH
10. Birdsfoot Trefoil[2/3/5] and	6	10			
Tall Fescue or	6	10	X	X	5.0- 7.5
Orchardgrass or	3	5	X		
Timothy	2	3			
11. Perennial Ryegrass[4] and	25	30	X	X	5.0 - 8.0
Tall Fescue or	25	35			5.5 - 7.0
Kentucky Bluegrass	15	20			5.5 - 7.5
12. Switchgrass[5]	10	15	X	X	5.0- 7.5
13. Switchgrass and	10	15	X	X	5.0 -7.5
Birdsfoot Trefoil[2/3]	6	10			
14. Deertongue[5]	15	25	X		3.5 - 7.5
15. Deertongue[5] and	15	25	X		5.0 -7.5
Birdsfoot Trefoil[2/3]	6	10			

Footnotes for Table 2

[1]Consult the Agronomy Guide for cultivar recommendations of forage and turf species. Other species:

- Crownvetch ‘Penn gift’
- Flatpea ‘Lathco’
- Perennial Pea ‘Lancer’
- Switchgrass ‘Blackwell’ - Erosion control
  - ‘Cave-in-Rock’ - Forage
  - ‘Shelter’ - Wildlife
- Deertongue ‘Tioga’

[2]Inoculate legume seeds, use four times the normal rate of inoculate when hydroseeding.

[3]Birdsfoot Trefoil is not recommended in MLRA 148 and 149, where crown and root rots may injure the stand.

[4]Use only the “turf-type” fine-leaved perennial ryegrass varieties

[5]Use these mixtures on gentle, less erosive slopes; must be drilled or broadcast and cultipacked.

[6]Drill ½-inch deep or broadcast flatpea and perennial pea then cultipack.

Table 2a – Grass and Legume Seed Mixtures in Table 2 suitable for various areas or purposes.	
Area/Purpose	Suitable Mixtures (Select One)
Slopes and Banks – non-mowed	
Well drainage	3, 4, 5, 6, 7, 8
Variable drainage	3, 6
Slopes and Banks (mowed)	1, 2, 11
Gullies and eroded areas	3, 4, 5, 6, 7, 8
Conservation Structures	
Sod waterways, spillways, and other frequent waterflow areas	1, 2, 3
Drainage ditches	
Shallow, less than 3 feet	1, 2, 3
Deep, non-mowed	5, 6, 7, 8
Pond banks, dikes, levees, dams, diversion channels, and occasional waterflow areas	
Mowed areas	1, 2, 3, 4, 11
Non-mowed areas	5, 6, 7, 8
Hay or silage on diversion channels and occasional waterflow areas	use adapted hay mixtures or 9, 10
Sanitary landfill areas	3, 4, 5, 6, 12, 13, 14, 15
Strip-mined spoils, mine wastes, fly ash, slag, settling-basin residues, and other severely disturbed areas (lime to soil test)	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,15
Wildlife habitat	9, 10, 12, 13, 14, 15
Effluent Disposal Areas	10, 12, 13
Sand and Gravel Pits	12, 13, 14, 15

Table 2b – SEEDING DATES for species and mixes in Table 2 Permanent Cover Grasses and Legumes		
COOL SEASON PLANTS (MIXES 1 - 12)		
	Hardiness Zone 6 & 7	**Hardiness Zone 4 & 5**
Optimum	03/01- 04/15	03/15 - 05/01
Normal Range	11/15 - 06/15	11/01 - 07/01
	08/15 - 09/15	08/01 - 09/01
Project	11/15 - 09/15	01/01 - 09/01
WARM SEASON PLANTS (MIXES 12 - 15)		
	Hardiness Zone 6 & 7	**Hardiness Zone 4 & 5**
Optimal	03/01- 04/15	03/15 - 05/01
Normal Range	12/01 - 04/15	01/15 - 05/01

Table 3 – Trees suitable for highly disturbed areas

SPECIES	LOWER LIMIT pH TOLERANCE	TOLERANCE TO SHADE[1]	DRAINAGE ADAPTATION	ELEVATION[2]
CONIFERS				
Larch, Japanese	4.0	intermediate	Excessive – poor	
Pine, Austrian	4.0	intermediate	Well	
Pine, Pitch	4.0	intolerant	Excessive – well	Below 3000 feet
Pine, Red	4.0 – 4.5	intolerant	Excessive – well	Above 2000 feet
Pine, Scotch	4.0	intolerant	Well	
Pine, Virginia	4.0	intolerant	Excessive – well	Below 2500 feet
Pine, White	4.5	intermediate	Well – poor	
Spruce, Norway	4.5 – 5.0	tolerant	Well	
Spruce, White	4.5 – 5.0	tolerant	Well - poor	
HARDWOODS				
Alter, European Black	3.5	intolerant	Well-poor	Below 2500 feet
Aspen, Bigtooth	4.0	intolerant	Excessive-well	
Aspen, Quaking	4.0	intolerant	Excessive-well	
Birch, Gray	3.5	intolerant	Excessive-well	
Birch, Sweet	4.0	intermediate	Excessive-well	
Chestnut, Chinese	5.0	intermediate	Well	
Locust, Black[3] 'Steiner'	4.0	intolerant	Excessive-well	Below 3000 feet
Oak, Red	4.0	intermediate	Well	
Oak, Sawtooth 'Gobbler'	5.0	intolerant	Excessive-well	
Poplar, Hybrid	4.0 – 4.5	intolerant	Well	
Poplar, Yellow	4.5	intolerant	Well	Below 3000 feet
Sycamore	4.0 – 4.5	intolerant	Poor	Below 2500 feet

[1]Shade tolerance of species defined as follows: **Tolerant** – can withstand completely shaded conditions; **Intermediate** – partial shade is tolerated; plant requires some sunlight; **Intolerant** – plant requires full sunlight

[2]Blank spaces indicates no restriction: "Below" means that species are to be planted below this elevation

TREE PLANTING DATES: Plant as soon as frost is out of the ground but no later than April 15 in hardiness zones 6 & 7; May 1 in hardiness zones 4 & 5.

TABLE 4: Shrubs suitable for highly disturbed areas					
SPECIES[1]	LOWER LIMIT pH TOLERANCE	TOLERANCE TO SHADE[2]	DRAINAGE ADAPTATION	YEARS TO FRUIT MATURITY	MONTHS OF FRUIT MATURITY
Coral berry	5.0	tolerant	excessive-well	3	September – October
Crabapple	4.5 – 5.0	intolerant	well	3	September – October
Dogwood, Gray	5.0	intermediate	excessive-well	5	September – October
Dogwood, Silky	4.0	tolerant	well-poor	4 – 5	August – September
Honeysuckle, Amur	4.5 – 5.0	intermediate	excessive-well	3 – 4	September – October
Indigobush	4.0	intermediate	excessive-well	3	August
Locust, Bristly	3.5	intolerant	excessive-well	3 – 5	September
Privet, Amur	4.5 – 5.0	tolerant	well	4	September
Sumac, Aromatic	4.5	tolerant	excessive-well	5	July – August
Sumac, Shining	4.0	intermediate	excessive-well	4	September – October
Sumac, Smooth	4.5	intermediate	excessive-well	4	September – October
Viburnum, Arrowwood	4.5	tolerant	well-poor	3 – 5	September – October
Viburnum, Cranberrybush	4.5	intermediate	well-poor	3 – 5	August – September

[1]Recommended varieties are:

- Crabapple - ‘Midwest’, ‘Roselow’
- Dogwood, Silky - ‘Indigo’
- Honeysuckle, Amur - ‘Rem Red’
- Locust, Bristly - ‘Arnot’
- Sumac, Aromatic - ‘Konza’

[2]Shade tolerance of species defined as follows;

- Intermediate - partial shade is tolerated; plant requires some sunlight
- Intolerant - plant requires full sunlight
- Tolerant - can withstand completely shaded conditions

PLANTING DATES: Plant as soon as frost is out of the ground but no later than:	
HARDINESS ZONE	**DATE**
6 & 7	04/15
4 & 5	05/01

Practice Specification
Roofs and Covers (Code 367)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the roof or cover, as outlined in this specification and the drawings.

Construction work covered by this specification shall not be performed between December 1 and the following March 15 unless the site conditions and/or the construction methods to be used have been reviewed and approved by the Engineer or his/her designated Representative.

2. MATERIALS

All materials used shall conform to the quality and grade noted on the drawings, set forth in Section 8, or as otherwise listed below:

PORTLAND CEMENT shall be Type I, IA, II or IIA and conform to ASTM-C150, unless otherwise set forth in Section 8. If Type I or II is used, an air-entrainment agent shall be used.

CONCRETE AGGREGATE shall meet the requirements and gradation specified in ASTM-C33. Coarse aggregate shall meet the gradation for size numbers 57 or 67.

WATER used in mixing or curing concrete shall be clean and free from injurious amounts of oil, acid, salt, organic matter or other deleterious substances.

REINFORCEMENT BARS shall be grade 40 or higher, and shall conform to ASTM- A615, A616, or A617. Welded wire fabric reinforcement shall conform to ASTM-A185 or A497. Reinforcement shall be free from loose rust, oil, grease, curing compound, paint or other deleterious coatings.

CONCRETE ADMIXTURES shall conform to ASTM-C260 for air-entrainment, and ASTM-C494, type A, D, F or G, for water- reduction and set-retardation, and type C or E for non-corrosive accelerators.

POZZOLAN shall conform to ASTM-C618, Class F, except loss of ignition shall not exceed 3.0 percent.

CURING COMPOUND shall meet the requirements of ASTM-C309, Type 2, Class A or B or as otherwise required in Section 8.

MASONRY COMPONENTS shall meet the requirements of ASTM-C90 & C270, and placed in accordance with ACI-530.

PRECAST CONCRETE units shall comply with ACI-525 and 533.

PREFORMED EXPANSION JOINT FILLER shall conform to the requirements of ASTM- D1752, Type I, II, or III, unless bituminous type is specified, in which case it shall conform to ASTM-D994 or D1751.

JOINT SEALERS shall conform to the requirements for ASTM-C920, Federal Specification SS-S-210A, or Federal Specification TT-S-227, as appropriate for the specific application.

WATERSTOPS. Vinyl-chloride polymer types shall be tested in accordance with Federal Test Method Standard No. 601, and shall show no sign of web failure due to brittleness at a temperature of -35 degrees Fahrenheit. Colloidal (bentonite) waterstops shall be at least 75 percent bentonite in accordance with Federal Specification SS- S-210A. Non-colloidal waterstops shall only be used if approved by the Engineer.

METALS shall conform to the following standards:

Structural steel - ASTM-A36

Carbon steel - ASTM-A283, grade C or D; or A611, grade D; or A570, grade C or D

Aluminum alloy - ASTM-B308, B429, B221, B210, B211, or B209

Bolts - ASTM-A307; zinc coating shall conform to ASTM-A153, B633 (cond. SC3), A165 (type TS).

Screws - wrought iron or medium steel Split or tooth-ring connectors - hot-rolled, low carbon steel conforming to ASTM- A711, grade 1015

WOOD shall be graded and stamped by an agency accredited by the American Lumber Standards Committee as meeting the required species, grade, and moisture content. In the absence of such a stamp, the Contractor or material supplier shall provide written certification that the wood products meet the designated quality criteria.

MANUFACTURED TRUSSES shall be certified as having been designed and built to Truss Plate Institute standards.

PRESSURE TREATED WOOD PRODUCTS shall be Douglas Fir, Southern Yellow Pine, or as otherwise specified on the drawings or in Section 8. They shall be treated with preservatives in accordance with the American Wood Preservers Association (AWPA) Standard C16, “Wood Used on Farms, Pressure Treatment.” Each piece shall bear the AWPA stamp of quality. In the absence of such a stamp, the Contractor or material supplier shall provide written certification that the pressure treated wood meets the designated quality criteria.

FASTENERS for roofs and covers shall be stainless steel and/or galvanized in accordance with ASTM A153, and/or A653 Class G185, and Type 304 or 316, or otherwise protected from corrosion due to contact with moisture, manure and associated gasses. All fasteners, connectors, and any other metal contacting ACZA, ACQ or CA treated wood shall be stainless steel, in accordance with Supplement A below.

GEOMEMBRANES shall comply with the requirements of Construction Specification PA521A-PE/PP, as applicable.

3. FOUNDATION PREPARATION AND CONDITIONS

All trees, brush, fences, and rubbish shall be cleared within the area of the structure, including any appurtenances, and borrow areas. All material removed by clearing and excavation operations shall be disposed of as directed by the Owner or his/her Representative. Sufficient topsoil shall be stockpiled in a convenient location for spreading on disturbed areas. All structures shall be set on undisturbed soil or non-yielding compacted material. Over excavation must be corrected as noted on the drawings or as directed by the Engineer or his/her designated Representative.

In addition to uniformity, the existing subgrade material must have sufficient strength to support the structure and its associated loads. Organic soil or soils with high percentages of clays and silts shall be removed. A base course (a layer of granular material placed on the subgrade prior to placement of concrete) may be used to improve the stability of the foundation. In addition, geosynthetics may be used, if approved by the Engineer, to further separate and/or stabilize the foundation.

Surface and subsurface drainage systems shall be installed and operating adequately to remove water from the foundation to allow for proper structure placement.

Drainfill upon which concrete is to be placed shall be covered with a geosynthetic that has an AOS between 20 and 100, inclusive.

Concrete shall not be placed until the subgrade, forms and steel reinforcements have been inspected and approved by the Engineer or his/her designated Representative. Notification shall be given far enough in advance to provide time for the inspection.

Prior to placement of concrete, the forms and subgrade shall be free of chips, sawdust, debris, standing water, ice, snow, extraneous oil, mortar or other harmful substances or coatings.

Earth surfaces against which concrete is to be placed shall be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill or frozen subgrade will not be permitted.

4. CAST-IN-PLACE CONCRETE STRUCTURES

a. Concrete Forms

Forms shall be of wood, plywood, steel, or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours.

Form surfaces shall be smooth and essentially free of holes, dents, sags, or other irregularities. Forms shall be coated with form oil before being set into place. Care shall be taken to prevent form oil from coming in contact with steel reinforcement.

b. Concrete Mix

Concrete for structures shall have a 28-day compressive strength of at least 4000 psi, unless otherwise specified on the drawings or in Section 8. The Contractor shall be responsible for the design of the mix and certification of the necessary compressive strength. Current certification of the design mix by Penn DOT may be accepted in lieu of additional testing.

The slump shall be 3 to 6 inches (without superplasticizers, if any); the air content by volume shall be five to seven percent of the volume of the concrete. Admixtures such as superplasticizers, water-reducers and set-retarders may be used provided they are approved by the Engineer prior to concrete placement and are used in accordance with the manufacturer's recommendations. Superplasticizers (ASTM C494, Type F or G) may be added to concrete that has a 2 to 4 inch slump before the addition, and that is not warmer than 95°F. The slump shall not exceed 7½ inches with the addition of superplasticizer.

c. Mixing and Handling Concrete

In general, concrete shall be transported, placed, and consolidated in accordance with ACI-304, of which some specific interpretations are set forth below.

The supplier shall provide a batch ticket to the Owner or Technician with each load of concrete delivered to the site. The batch ticket shall state the class of concrete, any admixtures used, time out, and the amount of water that can be added at the site and still be within the design mix limits. Concrete shall be uniform and thoroughly mixed when delivered to the job site. The Contractor shall test slump and air entrainment as necessary to insure that the concrete meets the requirements of this specification. Variations in slump of more than one inch within a batch will be considered evidence of inadequate mixing and shall be corrected or rejected. No water in excess of the amount called for by the job design mix shall be added to the concrete.

For concrete mixed at the site, the mixing time after all cement, aggregates and water are in the mixer drum shall be at least 1-1/2 minutes.

Concrete shall be conveyed from the mixer to the forms as rapidly as practical by methods that will prevent segregation of the aggregates or loss of mortar. Concrete shall be placed in the forms within 1-1/2 hours after the introduction of cement to the aggregate unless an approved set-retarding admixture is used in the mix. During periods of hot weather, it may be necessary to reduce this time.

Concrete shall not be dropped more than 5 feet vertically unless special equipment is used to prevent segregation.

Superplasticized concrete shall not be dropped more than 12 feet unless special equipment is used to prevent segregation.

Slab concrete shall be placed at the design thickness in one layer. Formed walls shall be placed in layers not more than 24-inches high, unless superplasticizer is used, in which case the maximum layer shall be 5 feet. Each layer shall be consolidated to insure a good bond with the preceding layer.

Immediately after placement, concrete shall be consolidated by spading and vibrating, or by spading and hand tamping. It shall be worked into corners and angles of the forms and around all reinforcement and embedded items in a manner that prevents segregation or in the formation of "honeycomb." Excessive vibration that results in segregation of materials will not be allowed. Vibration must not be used to make concrete flow in forms, slabs, or conveying equipment.

If the surface of a layer in place will develop its initial set, i.e., will not flow and merge with the succeeding layer when vibrated, a construction joint shall be made. Construction joints shall be made by cleaning the hardened concrete surface to exposed aggregate by sandblasting, air/water jetting, or hand scrubbing with wire brush, and keeping the concrete surface moist for at least one hour prior to placement of new concrete. Concrete surfaces do not require extensive finishing work; however, the surface shall be smooth and even with concrete paste worked to the surface to fill all voids. The concrete surface must be watertight. Careful screeding (striking-off) and/or wood float finishing shall be required, unless otherwise shown on the drawings. Exposed edges shall be chamfered, either with form molding or molding tools.

The addition of dry cement or water to the surface of screeded concrete to expedite finishing is not allowed.

d. Reinforcing Steel Placement

Reinforcement shall be accurately placed and secured in position in a manner that will prevent its displacement during the placement of concrete. In forms, this shall be accomplished by tying temperature and shrinkage steel or special tie bars (not stress steel) to the form “snap ties” or by other methods of tying. In slabs, steel shall be supported by precast concrete bricks (not clay bricks), or metal or plastic chairs. Except for dowel rods, placing steel reinforcement into concrete already in place shall not be permitted.

The following tolerances will be allowed in the placement of reinforcing bars shown on the drawings:

1. Maximum reduction in cover:
    - from formed and exposed surfaces - 1/4 inch
    - from earth surfaces - 1/2 inch
2. Maximum variation from indicated spacing - 1/12th of indicated spacing

Splices of reinforcing bars shall be made only at the locations shown on the drawings, unless otherwise approved by the Engineer. Unless otherwise required, welded wire fabric shall be spliced by overlapping sections at least one full mesh dimension plus two inches. All reinforcement splices shall be in accordance with ACI 318.

Reinforcing steel shall not be welded, unless approved by the Designer. The ends of all reinforcing steel shall be covered with at least 1-1/2 inches of concrete.

e. Curing

Concrete shall be prevented from drying for at least seven days after it is placed. Exposed surfaces shall be kept continuously moist during this period by covering with moistened canvas, burlap, straw, sand or other approved material unless they are sprayed with a curing compound. Wooden forms left in place during the curing period shall be kept wet.

Concrete, except at construction joints, may be coated with a curing compound in lieu of continuous application of moisture. The compound shall be sprayed on moist concrete surfaces as soon as free water has disappeared but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. Concrete shall be wet cured or remain in forms until immediately before patching, repairs, or finishing is performed. Curing compound shall not be allowed on any rebars.

Curing compound shall be applied in a uniform layer over all surfaces requiring protection at a rate of not less than one gallon per 150 square feet of surface. Surfaces subjected to heavy rainfall or running water within three hours after the curing compound has been applied, or otherwise damaged, shall be resprayed.

Any construction activity which disturbs the curing material shall be avoided during the curing period. If the curing material is subsequently disturbed, it shall be reapplied immediately.

Steel tying or form construction adjacent to new concrete shall not be started until the concrete has cured at least 24 hours. Vehicles, overlying structures, or other heavy loads shall not be placed on new concrete

slabs for at least three days, unless the concrete strength can be shown to be adequate to support such loads.

f. Form Removal and Concrete Repair

Forms for walls and columns shall not be removed for at least 24 hours after placing the concrete. When forms are removed in less than seven days, the exposed concrete shall be sprayed with a curing compound or be kept wet continuously for the remainder of the curing period. Forms which support beams or covers shall not be removed for at least seven days, or 14 days if they are to support forms or shoring.

Forms shall be removed in such a way as to prevent damage to the concrete. Forms shall be removed before walls are backfilled. Columns shall be at least seven days old before any structural loads are applied.

Where minor areas of the concrete surface are “honeycombed,” damaged or otherwise defective, the area shall be cleaned, wetted and then filled with a dry-pack mortar. Dry- pack mortar shall consist of one part Portland cement and three parts sand with just enough water to produce a workable paste.

g. Concreting in Cold Weather

Concreting in cold weather shall be performed in accordance with ACI-306R-88. In addition, the contractor shall provide a written plan at least 24 hours in advance of placing concrete in cold weather, and shall have the necessary equipment and materials on the job site before the placement begins.

h. Concreting in Hot Weather

Concreting in hot weather shall be performed in accordance with ACI 305, of which some specific interpretations are set forth below. The supplier shall applyeffective means to maintain the temperature of concrete below 90 degrees Fahrenheit during mixing and conveying. Exposed surfaces shall be continuously moistened by means of fog spray or otherwise protected from drying during the time between placement and finishing and during curing. Concrete with a temperature above 90 degrees Fahrenheit shall not be placed.

i. Backfilling New Concrete Walls

Backfilling and compaction of fill adjacent to new concrete walls shall not begin in less than 14 days after placement of the concrete, except that walls that can be backfilled on both sides simultaneously may be done so within seven days.

Heavy equipment shall not be allowed within three feet of a new concrete wall. Provide compaction near the wall by means of hand tamping or small, manually-directed equipment.

5. WOOD STRUCTURES

All framing shall be true and exact. Timber and lumber shall be accurately cut and assembled to a close fit and shall have even bearing over the entire contact surfaces. Nails and spikes shall be driven with just sufficient force to set the heads flush with the wood surface. Deep hammer marks in the wood shall be considered evidence of poor workmanship and may be sufficient cause for rejection of the work.

Holes for lag screws shall be bored with a bit not larger than the body of the screw at the base of the thread. Holes for bolts shall be bored with a bit no more than 1/16” larger than the bolt diameter to achieve a snug fit without forcibly driving the bolt.

Washers shall be used in contact with all bolt heads and nuts that would otherwise be in contact with wood.

All joints shall be fastened with the number, type, and size of fasteners specified, at the locations or spacing specified.

If field cuts of pressure-treated wood expose untreated interior wood, the untreated surfaces shall be covered with two coats of a liquid preservative, as approved by the Engineer.

Roof trusses shall be handled, installed and braced according to the Truss Plate Institute's HIB-91, "Handling, Installing and Bracing MPC Wood Trusses."

Wood structures shall be backfilled within the limits shown on the drawings by placing material in uniform lifts not to exceed nine inches. Compaction within three feet of walls shall be accomplished by means of hand tamping or small manually-directed equipment.

6. GEOMEMBRANE STRUCTURES

Semi-rigid and flexible covers which utilize geomembranes shall be installed as required by the manufacturer, and as otherwise set forth in Section 8 and Construction Specification PA521A-PE/PP.

7. STRUCTURES INSTALLED ACCORDING TO STANDARD DETAIL DRAWINGS PREPARED BY OTHERS

Commercially available structures shall be installed as shown on the drawings provided to and concurred in by NRCS. All materials furnished and installed shall conform to the quality and grade noted on the drawings. A site specific set of construction drawings shall be at the site during construction.

Modification of the structure outside limits shown on the drawings shall not be made without prior review and approval by the Engineer with appropriate approval authority. The Supplier or Contractor who submitted the original standard detail drawings shall be responsible for making any changes. Sufficient design documentation to allow an adequate review of the proposed modification shall accompany any request for a change.

Within thirty (30) days of the completion of construction of the structure, the Contractor or Supplier shall furnish written certification to the Engineer that all aspects of the installation are in conformance with the requirements of the drawings and specifications.

8. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Supplement A – "Guidelines for Selecting Corrosion-Resistant Fasteners for Use with Preservative-Treated Wood"

Based on a review of technical information posted by the major U. S. preservative manufacturers and selected fastener and connector manufacturers, the following guidelines summarize the current state-of-practice regarding the selection of metal fasteners and connectors for use with ACQ and copper azole (CA) preservative-treated wood:

AWPA Use Category and Description	**Appropriate Fastener/Connector Types**
UC 3A or B – Exterior Construction, Above Ground UC 4A – Ground Contact or Fresh Water, Non-critical components	Fasteners Hot-Dipped (HD) Galvanized per ASTM A153 or Stainless Steel (SS), Type 304 or 316 Connectors HD Galvanized per ASTM A653, Class G185 or Stainless steel, Type 304 or 316
UC 4B - Ground Contact or Fresh Water, Critical components or difficult to replace	Stainless steel, Type 304 or 316

Other Preservatives:

1. For CCA-treated wood, HD galvanized fasteners and connectors as specified above are recommended. CCA is less corrosive than ACQ and CA.
2. For ACZA-treated wood, SS fasteners and connectors as specified above are recommended. ACZA contains ammonia and is significantly more corrosive than ACQ and CA.
3. For other preservatives, the more stringent of the preservative manufacturer's recommendations and the fastener/connector manufacturer's recommendations should be followed.

Notes regarding NRCS-type structures:

1. Use Category UC 3A and B include railings, decking, bracing, and slats on composter bins.
2. Use Category UC 4A includes posts such as those used in composter bins.
3. Use Category UC 4B includes structural building poles and permanent wood foundations.

Practice Specification
Fence (Code 382)

SCOPE

Fences are constructed as barriers to control the movement of animals and people, including vehicles. Fences may be designed or installed as permanent or temporary use.

Permanent fencing is intended to be in place for long periods of time with minimum maintenance requirements; therefore, it should be built with durable materials and constructed to endure a longer life span. Permanent fences are most often used for exterior grazing or property boundaries and/or where animals or humans are prohibited. This can include fencing associated with Waste Storage Facilities (WSF), Waste Transfer (WT), and Heavy Use Areas (HUA).

Temporary or moveable fences are designed to be in place for short periods of time. Temporary fences are best used as subdivision fences for frequent movement or control of animals and where the exact location of the fence may not be the same from time to time. This fencing offers maximum flexibility in rotational stocking systems for subdividing pastures to enhance grazing efficiency, livestock movement, and afford temporary stream and riparian protection.

FENCE TYPE OR STYLE (SEE Table 1)

Barbed wire fence is commonly used as multi- strand permanent fencing material for perimeter fences, land use boundaries, exclusion, livestock containment and isolation areas as well as interior cross fencing to facilitate grazing management. Barbed wire fence is generally not recommended for horses, sheep, goats and hogs.

Woven, net and mesh wire fences are used as permanent fences for both perimeter and subdivision fences. Wire spacing and height varies depending on the type of livestock or animals being controlled.

Woven wire fences consist of a series of horizontal (line) wires and vertical (stay) wires, and are offered in two main types including “hinge joint” and “continuous stay fixed knot.”

In a hinge-joint woven wire fence, the vertical stays actually wrap around the line wires. In a continuous stay fixed knot fence, the vertical stay wires are fixed with a separate wire to the line wire. Both of these main types come in various designs (line and stay spacing), tensile strength grades and metallic coating types and grades. High-tensile continuous stay fixed knot woven wire at 12.5 gauge may be used for all animals as specified by manufacturer.

High tensile smooth wire fence is commonly used as a multi-strand permanent fence for both perimeter and subdivision purposes. It can be used to control almost all animals when properly spaced. Smooth wire may be steel, aluminum or vinyl coated and electrified or non- electrified.

Electric fences may be permanent or temporary. The electrical power source can be from 110 or 220 electrical current or battery. Batteries may be re-charged by solar or electrical power. Livestock must be trained to respect electric fence.

Board fences are usually wood or some composite material used for permanent and subdivision purposes. Board fence is used primarily where aesthetics or animal safety is a concern and most often used around horses or for working facilities.

Other fence types may include chain link, pipe, vinyl, galvanized panel, guard rail, and cable fences. These are commonly used around homesteads, waste storage facilities and in corrals. They may be used to restrict access to unsafe or prohibited areas.

Heavy use area containment fencing is used to control access into and out of feed areas to minimize damage to soil and pasture around these permanent feed sites. This fencing is usually constructed of board, pipe, guard rail, cable or high tensile smooth wire built to sustain heavy use by high numbers of livestock around a confined feed area.

Non-conventional fencing includes variations of alternative fence systems that may be acceptable when installed according to manufacturer’s recommendations and pre- approved by the *PA NRCS State*

Grassland Conservationist. Alternative fence systems are often applicable for horses and other animals having special needs.

MATERIAL SPECIFICATIONS

Acceptable fencing criteria for various fencing needs may be selected from Tables 1 and 2; except when fencing requirements are shown in a set of Engineering Drawings and Specifications associated with WSF, WT, and HUA. Install as per details included; variations must be approved by the *Engineer of Record*.

The materials used in the construction of a chosen fence type must be new and of high quality and meet the size, strength, durability and lifespan requirements found in this specification including Tables 3 - 9.

Variations of what is presented in this document may be approved if alternatives will meet or exceed current specifications. Sufficient documentation must be presented to *PA NRCS State Grassland Conservationist.*

INSTALLATION

Fence-Line Clearing

Prior to construction, the fence line shall be cleared of any obstruction that would hinder fence placement and operation. Clearing along stream banks will be held to a minimum except as required for stream crossings. The soil surface along the fence line shall be relatively smooth such that placement of the bottom wire does not exceed specified maximum wire spacing from soil surface.

Setting posts

All post shall be set and maintained in a vertical position or leaning slightly (1-2” off vertical) away from direction of wire tension.

Posts in curves should be set approximately 4” off vertical. Posts set with a driver have about 9 times the holding strength of hand- set posts. If hand set, holes should be at least 6” larger than the diameter of the posts and all backfilled material shall be thoroughly tamped in layers no thicker than 4 inches. The post hole shall be filled to the ground surface. Concrete backfill is not necessary when posts are driven or hand set with proper tamping; however, if used it shall be rodded into place in layers not thicker than 12 inches and shall completely fill the post hole to the ground surface. No stress shall be applied to posts set in concrete for 24 hours.

Line Posts

Specifications of line posts are found in Table 4. The maximum spacing of line posts for permanent fences is found in Table 1 and will be the same for all types of posts. **Spacing will vary depending on terrain and pressure from livestock.** Installation shall ensure that adequate fence height is maintained based on its purpose.

Note: Landscaping timbers should not be used for any post or brace component of a fence system.

Installing Curves

Installing curves in high tensile, woven wire, and barbed wire fences is permissible as long as the change in direction from one post to the next does not exceed 20 degrees. Posts on curves shall be 5 inch minimum top diameter for changes up to 14 degrees and 6 inch minimum top diameter for changes up to 20 degrees.

Posts on curves should be driven 48 inches deep with 4 inches of lean to the outside of the curve and spaced no closer than 4 foot apart. (In an 8-foot long section, 14 degrees is approximately 24 inches off straight line and 20 degrees is approx. 35 inches off the straight line).

Line Posts – Stream Crossing

Anchor posts are required on both sides of a stream crossing. For crossings less than 16 feet wide, standard line posts set on both sides will be adequate. For crossings wider than 16 feet, or when non-electrified heavy flood gate is used, a single H-brace assembly or other suitable brace shall be used.

- Where needed, flood gates will be attached below bottom wire and will be designed to allow water and debris to pass while still controlling livestock. Some type of hinged or breakaway floodgate works best.

Posts that are set in low areas or gullies may need to be weighted or anchored to prevent lifting out.

Stays or battens between line posts

Stays or wire spacers or battens may be used to maintain desired wire spacing between line posts; note that specifications for post spacing differs with and without stays (Table 1). Stays shall be secured sufficiently to remain in position along wire line.

Offset Brackets

Offset brackets made of galvanized high tensile spring wire with an insulator of high density polyethylene with ultraviolet stabilizer or porcelain can be attached to standard barbed wire fence or woven wire fence to provide transmission line and /or to protect a standard fence. Other corrosion resistant offset brackets with insulators that attach directly to the fence posts can also be used.

Place offset brackets up to 40 feet apart and attach to wires of standard fence next to post. If control of animals is desired, place offset brackets at 2/3 the height of the animals to be controlled. Make sure no wires of the old fence come in contact of the electric fence wire, as a short will occur. Use offset brackets that hold the electric wire at least 4 inches from the non- electrified fence material.

Post Bracing

Bracing of anchor (pull) posts is required at all corners, gates, fence ends and at definite slope and alignment changes in the fence line. The type of fence, number of fence wires, and length of span will determine type, size and spacing of bracing required to support a fence. See table 8 for additional information.

Bracing shall withstand the forces of the fence load and transfer to the surrounding soil. They come in a number of configurations depending on the purpose and number of posts utilized. The length of braces should be at least 2 times the height of the fence fabric they are supporting. See Tables 5 and 6 for selection criteria and design specifications of single and double brace assemblies.

Corner braces are required at all points where the fence alignment has a change of 20 degrees or more from one post to the next. (In an 8-foot long section, 20 degrees is approx. 35 inches off the straight line).

End braces are required where fence ends and on both sides of gate openings and has pull from only one direction.

In–line pull post assemblies are located in straight sections of the fence line and where there are sudden changes in elevations, such as at the bottom and top of slopes. Tie off all wires at in-line pull assemblies and start new wires for the next fence section. Posts that are set in low areas or gullies may need to be weighted or anchored to prevent lifting out.

Single post braces may be used with 2- strand or less high tensile electrical wire (Table 7) if corner/end post are set 4’ deep. If this cannot be accomplished, then a single H corner/end brace assembly should be used.

Brace Rails

Refer to Table 6 for Criteria and Specifications.

- Placement of the horizontal brace rail will be between the top two wires of the fence or fence fabric. This should be a minimum 3 feet above ground.

- The length of the horizontal brace shall be at least 2 times the height of the fence fabric it is supporting.
- The longer the brace rail the stronger the brace.
- The brace and anchor posts should be fastened to the compression brace using galvanized brace pins (3/8” X 9” and 3/8” X 4”), drilled through vertical post and into end of horizontal brace, 2” deep. An H-brace bracket (dacromet-coated heavy gauge steel) may be used in place of brace pins. Install with minimum 1.75” screws.
- Do not notch vertical posts (wood) for stabilizing horizontal brace support as this will increase chance of wood rot.

Note: Landscaping timbers should not be used for any post or brace component of a fence system.

Adjoining Fences

A fence adjoining an existing fence must terminate in a brace assembly as required per fence brace specifications in Table 5, 6, and 7.

Tension of Brace (Guy) Wires

For guy wires use two complete loops of 12½ gage HT wire or one loop of 9 gauge soft wire, or a single 3/16” galvanized cable with cable lock.

For horizontal braces, brace wire will be double wrapped and stapled to brace post at a height of just above the brace member and to the anchor (pull) post at a point approximately 2-3 inches above the ground level.

Brace (Guy) wire will be tightened using a wire tightener or strainer. Another suitable method is to tension the brace wire with a chain grab and splice using a double crimp or compression sleeve.

INSTALLATION OF WIRE

Barbed and woven wire will be stretched to sufficient tension prior to being fastened to posts. Temperature variations must be considered (wire will tighten in cold weather and expand in hot weather). See wire specification requirements in Table 3.

Tensioning the wire

Woven Wire - In warm weather, wire shall be stretched until 1/3 of the height of the “tension curve” is removed. In cold weather, remove ½ of the tension curve. *Fixed-Knot High Tensile Woven Wire* - The tension crimp should be ½ the size of an un-tensioned crimp.

Barbed Wire - In warm weather, a 100 ft. stretch of wire should sag no more than 4 inches in the middle (prior to attaching to posts) and no more than 2 inches in cold weather.

High Tensile Wire - Tension should be 250 lbs. for cattle, horses, goats and sheep. For electrified high tensile wire the tension should be sufficient to maintain the proper average height and spacing of the fence wires.

Tension springs

In-line wire spring-tensioners are designed to indicate lbs. of tension on the line, assuming placement within the line is appropriate.

On most fences the use of one tensioner per pull will provide sufficient indication of the tension on adjacent wires.

Springs offer only 3-6 inches of elasticity therefore are of little benefit when something like a tree falls on the wire.

Staples and fasteners

Staples should be installed into post to allow free slippage of wire.

Staples shall be driven diagonally across the grain of the wood and at a slight downward angle (except in dips of landscape) and shall not be driven so tightly as to bind the wire against the post.

Electrically charged smooth wires must be attached to conductive posts with an appropriate ceramic, UV resistant HDPE (High Density Polyethylene) or HDPP (High Density Polypropylene) or tube type plastic reinforced insulators.

For steel line posts, the fencing shall be fastened with either 2 turns of 14 gauge galvanized steel wire or the post manufacturer's special wire clips. For all other types of posts, attach as specified by manufacturer.

Tie off of wire or insulators: High tensile wire is tied off using the "thread through method" (a half hitch and 3 wraps) or with compression sleeves. A length of high tensile wire is fastened around the groove of the insulator then looped around the post and stapled on opposite side of post. An alternative is the tubular plastic reinforced insulator to prevent cracking of the plastic and grounding of the wire. All insulators must be rated for use with high tensile fence.

Wire attachment to posts

Attaching Fence Wire to Anchor (Pull) Post: For **Barbed wire** fences, wires will be attached to anchor (pull) post by one complete wrap around the post, double stapled (wood posts) or wired (steel posts) and ends tightly wrapped around stretched wire five times. Compression sleeves may be used to connect ends of brace wire.

For **Woven or Mesh wire**, determine amount of wire needed to fully wrap around post once then remove enough vertical stays to provide that length. The wire ends are then attached as described in previous paragraph. All lines are stapled to the post.

For **High Tensile** wire, the line wires are attached to each anchor post by wrapping the post and securing with a half hitch with 3 wraps, or using appropriate double crimp sleeves.

Fixed-knot woven wire fence shall be stapled to wood post or fastened to steel post at every horizontal wire using manufacturer recommended wire c lips.

High Tensile electric wire that pulls through corners or bends may be suspended from the inside of posts in corners and bends using ceramic or appropriate UV resistant HDPE or HDPP donut type plastic high strain insulators. The tubular plastic reinforced high strain insulators can wrap around the outside of bends and corner posts.

Attaching Fence Wire to Line Post: **Barbed wire** shall be attached at each post with 1.5 inch staples driven to allow slippage. The top wire shall be at least 2 inches below the top of posts on wood posts and at least 1 inch below the top on steel posts. Wire shall be spaced no more than 10 inches apart and often closer depending on livestock controlled.

Woven wire and fixed-knot woven wire fencing shall be attached to posts at the top 3 and bottom 3 strands on every posts and then alternate every other line making sure you attached to the missed lines on the next alternating line post.

HT electric wire shall be attached using ceramic or appropriate UV resistant HDPE or HDPP plastic insulators. The tubular plastic reinforced high strain insulator can be used on the outside of corners, curves or bends.

Post side wire placement: the wire shall be placed on the livestock side of line posts and on the outside of curves and bends.

Wire Splicing

There are two basic ways to splice wire:

1. Hand knot
2. Crimping or compression sleeves (per manufacturer recommendation)

Barbed wire and woven wire shall be spliced by means of a western union splice or by suitable compression sleeves applied with a tool designed for the purpose.

Gates

Gates weighing less than 100 lbs may be hung from single end post properly installed. Heavy metal or wood gates more than 6 ft. wide shall best be attached to the pull post of an H-brace or diagonal floating brace.

All gates must be substantial enough to withstand expected pressures from livestock and wildlife.

A 12 ½ gauge overhead or insulated underground transmission line will be used to carry electricity across all gate openings (including electrified gates) to charge the remainder of the fence.

Gates Over Streams and Ditches

Hanging gates should terminate approximately 6 inches above average normal water level.

Non-electric flood gates should be hinged such that gate will swing with rising water during storm events.

An electrified flood gate may be used to minimize debris problems on stream crossings. The electrified flood gate is constructed by stretching an electrified wire across the drainage above high water flow level. Attach, with compression sleeves, hanging galvanized chains or wire to the electrified wire at a spacing of 6 inches for goats, hogs and sheep or 12 inches for cattle and horses. It is advisable to connect the gate to electric fence with double insulated cable through a cut-off switch and flood gate controller.

Stream Bank Protection

Permanent fencing will be placed at least 10 feet from the top of the stream bank and should allow for more area in meanders and in areas with bank erosion to minimize corner bracing. Permanent fencing setback distance from drainage ditches should be enough to allow sufficient room for vegetation management and fence maintenance.

SAFETY

- Electrical fences shall be clearly labeled or identified with the appropriate warning signs spaced every 300 feet where the public has access. Barbed wire shall not be electrified because of safety hazard.
- Fencing operations can result in painful and serious injury. Wear heavy gauntlet leather gloves to protect hands and wrists, and boots or high-top shoes to protect legs and ankles.
- Tough, close fitting clothing will reduce risks of catching on wire. Wear safety glasses to protect eyes from injury. When stretching woven, fixed- knot, or barbed wire, stand on the opposite side of the post from the wire and stretcher unit.
- It is dangerous to use a tractor to stretch wire fencing because of potential breaking of the wire resulting in serious injury from the recoil of the clamp bar, chain, or wire. Keep chains and wire stretching clamps in good condition.
- Carry staples, nails, or other fasteners in a metal container or in an apron and not in your trouser pockets. Do not hold fasteners in your mouth which is a common but extremely dangerous habit.
- If you handle preservative treated posts, do not rub your hands or gloves on your skin, nose, eyes, or month. Wash your hands after handling treated posts. Minimize the inhaling of sawdust. Do not burn treated posts or apply the ash to a garden. Properly dispose of treated wood in a landfill.

Additional conditions which apply to this practice:

1. A professional fencing contractor is recommended during the planning phase of any fence system.
2. Woven wire for sheep and goats should have vertical wire wide enough (9” to 12”) or narrow enough (<4”) to minimize potential injury. Otherwise use an electric offset wire to keep animals away from woven wire that might “entangle” them.
3. Never use household electrical wire for any part of an electrified fence. Splicing wires of different metals often results in oxidation and corrosion which causes short circuits and poor conductivity.

4. A digital voltmeter is essential to monitoring and maintaining electrical power fences.
5. Avoid placing electrical fences parallel with telephone or commercial power lines since static field can sometimes be created.
6. It is recommended that fences be located 20 feet or more from streams with a maintenance gate to allow for emergency access to water. This distance can also lessen fence maintenance by reducing flood damage. Temporary fencing may be used to protect streambanks while using forage adjacent to the stream.

PA NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD FENCE (382)

Table 1. Permanent Fence Selection Criteria

Fence design and construction must meet the minimum requirements for controlling specific animal types.

Animal Type to Control	Fence Type	Purpose of Fence				Suggested Spacing (in. above ground) ww fences start 2-4" above ground	Line Posts and Stay Spacing (Maximum spacing)		
		Perimeter	Travel Lanes	Interior Subdivision	Surface Water Exclusion		Posts w/o stay	Post with stay	Stay Spacing
		Minimum Criteria				Inches	Feet		
Cattle	Barbed 3-wire	NO	Meets	Meets	NO	18, 28, 38	16	20	10
Cattle	Barbed 4-wire	Meets	Exceeds	Exceeds	Meets	14 to 44 evenly spaced	12	20	10
Cattle	Barbed 5-wire	Exceeds	Exceeds	Exceeds	Exceeds	10 to 46 evenly spaced	12	20	10
Cattle	Non-Electric 6-wire high tensile smooth	Meets	Exceeds	Exceeds	Meets	9 to 46 evenly spaced	16	30	10
Cattle*	Non-Electric 8-wire high tensile smooth	Exceeds	Exceeds	Exceeds	Exceeds	6 to 46 evenly spaced	16	30	10
Cattle	Electric 1-wire high tensile smooth	NO	Meets	Meets	Meets	26-32	60	NA	NA
Cattle	Electric 2-wire high tensile smooth (both hot)	NO	Meets	Exceeds	Meets	20, 34	50	80	20
Cattle	Electric 3-wire high tensile smooth (min. 2 hot)	**NO	Exceeds	Exceeds	Exceeds	13, 24, 36	50	80	20
Cattle	Electric 4-wire high tensile smooth (min. 2 hot)	Meets	Exceeds	Exceeds	Exceeds	8, 20, 32, 44	50	80	20
Cattle	Electric 5-wire high tensile smooth (min. 2 hot)	Exceeds	Exceeds	Exceeds	Exceeds	8, 16, 24, 34, 44	50	80	20
Cattle	Woven wire (hinge joint) plus one or more HT or barbed top wires	Meets	Exceeds	Exceeds	Meets	47 min, 6" max between top wires	10	NA	NA
Cattle	HT woven wire (hinged joint) plus one or more HT or barbed top wires	Meets	Exceeds	Exceeds	Meets	47"min, 6" max between top wires	20	NA	NA
Cattle	HT Woven wire (fixed knot)	Meets	Exceeds	Exceeds	Meets	47 min	20	NA	NA
Cattle	Wood or Composition 4 board (6" wide)	Exceeds	Exceeds	Exceeds	Exceeds	6 , 6, 8, 10 between boards	8	NA	NA
Goats & Sheep***	Electric 3-wire high tensile smooth (min. 2 hot)	NO	Meets	Meets	NO	6, 18, 35	50	80	20
Goats & Sheep***	Electric 4-wire high tensile smooth (min. 2 hot)	NO	Exceeds	Exceeds	Meets	6, 16, 26, 36	50	80	20
Goats & Sheep***	Electric 5-wire high tensile smooth (min. 2 hot)	Meets	Exceeds	Exceeds	Exceeds	6, 12, 18, 28, 38	50	80	20
Goats & Sheep	Woven wire plus one HTE offset inside	Meets	Meets	Meets	Meets	42" min, one HTE offset 2/3 animal ht	10	NA	NA
Goats & Sheep	Woven wire plus one or more HT or Barbed top wires to 48"	Meets	Meets	Meets	Meets	36 min, 6" max between top wires	10	NA	NA
Goats & Sheep	HT fixed knot woven wire plus one or more HT or Barbed top wires to 48"	Meets	Exceeds	Meets	Meets	42 min, 6" max between top wires	20	NA	NA
Horses****	Electric 2-wire high tensile smooth (both hot)	No	Meets	Meets	Meets	28, 38	50	80	20
Horses****	Electric 3-wire high tensile smooth (min 2 hot)	No	Exceeds	Exceeds	Exceeds	28, 38, 48	50	80	20
Horses****	Electric 4-wire high tensile smooth (min 2 hot)	Meets	Exceeds	Exceeds	Exceeds	18 – 54 evenly spaced, minimum 2 hot	50	80	20
Horses	Woven wire (2"x 4" openings max.)w/1 wire HT on top	Meets	Exceeds	Exceeds	Meets	48 + HT at 54	10	NA	NA
Horses	HT vinyl-coated or polymer encased (2"x 4" openings)	Meets	Exceeds	Exceeds	Meets	48 + HT at 54	10	NA	NA
Horses	HT woven wire (fixed knot) (2"x 4" openings max.)	Meets	Exceeds	Exceeds	Meets	60	20	NA	NA
Horses	Mesh "No climb" (2"x4" spacing)	Exceeds	Exceeds	Exceeds	Exceeds	48 + HT at 54"	16	NA	NA
Horses	Wood or Composition boards (6" wide)	Exceeds	Exceeds	Exceeds	Exceeds	18 min. 12 max. between boards	8	NA	NA

PA NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD FENCE (382)

Table 1. Permanent Fence Selection Criteria Continued

Fence design and construction must meet the minimum requirements for controlling specific animal types.

Animal Type to Control	Fence Type	Purpose of Fence				Suggested Spacing (above ground) ww fences start 2-4" above ground	Line Posts and Stay Spacing (Maximum spacing)		
		Perimeter	Travel Lanes	Interior Subdivision	Surface Water Exclusion		Posts w/o stay	Post with stay	Stay Spacing
		Minimum Criteria				Inches	Feet		
Hogs	Electric 2-wire high tensile smooth (both hot)	NO	Meets	Meets	Meets	6-10, & 16-18	20	30	15
Hogs	Electric 6-wire high tensile smooth (min 2 hot)	Meets	Exceeds	Exceeds	Exceeds	6, 12(+), 18(+), 26, 34, 42	20	30	15
Hogs	Woven wire 32" w/ barbed wire	Meets	Exceeds	Exceeds	Meets	32 + 1 barb above, and one barbed 2" off ground and 2" below woven wire	10	NA	NA
Hogs	Woven wire 32" w/ 1 HT electric inside	Meets	Exceeds	Exceeds	Meets	32 + 1barbed or HTE 6" above and one HTE wire 8" off ground, 8" inside of fence	10	NA	NA
Hogs	HT woven wire (fixed knot) 32" w/ 1 barb or HTE	Meets	Exceeds	Exceeds	Meets	35" + 1 HTE offset like above	20	NA	NA
Deer*****	HT woven wire (fixed knot) 96" tall with 12" verticals	Meets	Meets	Meets	Meets	96	20	NA	NA
Deer*****	Electric 7-wire High tensile smooth wire slanted	Meets	Meets	Meets	Meets	see diagram of slant measurements	30	100	25
Deer*****	Electric 9-wire High tensile smooth wire	Meets	Meets	Meets	Meets	8, to 72 evenly spaced	30	100	25
Deer*****	Electric 12-wire High tensile smooth wire	Exceeds	Exceeds	Exceeds	Exceeds	6, to 72 evenly spaced	30	100	25
Deer*****	Electric 15-wire High tensile smooth wire	Exceeds	Exceeds	Exceeds	Exceeds	2, to 96 evenly spaced	30	100	25
Buffalo	Electric 4-wire high tensile smooth	NO	Meets	Meets	Meets	16 to 42 evenly spaced	30	100	25
Buffalo	Electric 5-wire high tensile smooth	NO	Exceeds	Exceeds	Exceeds	16 to 48 evenly spaced	30	100	25
Buffalo	Electric 6-wire high tensile smooth	Meets	Exceeds	Exceeds	Exceeds	12 to 52 evenly spaced	30	100	25
Buffalo	HT woven wire (fixed knot)	NO	Meets	Meets	Meets	48	20	NA	NA
Buffalo	HT woven wire (fixed knot)	Meets	Exceeds	Exceeds	Exceeds	60	20	NA	NA
Chickens/turkey	Woven wire 2"x4" 1 wire HT or barb above	Exceeds	Exceeds	Exceeds	Exceeds	72	10	NA	NA
Emu and ostrich	Woven wire 2"x4" 1 wire HT or barb above	Exceeds	Exceeds	Exceeds	Exceeds	72	10	NA	NA
Chickens/turkey	HT Woven wire 2"x4" 1 wire HT or barb above	Exceeds	Exceeds	Exceeds	Exceeds	72	18	NA	NA
Emu and ostrich	HT Woven wire 2"x4" 1 wire HT or barb above	Exceeds	Exceeds	Exceeds	Exceeds	72	18	NA	NA
People WSF	Chain link	Meets	Preferred option			60	10	NA	NA
People WSF	Electric 15-wire HT	Meets				4 to 60 evenly spaced	8	NA	NA
People WSF	Woven wire 48 inch plus 3 barbed wires or 2 HT electric	Meets				48 min. WW with HT or barb at 4"space to 60. HT may be electrified	10	NA	NA

Use the information in this table as a guide to determine the number of strands and spacing requirements. Adjustments may be made based on manufacturer's recommendations and landowners preference for confinement with NRCS approval.

*HUA containment fencing should be built of a suitable material (usually HT smooth wire, pipe, cable, guardrail, or board) and post spacing to endure heavy use around permanent feed areas. WSF, WT and HUA fencing requirements are found in associated engineering drawings.

**May be used as perimeter fence for dairy cattle only.

***If the goats or sheep are not trained to electric fencing, then high tensile electric fencing is probably not a good option for the livestock operation.

****Consideration for visibility should be taken when using high tensile fence for horses. Poly coated or vinyl encased wire or rail can be used following manufacturer recommendations for installation.

***** Exclusion fence only

PA Natural Resources Conservation Service Conservation Practice Standard Fence (382)						
Table 2. Temporary Fence Selection Criteria						
Fence design and construction must meet the minimum requirements for controlling specific animal types.						
Animal Type to Control	**Fence Type[1] (all wires hot)**	**Purpose of Fence**			**Suggested Spacing Above Ground**	**Line Posts (maximum spacing)**
		Travel Lanes	**Interior Subdivision**	**Surface Water Exclusion**		
		Minimum Criteria			**Inches**	**Feet**
Cattle	Electric 1-wire Polywire or Polytape or galvanized steel braided wire	Meets	Meets	Meets[2]	26-36	40
Cattle	Electric 2-wire Polywire or Polytape or galvanized steel braided wire	Exceeds	Exceeds	Exceeds	20, 32	40
Goats/Sheep	Electric 4-wire Polywire or Polytape	Meets	Meets	NO	8, 16, 24, 32,	40
Goats/Sheep	Electric Net Fencing[3]	Meets	Meets	Meets	0, (minimum 35 inches tall)	built in[4]
Horses	Electric 1-wire Polywire or Polytape	Meets	Meets	NO	34	25
Horses	Electric 2-wire Polywire or Polytape	Exceeds	Exceeds	Meets	28, 40	25
Hogs	Electric 2-wire Polywire or Polytape or galvanized steel braded wire	Meets	Meets	NO	8, 18	40
	Electric Net Fencing[3]	Meets	Meets	Meets	0, (35 inches tall)	built in[4]
Poultry	Electric Net Fencing[3]	Meets	Meets	Meets	0, (minimum 40 inches tall)	built in[4]
[1] Livestock must be trained to respect electric fencing prior to using temporary fence products for complete containment.						
[2]Two wires may be needed to prevent young calves from going beneath the fence.						
[3]Use electric netting specifically designed for the type of livestock being controlled; it is not suggested for small animals with horns (consider spacing of vertical stays and horizontal lines and fence height).						
[4]Line posts are typically built into the rolls of netting near 12.5 feet spacing.						
Based on the type of livestock, use the information in this table as a guide to determine the number of strands and spacing for different types of temporary fencing products. Adjustments may be made based on manufacturer's recommendations and landowners preference and ability to control the livestock. Temporary fencing products are not intended to be used as permanent or semi-permanent containment fencing.						

PA Natural Resources Conservation Service Conservation Practice Standard Fence (382)				
Table 3. Wire Specifications				
Wire Type	Minimum Wire Size	Minimum Wire Coating/Composition	Wire Strength and Other Considerations	
Barbed, Standard Double Strand (must meet ASTM A121)	12.5 gauge (ga.) with 4 point barbs spaced on 5" centers	Class 3 zinc coating per ASTM A641-	950 lbf	
	15.5 ga. with 4 point barbs spaced on 5" centers	Class 3 zinc coating per ASTM-A641		
Barbed, High-Tensile Double Strand (Gaucho Wire) (must meet ASTM A121)	15.5 ga. 4 point barbs	Class 3 zinc coating per ASTM-A641	170,000 psi or 950 lbs.	
High Tensile Smooth single strand (must meet ASTM A854)	12.5 ga.	Class 3 zinc coating per ASTM-A641	200,000 psi or 1540 lbs.	
High Tensile Vinyl Coated or Polymer Encased Wire	12.5 ga.	UV resistant polymer	1,300 lbs per wire or 4,000 lbs per rail	Can be used for permanent fences
Galvanized Steel	14 ga.	Class IV	160 lbs	Can be used for 1 or 2 wire temporary fences
Standard Woven Wire "hinged joint" or continuous stay "fixed knot" (must meet ASTM A116)	Top & Bottom wires: 12 gauge min. Intermediate wires: 12.5 ga.	Class 3 zinc coating per ASTM A641	Horizontal and vertical spacing should be appropriate for animal types. Design numbers of woven fence are related to the characteristics of the fence fabric. For example: 1047-12-12 ½ has 10 line wires is 47" high has 12" stay wire spacing and is 12.5 gauge.	
High Tensile Woven Wire (must meet ASTM A116)	12.5 gauge	Class 3 zinc coating per ASTM A641	175,000 psi on line wires	
Mesh Wire; such as Horse-No-Climb	Top & Bottom wires: 12.5 gauge Intermediate & Stay Wires: 12.5 gauge	Class 3 zinc coating per ASTM A641	At least 48" high, less than or equal to 2-inch x 4-inch mesh spacing.	
Polywire or "Twine " – Type	Minimum of 6 strands of aluminum, stainless steel or mixed metal wires	Wires interwoven with polyethylene or polypropylene fiber.	Polywire (twine-type), as compared to polytape is more durable under frequent movement. Polytape is best used where high visibility is needed. Do not use on fences more than 1 mile in length (low-conductivity). Life expectancy is 3-5 years if moved frequently.	
Polytape or Tape-Type	Minimum ½ inch wide and 5 strands of stainless steel or mixed metal wire filaments			
Aluminum	12.5 gauge	Aluminum	May be used as one of the wires in a multi-wire fence or as single wire subdivision fence. May be used as lead out cable from Power Energizer to fence.	
Steel wire and hardware used to construct a permanent fence will be new and galvanized material. Not all materials are for permanent or containment fencing, reference Table 1 to ensure the fence material selected is appropriate for the type of fence and the livestock to control.				

PA Natural Resources Conservation Service Conservation Practice Standard Fence (382)			
Table 4. Line Post Type, Size and Depth Specifications			
Fence Type	**Post Type**	**Minimum Diameter/ Weight**	**Minimum Depth***
Barbed Wire Woven Wire Smooth High Tensile wire non-electrified	Pressure treated wood (Material Spec 585), black locust, red cedar (>50% heartwood)	4"	30"
	Steel T posts[1] Steel U posts[1] Steel L posts[1] (When using steel posts, wooden posts shall be set every 4th post)	1-3/8" x 1-3/8" x 1/8" thick 2" x 1-1/4" x 3/32" thick 2" x 2" x ¼" thick All 1.25 lbs. per foot, exclusive of anchor plates	18"
	Steel pipe, galvanized	2" outside diameter	18"
Smooth High Tensile wire electrified	Pressure treated wood (Material Spec 585), black locust, red cedar (>50% heartwood) bb	4"	30"
	Steel T posts[1] Steel U posts[1] Steel L posts[1] (When using steel posts, wooden posts shall be set every 4th post)	1-3/8" x 1-3/8" x 1/8" thick 2" x 1-1/4" x 3/32" thick 2" x 2" x ¼" thick All 1.25 lbs. per foot, exclusive of anchor plates	18"
	Fiberglass[2,4]	5/8"	16"
	HDPE[3,4]	1.33" (per manufacturer recommendations)	12"
	Composite[3,4]	1 1/8" (per manufacturer recommendations)	16"
	PVC T or H posts[3,4]	1.5"	12"
Stays (Battens, Droppers, or Spacers)	Wire stays Composite Fiberglass Steel T post w insulators Wood PVC	12 ga. galvanized for barbed wire 1" ½" Listed above 1.5"X1.5" 1"	Stays are not always designed to touch the soil surface, but should be sufficient to maintain wire spacing
Temporary Electric Fences	Fiberglass, composite, plastic, PVC, steel rod	3/8"	4"

[1]All steel posts shall be new and painted or galvanized.
[2]Fiberglass posts should be coated to prevent splintering and cracking.
[3] All HDPE, PVC and composite material must be UV protected.
[4]Fiberglass, composite, PVC and HDPE posts are not to be used in bends, curves or at places in the fence with abrupt changes in elevation.
*Minimum depth unless specified by manufacturer. If top fence wire is greater than 60 inches minimum depth increases, consult NRCS technical specialist during design for approval prior to construction.

PA Natural Resources Conservation Service Conservation Practice Standard Fence (382)			
Table 5. H-Brace Pull Post (corner, gate and end) Specifications			
Brace Post Type	**Minimum Top Diameter**	**Depth Anchoring[1]**	**Other**
Pressure treated pine (Material Spec 585) or other wood of suitable strength: red cedar (>50% heartwood), black locust.	6" top diameter (corners, ends, pull posts and gates);	48"	Minimum post lengths should allow for required buried depth and fence height plus at least 2 inches of post above top wire. Posts will have appropriate treatment to prevent rust and deterioration. The assembly strength of a corner post set 2.5' deep is approximately half compared to a post set at 3.5' deep. A single post brace assembly can be used as bracing for ≤2 HT smooth electric wires. See Table 7.
	5" top diameter all other wooden brace posts	48"	
Steel round pipe – braced[2]	2-3/8" nominal; 7 lbs/ft. or equivalent	36" set in 12 in diameter hole with concrete	
	4" nominal; 10 lb./foot or equivalent	36" driven	
Steel, angle iron – braced[2]	2.5" x 2.5" x 0.25"	36" set in 12 in diameter hole with concrete	
[1]If top fence wire is greater than 60 inches depth anchoring increases, consult NRCS technical specialist during design for approval prior to construction. [2]All steel posts shall be new and galvanized.			

PA Natural Resources Conservation Service Conservation Practice Standard Fence (382)			
Table 6. Brace Rail Specifications for H-Brace			
Brace Member Type	**Minimum Diameter/ Weight**	**Typical Length**	**Other**
Pressure treated pine (Material Spec 585) or other wood of suitable strength; red cedar (>50% heartwood), black locust.	4 inches	8-10 feet	Posts will be straight and free of splintering. Posts will have appropriate treatment for rust and deterioration. The wider this brace the stronger the brace.
Galvanized steel pipe[1]	2" diameter, schedule 40	8-10 feet	
Steel, angle iron[1]	2.5" x 2.5" x 0.25"	8-10 feet	
[1]All steel posts shall be new and galvanized.			

PA Natural Resources Conservation Service Conservation Practice Standard Fence (382)			
Table 7. Single Post Brace[1] Specifications for 1-2 strands high tensile electric fence only			
Brace Post Type	**Minimum Top Diameter**	**Minimum Depth Anchoring**	**Other**
Steel round pipe or tubular steel[2] (galvanized)	2.5" outside diameter schedule 40	24" set in 12" diameter hole with concrete	For single wire fences, concrete not needed if posts are driven 3 feet deep
Steel angle iron[2]	2.5" x 2.5" x 0.25"		
Steel[2]	4" outside diameter	48"	Concrete not needed
Pressure treated pine (Material Spec 585) or other wood of suitable strength; red cedar (>50% heartwood), black locust.	6 inch (post must be driven)		*If single brace post cannot be installed to 48", use a corner or end brace.*
[1]Single posts as braces should lean approximately 4 inches away from the direction of pull.			
[2]All steel posts shall be new and galvanized.			

PA Natural Resources Conservation Service Conservation Practice Standard Fence (382)			
Table 8. Maximum Brace Assembly Spacing (on straight and level pulls)*			
Fence Type	**Distance Between Anchor (pull) Posts (ft.)**	**End / Corner Brace Types**	**Inline Brace Type**
Barbed Wire and Standard Woven (net) wire (Hinge Joint)	0 - 600	Single H Brace	NA
	601-1,320	Double H Brace	NA
	>1,320	Double H Brace	Double H Brace
High Tensile Fixed Knot Woven Wire (Continuous Stay)[2]	0 – 1,320	Single H Brace	NA
	>1,320	Double H Brace	Double H Brace
Smooth HT wire – non-electrified or electrified	3-6 strands [1]	Single H Brace	N/A
	6+ strands	Double H Brace	N/A
*The maximum distance between anchor posts of a brace assembly will often be shorter than what is listed in this table due to abrupt changes in topography or fence direction that will require closer brace assembly spacing.			
*All wires must be tied off at in-line pull assemblies and new wires started for the next fence section.			
*Use this information as a guide to determine bracing requirements for the type of fence being constructed. Minor adjustments may be made based on topography and the number or height of fence wires installed with NRCS approval.			

[1]Single post brace assembly of suitable diameter can be used for fences with 1-2 strands HT electric wires, see Table 7.
[2]Build HT fixed knot WW fence according to recommendations of the fencing manufacturer.

PA Natural Resources Conservation Service Conservation Practice Standard Fence (382)	
Table 9. Specifications of other Fence Components	
Component	**Description/Specification**
Electrical Energizers or "Chargers"	Energizers for permanent electric fencing must be manufactured for the purpose of agricultural fencing and be high power, low impedance that can produce at least 5,000 volt peak output and a short pulse less than 300 milliamps (mAmps) in intensity, finished within 0.0003 of a second, and at a rate of 35-65 pulses per minute. It is recommended that the energizer have a fence charge meter. Only one charger is allowed per fence. It is recommended the unit include a high impact self-insulating weather resist case, a snap-in circuit panel, a safety pace fuse, a lightening arrester, have full power input and reduced power output. May be solar, 110 or 220 volt, or 12 volt battery units. OUT PUT Joule rating should be based on the size of fence system, the type of fence being electrified and high enough to provide a minimum shock at the farthest point in the fence. To control most livestock it is recommended to maintain fence line voltage ≥ 3,000 volts. Use higher voltage for sheep, goats and predator control.
Lightening Arrestor	A properly grounded lightning arrester and a "lightning choke" shall be installed to protect the energizer from lightning strikes. A voltage spike protector is also recommended.
Electrical Insulators	Insulators shall be made of high quality glazed porcelain or UV resistant HDPE or HDPP plastic manufactured for durability under high tensile strain. UV resistant tubular plastic insulators that wrap around end and corner posts must have a reinforced strip to prevent cracking and grounding under high tensile strain. Galvanized 12.5 gauge wire may be used on fiberglass and other non conductive posts to secure wire to post.
Wire connecting energizer to fence or beneath gate or road	Underground cable (insulated wire) is often used where wires are buried under gates and as leads from the energizer to the fence. Underground cable should be 12.5 gauge galvanized or soft steel wire with bonded, high density, ultra-violet stabilized polyethylene or polypropylene or polypropylene insulation. Never use household or underground electrical copper wire with fence energizers. Where underground insulated wire is buried under gates or roads, it is strongly recommended to run the wire through a non-metal conduit (with water tight connections) to decrease the incidence of short circuiting over time.
Ground rod and installation	Ground rods should be 6 to 8 feet long x ½"- 5/8" galvanized steel rod set minimum 10 feet or 1 ½ times the length of the rod whichever is greater apart and driven to no more than 6" above the ground. The number of ground rods needed is based on a minimum of 3 feet of ground rod per joule of energizer output capacity. All energizers must be grounded sufficiently to test less than 300 Ohms on the last ground rod when the fence is "grounded" 300 feet from energizer. Galvanized ground rods for the fence must be driven into the ground a minimum of 6 feet. Install ground fields at least 75' away from other ground fields. If this is impossible, alternative methods of grounding include putting rods in trenches surrounded with Epson Salt or Bentonite. Placing ground rods in damp areas will improve effectiveness. Follow manufacturer's recommendations for grounding the system.
Staples or Fasteners	Staples used to fasten wire to wood post shall be 9 gauge Class 3 galvanized barbed with a minimum length of 1 ½ inches for treated posts and 1 ¼ inches for locust posts.For ACQ treated wood use only stainless steel or galvanized fasteners. For steel line posts, the fencing shall be fastened with 14 gauge galvanized steel wire or the post manufacturer's special wire clips. For all other types of posts, attach as specified by manufacturer.
Gates	Only new materials may be used for gates and they must be made of suitable material and coated to be durable enough to last 20 years with suitable maintenance. All non-electrified gates must be substantial enough to withstand expected pressures from livestock and wildlife. Gates between electrical subdivision fences may be of polywire, polyrope or coiled spring connected to spring loaded handles.

USDA United States Department of Agriculture

Natural Resources Conservation Service
Practice Specification
Roof Runoff Structure (Code 558)

1. SCOPE

The work shall consist of furnishing, fabricating, and installing all components of the roof runoff structure(s) as outlined in this specification and as shown on the drawings.

2. MATERIALS

GUTTERS, DOWNSPOUTS, AND SUPPORTS shall be made of aluminum, galvanized steel, wood, or plastic, and the size and type set forth in Section 4, or as shown on the drawings. Aluminum gutters and downspouts shall have a nominal thickness of at least 0.027 and 0.020 in (0.07 and 0.05 cm), respectively. Galvanized steel gutters and downspouts shall be at least 28 gauge. Wood gutters shall be redwood, cedar, cypress, or pressure-treated, and shall be clear and free of knots. Plastics shall contain ultraviolet stabilizers. Supports shall have sufficient strength to withstand anticipated water, snow, and ice loads. The type of supports for manufactured gutters and downspouts shall be determined by the manufacturer's requirements, given the type of installation and type of gutter or downspout.

DRAIN FILL for subsurface drains and driplines shall meet the size and quality requirements of PennDOT Publication 408, Section 704, Type A, Coarse Aggregate, with gradation as shown in Section 4 or in the drawings.

DRAIN PIPE for subsurface drains and drip lines shall be perforated corrugated polyethylene (PE) pipe and fittings meeting the requirements of ASTM F405 or ASTM F667.

APPURTENANCES, such as storage tanks, guard pipe, flush diverters, etc., if required, shall be of the materials set forth in Section 4 and/or the drawings.

3. INSTALLATION

Gutters and drainpipes shall be installed at the locations and grades shown on the drawings. Gutter supports shall have maximum spacing of 48 in (120 cm) for galvanized steel and 24 in (60 cm) for aluminum or plastic. Joints shall be made watertight with the use of mastics or by welding. Dissimilar metals shall not be in contact with each other. Wood gutters shall be mounted on fascia boards using furring blocks that are a maximum of 24 in (60 cm) apart.

Gutters shall be hung so that the outer edge of the gutter is below the projection of the roof line as shown on the drawings. Roof edges shall be nearly level. Replacement or repair of structure members may be necessary to provide a nearly level and uniform roof edge.

Downspouts shall be securely fastened at the top and bottom, with intermediate supports that are a maximum of 10 ft (3 m) apart.

Drain pipe shall be installed in accordance with ASTM F449.

Drain fill shall be placed in the drip drain trench in such a manner so as not to be contaminated with adjacent soil. Geotextile may be used to envelop the bottom and sides of the drain fill to accomplish this. Geotextile shall have properties equal to or exceeding the requirements of NRCS Design Note 24.

Outlets shall be located as shown on the drawings. Where downspouts empty directly onto the ground surface there shall be an elbow to direct the flow away from the building and splash blocks or other protection to prevent erosion. Downspouts shall not outlet into foundation drains.

4. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Natural Resources Conservation Service
Practice Specification
Access Road (Code 560)

1. SCOPE

The work shall consist of construction of the Access Road at the location, and to the dimensions and grades, shown on the drawings and as staked in the field.

2. SITE PREPARATION

All trees, stumps, roots, brush, weeds, and other objectionable material shall be removed from the work area and disposed of as directed.

All unsuitable material shall be removed from the roadbed area prior to placing fill or surfacing materials.

The roadbed shall be graded to the required elevations. All areas which require filling will be scarified prior to placement of fill. All fill shall be compacted according to the specified method with the appropriate equipment or to the specified density.

3. SURFACING

Aggregate for the subbase shall be clean and free from deleterious substances.

GEOTEXTILE shall meet the requirements as outlined in NRCS Design Note 24 and NRCS Material Specification 592 or as otherwise stated in Section 6.

Gradation shall be such that a stable base will be formed. Placement of the surface course shall be in accordance with sound highway construction practices.

4. SEEDING

All disturbed areas shall be revegetated as designated on the drawings.

5. EROSION CONTROL

Construction operations shall be carried out in such a manner that erosion and air and water pollution will be minimized. State and local laws concerning pollution abatement must be followed.

6. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Natural Resources Conservation Service
Practice Specification
Heavy Use Area Protection (Code 561)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the paved surface treatment areas for heavy use area protection as outlined in this specification and the drawings.

2. MATERIALS

All materials used shall conform to the quality and grade noted on the plans, set forth in Section 6, or as otherwise listed below:
PORTLAND CEMENT shall be Type I, IA, II, or IIA and conform to ASTM-C150, unless otherwise set forth in Section 6. If Type I or II is used, an air-entrainment agent shall be used.

CONCRETE AGGREGATE shall meet the requirements and gradation specified in ASTM-C33. Coarse aggregate shall meet the gradation for size numbers 57 or 67.

WATER used in mixing or curing concrete shall be clean and free from injurious amounts of oil, acid, salt, organic matter or other deleterious substances.

REINFORCEMENT BARS shall be grade 40 or higher, and shall conform to ASTM-A615, A616, or A617.Welded wire fabric reinforcement shall conform to ASTM-A185 or A497. Reinforcement shall be free from loose rust, oil, grease, curing compound, paint or other deleterious coatings.

CONCRETE ADMIXTURES shall conform to ASTM-C260 for air-entrainment, and ASTM- C494, type A,D, F or G, for water-reduction and set-retardation, and type C or E for non- corrosive accelerators.

POZZOLAN shall conform to ASTM-C618.

COAL COMBUSTION BYPRODUCTS (CCB) shall have a chemical analysis that provides adequate cementing and safety (toxicity) for the purpose intended.

CURING COMPOUND shall meet the requirements of ASTM-C309, Type 2, Class A or B, or as otherwise required in Section 6.

MASONRY COMPONENTS shall meet the requirements of ASTM-C90 & C270 and be placed in accordance with ACI - 530.

PRECAST CONCRETE units shall comply with ACI-525 and 533.

PREFORMED EXPANSION JOINT FILLER shall conform to the requirements of ASTM-D1752, Type I, II, or III, unless bituminous type is specified, in which case it shall conform to ASTM-D994 or D1751.

JOINT SEALERS shall conform to the requirements for ASTM-C920, Federal Specification SS-S-210A, or Federal Specification TT-S-227, as appropriate for the specific application.

WATERSTOPS. Vinyl-chloride polymer types shall be tested in accordance with Federal Test Method Standard No. 601 and shall show no sign of web failure due to brittleness at a temperature of -35 degrees Fahrenheit. Colloidal (bentonite) waterstops shall be at least 75 percent bentonite in accordance with Federal Specification SS-S-210A. Non-colloidal waterstops shall only be used if approved by the Engineer.

AGGREGATES. Aggregates shall meet the requirements of Pennsylvania Dirt and Gravel Road Program(DSA), PennDOT Pub. 408, Section 703, for the gradations specified in the drawings or Section 6, or as otherwise set forth in Section 6.

BITUMINOUS CONCRETE. Bituminous concrete shall meet the requirements of PennDOT Pub. 408,Sections 401, 420 and 421, for the course(s) specified in the drawing or Section 6, or as otherwise set forth in Section 6.

WOOD shall be graded and stamped by an agency accredited by the American Lumber Standards Committee as meeting the required species, grade, and moisture content. In the absence of such a stamp, the Contractor or material supplier shall provide written certification that the wood products meet the designated quality criteria.

PRESSURE TREATED WOOD PRODUCTS shall be Douglas Fir, Southern Yellow Pine, or as otherwise specified on the drawings or in Section 6. They shall be treated with preservatives in accordance with the American Wood Preservers Association (AWPA) Standard C16, “Wood Used on Farms, Pressure Treatment.” Each piece shall bear the AWPA stamp of quality. In the absence of such a stamp, the Contractor or material supplier shall provide written certification that the pressure treated wood meets the designated quality criteria.

FASTENERS for roofs and covers shall be stainless steel and/or galvanized in accordance with ASTM A153, and/or A653 Class G185, and Type 304 or 316, or otherwise protected from corrosion due to contact with moisture, manure and associated gasses. All fasteners, connectors, and any other metal contacting ACZA, ACQ or CA treated wood shall be stainless steel, in accordance with Supplement A below.

GEOTEXTILES. Geotextiles shall meet the requirements of PennDOT Pub. 408, Sections 212 and 735,for the Type and Class specified in the drawings or Section 6, or as otherwise set forth in Section 6.

ORGANIC SURFACES. Materials such as tanbark and saw dust shall be free of contaminants and rot.

3. FOUNDATION PREPARATION

Clear all trees, brush, fences, manure, and rubbish within the area to be protected, including any appurtenances, and borrow areas. All material removed by clearing and excavation operations shall be disposed of as directed by the Owner or his/her Representative. Sufficient topsoil is to be stockpiled in a convenient location for use on disturbed areas to facilitate seeding.

Set all base course material on undisturbed soil or non-yielding compacted material. Geosynthetics may be used, if approved by the Engineer, to further separate and/or stabilize the foundation. Over-excavation must be corrected as noted on the drawings or as directed by the Engineer or his/her designated Representative.
Surface and subsurface drainage systems shall be installed and operating adequately to remove water from the foundation to allow for proper placement of base and surface materials.

Drain fill upon which concrete is to be placed shall be covered with a geosynthetic that has an AOS between 20 and 100, inclusive.

4. BASE COURSE

The base course shall be placed on the area to the grades and thicknesses shown on the plans. The base material shall be as set forth in Section 6 and/or as shown on the drawings. The material shall be wetted and compacted by rollers or other construction equipment approved by the Engineer.

5. SURFACE TREATMENTS

A. Portland Cement Concrete

CONCRETE MIX

Unless otherwise specified in Section 6, concrete shall be proportioned to provide a minimum compressive strength at 28 days of 4,000 psi. The Contractor shall be responsible for the design of the mix and certification of the necessary strength, in accordance with ACI 301. Acceptance and certification of design mixes by PennDOT within the past year may be accepted in lieu of additional testing.

REINFORCING STEEL PLACEMENT

Reinforcement shall be accurately placed and secured in position in a manner that will prevent its displacement during the placement of concrete.
Steel shall be supported by precast concrete bricks (not clay bricks), metal or plastic chairs, or hard fieldstone. Except for dowel rods, placing steel reinforcement into concrete already in place shall not be permitted.

The following tolerances will be allowed in the placement of reinforcing bars shown on the drawings:

1. Maximum reduction in cover: from exposed surfaces -1/4 inch from earth surfaces -1/2 inch

2. Maximum variation from indicated spacing: 1/12th of indicated spacing

Splices of reinforcing bars shall be made only at the locations shown on the drawings, unless otherwise approved by the Engineer. Unless otherwise required, welded wire fabric shall be spliced by overlapping sections at least one full mesh dimension plus too inches. All reinforcement splices shall be in accordance with ACI 318.

Reinforcing steel shall not be welded unless approved by the Designer.

The ends of all reinforcing steel shall be covered with at least 1-1/2 inches of concrete.

MIXING AND HANDLING CONCRETE

In general, concrete shall be transported and placed in accordance with ACI-304, of which some specific interpretations are set forth below.

For concrete mixed at the site, the mixing time after all cement, aggregates and water are in the mixer drum shall be at least 1-1/2 minutes. Concrete shall be conveyed from the mixer as rapidly as practical by methods that will prevent segregation of the aggregates or loss of mortar. Concrete shall be placed within1-1/2 hours after the introduction of cement to the aggregate unless an approved set- retarding admixture is used in the mix. During periods of hot weather, it may be necessary to reduce this time.

For each load of concrete delivered to the site, a batch ticket shall be provided to the Owner or Technician by the Supplier. As a minimum, this ticket shall show the design strength, time out, admixtures (if any), and amount of water that may be added (if any) on site and still be within the design mix limits.

The Contractor shall test slump and air entrainment as necessary to ensure that the concrete meets the requirements of this specification. The slump shall be three to six inches (without superplasticizers) and the air content shall be five to seven percent of the volume of the concrete. Admixtures such as superplasticizers, water-reducers and set-retarders may be used provided they are approved by the Engineer prior to concrete placement and are used in accordance with the manufacturer’s recommendations. Superplasticizers (ASTM C494, Type F or G) may be added to concrete that has a 2- to 4- inch slump before the addition, and that is not warmer than 95o F. The slump shall not exceed 7½ inches with the addition of superplasticizer.

Concrete shall be uniform and thoroughly mixed when delivered to the job site. Variations in slump of more than one inch within a batch will be considered evidence of inadequate mixing and shall be corrected or rejected. No water in excess of the amount called for by the job design mix shall be added to the concrete.

Immediately after placement, concrete shall be consolidated by spading and vibrating, or spading and hand tamping. It shall be worked into corners and around all reinforcement and embedded items in a manner which prevents segregation. Excessive vibration which results in segregation of materials will not be allowed. Vibration must not be used to make concrete flow in forms, slabs, or conveying equipment.

If the surface of a layer in place will develop its initial set, i.e., will not flow and merge with the succeeding layer when vibrated, a construction joint shall be made. Construction joints shall be made by cleaning the hardened concrete surface to exposed aggregate by sandblasting, air/water jetting, or hand scrubbing with wire brush, and keeping the concrete surface moist for at least one hour prior to placement of new concrete.

Concrete surfaces do not require extensive finishing work; however, the surface shall be smooth and even, with no depressions that would result in surface water ponding. Careful screeding (striking-off) and/or wood float finishing shall be required. Any additional desired finishing of the surface (such as roughening for improved traction) shall be accomplished after an initial stiffening of the concrete has taken place. These requirements will be stated in Section 6 or on the drawings. Exposed edges should be chamfered, either with form molding or molding tools.

The addition of dry cement or water to the surface of screeded concrete to expedite finishing is not allowed. If concrete placing is discontinued prior to completion of the entire structure, the unfinished end of the concrete shall be formed to create a proper construction or expansion/contraction joint.

EXPANSION/CONTRACTION JOINTS

When required in Section 6 or on the drawings, expansion/contraction joints shall contain a six-inch, Type B, vinyl waterstop with a minimum web thickness of 1/8-inch, or an approved joint sealer.

FORM REMOVAL AND CONCRETE REPAIR

Forms for walls and columns shall not be removed for at least 24 hours after placing the concrete. When forms are removed in less than seven days, the exposed concrete shall be sprayed with a curing compound or be kept wet continuously for the remainder of the curing period. Forms which support beams or covers shall not be removed for at least seven days, or 14 days if they are to support forms or shoring.

Forms shall be removed in such a way as to prevent damage to the concrete. Forms shall be removed before walls are backfilled. Columns shall be at least seven days old before any structural loads are applied.

Concrete that is damaged or otherwise defective shall be removed and replaced, or where feasible, repaired. The Engineer will determine the required extent of

removal, replacement, or repair. The plan for accomplishing the repair must be approved by the Engineer prior to beginning the repair work. Where minor areas of the concrete surface are “honeycombed,” damaged or otherwise defective, the area maybe cleaned, wetted, and then filled with a dry-pack mortar. Dry-pack mortar shall consist of one part Portland cement and three parts sand with just enough water to produce a workable paste.

CONCRETING IN COLD WEATHER

Concreting in cold weather shall be performed in accordance with ACI-306R-88. In addition, the contractor shall provide a written plan at least 24 hours in advance of placing concrete in cold weather and shall have the necessary equipment and materials on the job site before the placement begins.

CONCRETING IN HOT WEATHER

Concreting in hot weather shall be performed in accordance with ACI 305, of which some specific interpretations are set forth below.

The supplier shall apply effective means to maintain the temperature of concrete below 90 degrees) Fahrenheit during mixing and conveying. Exposed surfaces shall be continuously moistened by means of fog spray or otherwise protected from drying during the time between placement and finishing, and during curing. Concrete with a temperature above 90 degrees Fahrenheit shall not be placed.

CURING

In general, concrete shall be cured in accordance with ACI-308. Specifically, it shall be prevented from drying for at least seven days after it is placed. Exposed surfaces shall be kept continuously moist during this period by covering with moistened canvas, burlap, straw, sand, or other approved material unless they are sprayed with a curing compound.

Concrete, except at construction joints, may be coated with a curing compound in lieu of continuous application of moisture. The compound shall be sprayed on moist concrete surfaces as soon as free water has disappeared but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. Curing compound shall not be allowed on any rebars.

Curing compound shall be applied in a uniform layer over all surfaces requiring protection at a rate of not less than one gallon per 150 square feet of surface. Surfaces subjected to heavy rainfall or running water within three hours after the curing compound has been applied, or otherwise damaged, shall be resprayed. Any construction activity which disturbs the curing material shall be avoided. If the curing material is subsequently disturbed, it shall be reapplied immediately.

B. Bituminous Concrete

Bituminous concrete shall be installed in accordance with PennDOT Pub. 408, Sections 305, 320, & 400,as appropriate, and/or as otherwise set forth in Section 6.

C. Compacted Stone Aggregate
Compacted stone aggregate surfaces shall consist of the material specified in the drawing or Section 6. The material shall be moist and uniformly placed on the prepared base. The loose material shall be place to an adequate thickness so that when compacted the finished thickness is as specified. The stone aggregate shall be compacted with a vibratory smooth wheeled roller or other approved equipment to form a dense, smooth surface.

D. Other Materials and Structures
Surface treatments, such as saw dust, coal combustion byproducts, soil cement, etc., shall be placed asset forth in Section 6, and to the grades and thicknesses shown on the drawings.

6. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Natural Resources Conservation Service
Practice Specification
Trails and Walkways (Code 575)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the trails and walkways as outlined in this specification and the drawings.

2. MATERIALS

All materials used shall conform to the quality and grade noted on the plans, set forth in Section 8, or as otherwise listed below:

WEARING SURFACE, BINDER COURSE, and BASE COARSE aggregate shall meet the requirements and gradation specified in Section 8 or on the drawings.

GEOTEXTILE shall meet the requirements as outlined in NRCS Design Note 24 and NRCS Material Specification 592.

PIPE shall meet the requirements specified in Section 8 or on the drawings.

PRESSURE TREATED WOOD PRODUCTS shall be Douglas Fir, Southern Yellow Pine, or as otherwise specified on the drawings or in Section 8. They shall be treated with preservatives in accordance with the American Wood Preservers Association (AWPA) Standard C16, “Wood Used on Farms, Pressure Treatment.” Each piece shall bear the AWPA stamp of quality. In the absence of such a stamp, the Contractor or material supplier shall provide written certification that the pressure treated wood meets the designated quality criteria.

FASTENERS for wood structures shall be stainless steel, galvanized, or otherwise protected from corrosion due to contact with moisture and soil.

3. FOUNDATION PREPARATION

All trees, brush, fences, manure, and rubbish shall be cleared within the trail or walkway area, including any associated drainage control features and borrow areas. All stumps and roots larger than two-inch diameter shall be removed down to the subgrade elevation. All material removed by clearing operations shall be disposed of as directed by the Owner or his/her Representative.

Topsoil shall be stripped and stockpiled in a convenient location for use on disturbed areas to facilitate seeding.

Soil shall be excavated and if suitable can be used as fill as shown on the drawings to establish a uniform, stablesubgrade. Wet soil, mud, and topsoil shall not be used as fill. The fill material shall be compacted as specified in Section 8 or on the drawings.

Borrow material shall be taken from the designated borrow area as needed after excavation of the trail or walkway is complete. The borrow area shall be final graded to drain freely and blend into the surrounding undisturbed area.

Excess excavated material shall be disposed of in the designated spoil area, which shall be graded to blend into the surrounding undisturbed area. Geotextile or base course material shall be installed on undisturbed soil or non-yielding compacted material. Over-excavation must be corrected as noted on the drawings, or as directed by the Engineer or his/her designated Representative.

4. DRAINAGE STRUCTURES

Culverts, subsurface drains, and swales shall be installed as shown on the drawings. Surface and subsurface drainage structures shall be adequately removing water from the foundation to allow for proper placement of base and surface materials.

5. GEOTEXTILE

Where specified in Section 8 or on the drawings, geotextile shall be installed on the prepared subgrade. The geotextile shall be placed, overlapped and anchored as recommended by the manufacturer, unless otherwise specified in Section 8 or on the drawings.

Vehicles and heavy equipment shall not be operated directly on top of the geotextile. Base course or surface material shall be placed on the geotextile ahead of the construction equipment.

6. E&S CONTROL

E&S control measures shall be as set forth in the E&S Plan, and as otherwise detailed in the drawings.

Vegetation shall be established as set forth in Construction Specification PA 342, and/or as set forth in Section 8 and the drawings.

7. SURFACING

Where specified in Section 8 or on the drawings, the base and binder course shall be placed on the trail or walkway to the specified grades and thickness. The material shall be wetted and compacted by rollers or other construction equipment approved by the Engineer.

Surface material shall be placed to the grades and thicknesses set forth in Section 8 or on the drawings. The material shall be compacted by rollers or other construction equipment approved by the Engineer. The finished surface shall be smooth and free of projecting stones.

Vegetation shall be established in accordance with Construction Specification PA342.

The surface material within 3’ of surface water control devices and other structures (pipes, drop inlets, etc.) shall becompacted using manually directed tamping equipment.

8. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Subsurface Drain (Code 606)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the subsurface drain as outlined in the specification and the drawings.

2. MATERIALS

a. DRAINFILL AGGREGATE shall meet the requirements of Penn DOT, Publication 408, Section 703, fine and coarse aggregate. The size and gradation shall be as specified in the additional conditions of this specification or on the drawings.

Table 1 – Drain pipe requirements

Type	Specification
Clay drain tile, solid & perforated	ASTM-C-4
Clay pipe, perforated, standard and extra strength	ASTM-C-700
Clay pipe testing	ASTM-C-301
Concrete drain tile	ASTM-C-412
Concrete pipe for irrigation or drainage	ASTM-C-118
Concrete pipe or tile, determining physical properties of	ASTM-C-497
Concrete sewer, storm drain and culvert pipe	ASTM-C-14
Reinforced concrete culvert, storm drain and sewer pipe	ASTM-C-76
Perforated concrete pipe	ASTM-C-444
Portland cement	ASTM-C-150
Pipe, bituminized fiber & fitting	Federal Specification SS-P-1540
Styrene rubber (SR) plastic drain pipe & fitting	ASTM-D-2852
Polyvinyl chloride (PVC) sewer pipe & fitting	ASTM-D-2729
Polyvinyl chloride (PVC) pipe	ASTM-D-3034 type PSM
Corrugated polyethylene tubing & fitting (3-6 inch)	ASTM-F-405
Corrugated polyethylene tubing & fitting (8-24 inch)	ASTM-F-667
Pipe, corrugated (steel, polymer coated)	ASTM-A-762
Pipe, corrugated (steel, zinc coated)	ASTM-A-760

b. PIPE shall meet the requirements of Table 1, and as set forth in Section 9 and/or on the drawings. All pipes shall be clearly marked with the appropriate specification designation. If plastic pipe is stored on site for a length of time, it should be protected from sunlight. At the time of installation, it should be kept as cool as possible to minimize elongation of the pipe during installation.

c. GEOTEXTILE shall meet the requirements as outlined in PennDOT Publication 408, Section 735, Class 1, Subsurface Drainage.

3. SITE PREPARATION

All trees, brush, fences and rubbish shall be cleared within the area that the subsurface drain will be installed. All material removed by the clearing and grubbing operation shall be disposed of as directed by the Owner or his/her Representative.

4. INSPECTION AND MATERIAL HANDLING

Material for subsurface drains shall be carefully inspected before the drains are installed. If applicable, clay and concrete tile shall be checked for damage from freezing and thawing before it is installed. Bituminized fiber and plastic pipe and tubing shall be protected from hazard causing deformation or warping. Plastic pipe and tubing with physical imperfections shall not be installed. Any damaged section shall be removed and replaced. All material shall be satisfactory for its intended use and shall meet applicable specifications and requirements.

5. SAFETY

All positive “design” responses from the Pennsylvania One Call System are noted on the plans. It is the Contractor’s or Landowner’s responsibility to notify One Call of pending construction and to contact the affected utility for marking at the time of construction.

The Contractor must comply with OSHA requirements Part 1926, subpart P, for protection of workers entering trench.

6. INSTALLATION

Flexible conduits, such as plastic pipe or tubing and bituminized fiber pipe, shall be installed, according to the requirements in ASTM-F-449, “Standard Recommended Practice for Subsurface Installation of Corrugated Thermoplastic Tubing for Agricultural Drainage or Water Table Control.”

All subsurface drains shall be laid to line and grade and covered with approved blinding, envelope or filter material to a depth of not less than three inches over the top of the pipe. If an impervious sheet is used over the drain, at least three inches of blinding material must cover the sheet. No reversals in grade of the conduit shall be permitted.

If the conduit is to be laid in a rock trench or if rock is exposed at the bottom of the trench, the rock shall be removed below grade so that the trench can be backfilled, compacted and bedded. When completed, the tile conduit shall be not less than two inches from the rock.

Joints between drain tiles shall not exceed 1/8 inch except in sandy soils where the closest possible fit must be obtained and in organic soil where some of the more fibrous soil types make it desirable to slightly increase the space between tiles.

Earth backfill material shall be placed in the trench in a manner to ensure that the conduit does not become displaced and so that the filter and bedding material, after backfilling, meet the requirements of the plans and specifications.

If a filter is needed, no part of the conduit containing openings shall be left exposed. If a sand-gravel filter material is used, it shall be a gradation that is compatible with the base material in the trench. The trench shall be over excavated three inches and backfilled to grade with filter material. After the conduit is placed on the filter material, additional filter material shall be placed over the conduit to fill the trench to a depth of three inches over the conduit.

7. FITTING AND CONNECTIONS

All fitting and connections for pipe shall be made with manufacturer-supplied components made for the intended purpose.

8. CONDUIT PERFORATIONS

If perforations are specified, the water inlet area shall be at least 1inch/foot of the pipe length. The perforations shall be either circular or slots equally spaced around the circumference of the pipe in not less than three rows. Circular perforations shall not exceed 3/16 inch in diameter and slots shall not be more than 1/8 inch wide and 1 ¼ inch long for 3, 4 and 5 inch diameter pipe, or 1 ½ inch for 6 and 8 inch diameter pipe, or 1 ¾ inch for 10 and 12 inch diameter pipe. All slots and circular perforations shall be cleanly cut.

9. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Underground Outlet (Code 620)

1. SCOPE

The specification covers the fabrication, installation, and construction of underground outlets.

2. MATERIALS

The materials required for the underground outlet shall be as shown on the drawings or as otherwise required in Section 9.

a. DRAINFILL AGGREGATE shall meet the requirements of Penn DOT, Publication 408, Section 703, fine and coarse aggregate. The size and gradation shall be as specified in the additional conditions of this specification or on the drawings.

Table 1 – Drain pipe requirements

Type	Specification
Clay drain tile, solid	ASTM-C-4
Clay pipe, standard and extra strength	ASTM-C-700
Clay pipe testing	ASTM-C-301
Concrete drain tile	ASTM-C-412
Concrete pipe for irrigation or drainage	ASTM-C-118
Concrete pipe or tile, determining physical properties of	ASTM-C-497
Concrete sewer, storm drain and culvert pipe	ASTM-C-14
Reinforced concrete culvert, storm drain and sewer pipe	ASTM-C-76
Perforated concrete pipe	ASTM-C-444
Portland cement	ASTM-C-150
Pipe, bituminized fiber & fitting	Fed Spec SS-P-1540
Styrene rubber (SR) plastic drain pipe & fitting	ASTM-D-2852
Polyvinyl chloride (PVC), Sch'd. 40, 80, 120	ASTM-D-1785
Polyvinyl chloride (PVC) sewer pipe & fitting	ASTM-D-2729
Polyvinyl chloride (PVC) pipe	ASTM-D-3034
	type PSM
Corrugated polyethylene tubing & fitting (3-6 inch)	ASTM-F-405
Corrugated polyethylene tubing & fitting (8-24 inch)	ASTM-F-667
Pipe, corrugated (steel, polymer coated)	ASTM-A-762
Pipe, corrugated (steel, zinc coated)	ASTM-A-760

b. PIPE shall meet the requirements of Table 1, and as set forth in Section 9 and/or on the drawings. All pipes shall be clearly marked with the appropriate specification designation. If plastic pipe is stored on site for a length of time, it should be protected from sunlight. At the time of installation, it should be kept as cool as possible to minimize elongation of the pipe during installation.

c. GEOTEXTILE shall meet the requirements as outlined in PennDOT Publication 408, Section 735, Class 1, Subsurface Drainage.

d. CONCRETE and related materials shall meet the requirements set forth in Construction Specification PA313S, Waste Storage Facility (Structure), and/or as set forth in Section 9.

All materials shall be carefully inspected prior to installation. Clay and concrete tile shall be checked for damage by freezing. Plastic pipe and tubing shall be protected from hazards causing deformation. Any damaged or imperfect pipe or tubing shall not be installed. Any pipe or tubing which is damaged during installation shall be removed and replaced.

3. SITE PREPERATION

All trees, brush, fences and rubbish shall be cleared within the area that the subsurface drain will be installed. All material removed by the clearing and grubbing operation shall be disposed of as directed by the Owner or his/her Representative.

4. INSPECTION AND MATERIAL HANDLING

Material for underground outlets shall be carefully inspected before the drains are installed. If applicable, clay and concrete tile shall be checked for damage from freezing and thawing before it is installed. Bituminized fiber and plastic pipe and tubing shall be protected from hazard causing deformation or warping.

Plastic pipe and tubing with physical imperfections shall not be installed. Any damaged section shall be removed and replaced. All material shall be satisfactory for its intended use and shall meet applicable specifications and requirements.

5. SAFETY

All positive “design” responses from the Pennsylvania One Call System are noted on the plans. It is the Contractor’s or Landowner’s responsibility to notify One Call of pending construction and to contact the affected utility for marking at the time of construction.

The Contractor must comply with OSHA requirements Part 1926, subpart P, for protection of workers entering trench.

6. EXCAVATION

Construction operations shall be done in such a manner that soil and water pollution are a minimum and all state and local erosion regulations are followed.

Unless otherwise specified, excavation for each underground outlet shall begin at the outlet end and progress upstream. The trench shall be excavated to the grades and cross sections shown on the drawings. The trench width above the conduit may increase as necessary for safe installation or for the convenience of the Contractor. Trench shields, shoring, or bracing are required whenever workers will be in a trench deeper than four feet, or as otherwise required be OSHA Regulations.

7. INSTALLATION

BEDDING. In stable soils, the conduit shall be firmly and uniformly bedded throughout its entire length as required on the drawings or Section 9. Where the underground outlet foundation is in unstable soils, the bedding shall be as shown on the drawings or as otherwise required by the Engineer. Where the conduit is to be laid in rock, or rock is exposed at the trench bottom, the rock shall be removed at least two inches below the invert grade to allow for compacted bedding under the conduit.

PLACEMENT. Debris inside of pipes and tubing shall be removed prior to installation. The conduit ends shall be protected during placement. Similarly, all appurtenances, including trash guards and animal guards, shall be protected during installation to avoid damage. All underground outlets shall be laid to line and grade, and immediately covered with an approved blinding, envelope, or the required depth of filter material. No reversals in grade of the conduit are permitted, no more than five percent stretch is allowed. Special precautions must be taken in hot weather to observe this stretch limit.

Flexible conduits, such as plastic pipe or tubing and bituminized fiber pipe, shall be installed, according to the requirements in ASTM-F-449, “Standard Recommended Practice for Subsurface Installation of Corrugated Thermoplastic Tubing for Agricultural Drainage or Water Table Control.”

Earth backfill material shall be placed in the trench in a manner to ensure that the conduit does not become displaced and so that the filter and bedding material, after backfilling, meet the requirements of the plans and specifications.

8. BACKFILL

Initial backfill shall be of selected material that is free of rocks or other sharp-edged material that could damage the pipe. Earth backfill shall be placed in the trench in such a manner that the conduit is not displaced, and that the filter and bedding materials are not contaminated or displaced. Unless otherwise specified, where the underground outlet is laid under roads or at other designated locations, the backfill shall be placed in successive layers of not more than six inches, and each lift compacted before the subsequent layer. Backfill shall extend above the adjacent ground to allow for settlement, and be well rounded over the trench.

Work areas shall be restored to their pre- construction condition or as otherwise required in the plans or Section 9.

9. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Structure for Water Control (Code 587)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the structure for water control, as outlined in this specification and to the dimensions and grades shown on the drawings.

2. MATERIALS

Unless otherwise set forth in Section 6, the following materials are to be used:

a. Earth fill material used around conduits and structures shall be obtained from the project area, or other approved sources and thoroughly compacted.

b. Pipe type, pipe sizes, fittings and other necessary pipe material shall be as specified on the drawings or as defined in Section 6 of this specification, when applicable.

c. ROCK shall be durable and obtained from sources listed in Penn DOT Bulletin 14 or as otherwise approved by the designer. Size and gradation, where required, shall be as specified in Section 6 or as shown on the drawings. The nominal size of a rock is that dimension (middle) which passes through a square opening with the same size dimension; i.e. it is not the greatest dimension. The rock shall be free from soil and trash. Rocks shall be angular or subangular in shape. However, the least dimension of any individual rock shall be not less than one-third the greatest dimension.

d. GEOSYNTHETICS shall meet the requirements set forth in Section 6 and/or on the drawings. In addition, geotextile shall meet the requirements of Penn DOT Specifications, Section 635, for the appropriate class defined in Section 212. Certification from the manufacturer shall be provided by the Contractor that the geosynthetics meets these requirements.

e. AGGREGATE for bedding, drain fill, and concrete shall be durable and obtained from sources listed in Penn DOT Bulletin 14. The gradation shall be as set forth in Section 6 or on the drawings.

f. PORTLAND CEMENT shall be Type I, with air-entrainment agent, or Type IA, unless otherwise required in Section 6. All cement shall conform to ASTM-C150.

g. MASONRY shall meet the requirements of ASTM-C90 & C270.

h. PRECAST concrete units shall meet the requirements of ACI-525 & 533, unless otherwise specified in Section 6.

i. LUMBER shall be the dimensions and species specified in Section 6 or shown on the drawings. Wood shall be graded and stamped by an agency accredited by the American Lumber Standards Committee as meeting the required species, grade, and moisture content. Pressure treated wood products shall be Douglas Fir, Southern Yellow Pine, or as otherwise specified on the drawings or in Section 6. They shall be treated with preservatives in accordance with the American Wood Preservers Association (AWPA) Standard C16, “Wood Used on Farms, Pressure Treatment”, except that only non-CCA preservatives, suitable for use in aquatic habitats, can be used. Each piece shall bear the AWPA stamp of quality. In the absence of grade and treatment stamps, the Contractor or material supplier shall provide written certification that the wood meets the designated quality criteria.

j. Other required materials shall be as shown in the drawings or as defined in Section 6 of this specification.

3. SITE ACCESS AND CLEARING

All trees, roots and boulders and other obstructions shall be removed, as necessary. Tree and brush removal shall be done in such a manner to prevent damage to other property, and to minimize erosion. Unless otherwise specified in Section 6, all cleared materials, including trash, shall be removed from the site or burned. Burning shall comply with all state and local applicable regulations.

Unless otherwise set forth in Section 6, sufficient topsoil shall be stockpiled and re- spread over disturbed areas to establish a vegetative cover.

4. STRUCTURAL INSTALLATION

Structures shall be installed as shown on the drawings and as set forth in Section 6. Construction operations will be carried out in such a manner as to minimize erosion and sedimentation.

Provisions must be made to prevent piping and settlement where underground conduits are used from a structure. Backfill shall be placed in successive layers of not more than six inches, and each lift compacted before the subsequent layer.

Commercially manufactured structures, including but not limited to gabions, precast units, pipe, fence, etc., shall be installed as required by the manufacturer for flowing water applications.

5. VEGETATION

All exposed earth surfaces shall be protected by a vegetative cover as soon, after installation of the structure, as practical. Vegetation, if required, shall be established at the locations shown on the drawings and/or staked in the field, and as set forth herein, in Section 6, and/or as shown on the drawings.

6. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

United States Department of Agriculture

Natural Resources Conservation Service
Practice Specification
Pumping Plant (Code 533)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the pumping facility, as outlined in this specification and the drawings.

2. MATERIALS

All materials used shall conform to the size, type, etc. noted on the plans, set forth in Section 6, or as otherwise listed below:

1. PUMP:

   The pump shall meet the required capacity, pressure, and head requirements, as specified in Section 6 or on the drawings. Pumps shall be compatible and resistant to the type of water or manure being conveyed.

   The contractor shall be responsible for assessing the consistency, nature, quality and quantity of the substance to be pumped, and provide the appropriate equipment. The contractor shall provide in writing, or by performance tables provided by the manufacturer, the pumps performance characteristics (discharge, head, and pressure) and the relationship to or requirements of the following:

   a. Operating power requirements
   b. Estimated service life
   c. Maintenance requirements
   d. Efficiency

2. PIPE:

   Suction and Discharge pipe shall be chosen so that the type and class of pipe exceeds the systems pressure requirement. The operating pressure shall be specified in Section 6 or on the drawings, or as determined by the pump manufacturer. If the pipe is an integral part of another related planned practice or distribution system, the pipe type and class shall meet or exceed the requirements of the pipe installed in that planned system.

   Fittings shall be rated equal to the pipe being specified.

   The pipe and fittings, where applicable, shall be marked by the manufacturer as described in the applicable ASTM specification.

   Used pipe or seconds shall not be used. Pipe shall be approved by the engineer prior to installation.

3. CONTROLS:

   All check valves and directional control valves, gauges, quick disconnects, and automatic controls shall be durable and constructed with a rust resistant, non-corrosive, material able to withstand the type of water, or manure being pumped.

4. SUCTION AND DISCHARGE BAYS:

   Suction and discharge bays shall be designed to conform to the hydraulic characteristics of the pump. They shall be to the dimension and capacity as specified in Section 6 or on the drawings.

   Precast concrete units shall be in conformance with PennDOT specifications for such units and/or comply with ACI-525 and 533. All concrete units shall have a 28-day compressive strength of 4000psi., or greater, and all reinforcement bars shall be of grade 60 steel or higher, unless otherwise specified in Section 6 or on the drawings.

   Portland cement shall be Type I, IA, II, or IIA and conform to ASTM-C150, unless otherwise set forth in Section 6. If Type I or II is used, an air-entrainment agent shall be used.

   Concrete Aggregate shall meet the requirements and gradation specified in ASTM-C33. Coarse aggregate shall meet the gradation for size numbers 57 or 67.

   Reinforcement bars shall conform to ASTM-A615, A616, or A617. Welded wire fabric reinforcement shall conform to ASTM-A185 or A497. Reinforcement shall be free from loose rust, oil, grease, curing compound, paint or other deleterious coatings.

   All rock structures shall be of rock that is durable and resistant to weathering. The rock shall be of the type specified in Section 6 and shall be obtained from a source listed in the most current edition of PennDOT Bulletin #14. The gradation of the rock shall comply with the requirements set forth by the National Crushed Stone Association.

5. HOUSING AND ACCESSORIES:

   Trash racks, housings, and other devices shall be installed as shown on the drawings provided to and concurred in by NRCS. All materials furnished and installed shall conform to the quality and grade noted on the drawings. A site-specific set of construction drawings shall be at the site during construction.

   Wood shall be graded and stamped by an agency accredited by the American Lumber Standards Committee as meeting the required species, grade, and moisture content. All exposed or buried lumber shall be pressure treated. Pressure treated wood products shall be Douglas Fir, Southern Yellow Pine, or as otherwise specified in Section 6 or on the drawings. They shall be treated with preservatives in accordance with the American Wood Preservers Association (AWPA) Standard C16 for “wood used on Farms, Pressure Treatment”. Non-CCA preservative pressure treated lumber shall be used where aquatic life is a concern.

   Roofing material shall be corrugated 29 gage galvanized steel. Equivalent or better material maybe approved by the Engineer.

   Sheet piling shall be of steel or vinyl type. The piling must be of the thickness and grade specified in Section 6, and as recommended by the manufacturer for the intended use. Suitable methods of installing and anchoring the piling shall be as listed in Section 6, and as recommended by the manufacturer.

3. SITE PREPARATION

All trees, brush, fences, and other debris shall be cleared so as not to interfere with construction or proper functioning of the Pumping Plant system. All material removed by the clearing and grubbing operation shall be disposed of as directed by the Owner or his/her Representative.

4. SAFETY

All positive responses from the Pennsylvania One Call System should be shown on the drawings and the Pennsylvania One Call serial number and date noted on the plans. It is the Contractor's or Landowner's responsibility to contact the affected utility for marking at the time of construction.

The Contractor must comply with OSHA requirements Part 1926, subpart P, for protection of workers entering trenches.

5. INSTALLATION

Pipelines shall be placed so that they are protected against hazards imposed by traffic, farm operation, freezing temperatures, or soil cracking. Other means of protection must be provided if the depth required for protection is impractical because of shallow soils over rock or for other reasons.

Trenches for pipeline shall be free of rocks and other sharp-edged materials. The pipe shall be carefully placed to prevent damage.

Before backfilling, the pipeline shall be pressure tested. To pressure test the pipe, fill the pipe with water and test at the design working head and pressure. All leaks must be repaired, and the test must be repeated before backfilling.

All backfilling shall be completed before the line is placed in service. The initial backfill shall be of selected material that is free of rocks or sharp-edged materials that can damage the pipe.

Deformation or displacement of the pipe must not occur during backfilling.

All seeding shall be in accordance with the Critical Area Planting Standard and Specifications (PA342).

6. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Natural Resources Conservation Service
Practice Specification
Obstruction Removal (Code 500)

1. SCOPE

The work shall consist of completion of removal of obstructions performed as outlined in this specification and the drawings.

2. SITE PREPARATION

All obstructions shall be removed from the work area and disposed of as set forth in Section 5. Reshape and regrade all areas disturbed by the obstruction removal so that they blend with the surrounding land features and conditions. Compact fill areas according to the requirements in Section 5.

3. VEGETATION

Vegetation, if required, shall be established at the locations shown on the drawings and/or staked in the field. Vegetation shall be of the type, species, mixture, quality, etc. as set forth in Section 5.

4. EROSION AND POLLUTION CONTROL

Construction operations will be carried out in such a manner that erosion and air and water pollution will be minimized. State and local laws concerning pollution abatement must be followed.

5. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Waste Facility Closure (Code 360)

1. SCOPE

The work shall consist of furnishing and installing materials and removing existing facilities and materials as outlined in this specification and the drawings.

2. MATERIALS

FILL MATERIAL - Soil that is free from stumps, wood, brush, roots, sod, rubbish, matter that may decay, and other objectionable materials.

MANURE LADEN SOIL - Soil that has been visibly color stained by manure or mixed with manure or sludge.

SLUDGE - Thick manure and other settled solids that are too thick to be pumped, and is deposited on the sides and bottom of the waste impoundment.

3. WASTE REMOVAL

Empty the impoundment. Waste material shall be utilized by spreading on crop fields or pastures as set forth on the plans or Section 10.

1. Every effort should be made to remove as much of the waste material as possible.
2. Waste should be thoroughly agitated and pumped into a manure spreader or irrigation system.
3. Impoundments shall be further emptied by pushing or flushing the remaining waste material to an unloading point.

4. LINER REMOVAL

When required in Section 10, an existing concrete, geomembrane, soil liner or biological film or fibrous mat shall have 25% of the surface area, at the lowest elevation, removed to allow for free drainage. Liner removal shall only occur after all waste material has been removed.

5. EARTH STRUCTURE REMOVAL

The embankment shall be breached or removed as shown on the drawings or as specified in Section 10. The embankment shall be left in place until all waste has been removed, unless it is necessary to remove part of the embankment to provide access for waste removal. The breach shall not permit any remaining liquid manure, sludge or manure laden soil to leave the impoundment. A depth of storage, as specified in Section 10 or the drawings, shall be maintained until after all waste material and manure laden soil is removed from the impoundment.

If the area within the breached embankment is to be filled, or if the impoundment is an excavated pond, the impoundment shall be filled and shaped using fill material from the designated borrow area.

Frozen material shall not be placed in the fill, nor shall the fill material be placed on a frozen foundation.

Fill shall be placed in 9 inches lifts. Fill material shall be compacted by routing construction equipment over the fill area.

Fill material shall contain sufficient moisture so that it can be formed into a ball without crumbling. If water can be squeezed out of the ball, it is too wet to compact properly.

The backfill height shall exceed the design finished grade by 5% to allow for settlement. The top one foot of the backfill shall be constructed of the most clayey material available and graded to provide positive drainage. Incorporate available topsoil where feasible to aid establishment of vegetation.

6. STEEL AND CONCRETE STRUCTURE

Identified structures shall be disassembled as specified in Section 10.

Below ground structures shall be demolished, completely removed, or left in place with the top removed to the extent that fill material can be placed and compacted to fill all voids. Compaction inside of structures not accessible to equipment shall be compacted by manually operated compactors in 6” lifts. Below ground structures that will remain in place shall have 25% of the floor or bottom removed to allow for free drainage. Floor or bottom removal shall only occur after all waste material has been removed.

Excavations, depressions and all voids shall be filled with fill material as specified in Section 5.

7. APPURTENANCE REMOVAL

Waste transfer pipes shall be flushed clean of manure and either be removed for their entire length and properly disposed, or be plugged. Pipes shall be plugged as specified in Section 10 or on the drawings.

Where pipes are removed, the trench shall be filled with fill material as described in Section 5. Other appurtenances or structures shall be removed as described in Section 10 or on the drawings.

8. CONVERT TO FRESH WATER USE

Any existing concrete, geomembrane or soil liner and foundation drainage system shall remain in place. Any damaged to a seepage control liner shall be repaired as directed by the Engineer.

If the impoundment is to be converted to fresh water use, the bottom and sides of the impoundment shall be further cleaned as specified in Section 10. As a final step the impoundment shall be filled with clean water and emptied twice before being put into use as a fresh water impoundment. The water from this procedure shall be applied to land with vegetative cover at rates that will prevent surface runoff and deep percolation.

9. DISPOSAL

Manure laden soil, sludge or fibrous mat shall be spread evenly on cropland. After spreading, the manure laden soil, sludge or fibrous mat shall be incorporated using conventional tillage equipment.

Demolished materials including seepage control liner, pipe and other appurtenances shall be buried on site at the designated location(s) as shown on the drawings or removed from site and disposed of in an acceptable manner.

10. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Stream Crossing (Code 578)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the stream crossing, as outlined in this specification and the drawings.

2. MATERIALS

Unless otherwise set forth in Section 7, the following materials are to be used:

a. ROCK shall be durable and obtained from sources listed in PennDOT Bulletin 14 or as otherwise approved by the designer. Size and gradation, where required, shall be as specified in Section 7 or as shown on the drawings. The nominal size of a rock is that dimension (middle) which passes through a square opening with the same size dimension; i.e. it is not the greatest dimension. The rock shall be free from soil and trash. Rocks shall be angular or subangular in shape. However, the least dimension of any individual rock shall be not less than one-third the greatest dimension.

b. GEOSYNTHETICS shall meet the requirements set forth in Section 7 and/or on the drawings. In addition, geotextiles shall meet the requirements of PennDOT Specifications, Section 735, for the appropriate class defined in Section 212. Certification from the manufacturer shall be provided by the Contractor that the geosynthetics meets these requirements.

c. BIOTEXTILES, BIOMATS and other manufactured, natural materials shall conform to the requirements in Section 7, and be installed according to the manufacturer's recommendations for flowing water applications.

d. AGGREGATE for bedding, drainfill, and concrete shall be durable and obtained from sources listed in PennDOT Bulletin 14. The gradation shall be as set forth in Section 7 or on the drawings.

e. PORTLAND CEMENT shall be Type I, with air-entrainment agent, or Type IA, unless otherwise required in Section 7. All cement shall conform to ASTM-C150.

f. MASONRY shall meet the requirements of ASTM-C90 & C270.

g. PRECAST concrete units shall meet the requirements of ACI-525 & 533, unless otherwise specified in Section 7.

h. LUMBER shall be the dimensions and species specified in Section 7 or shown on the drawings. Pressure treated products shall conform to the requirements of the AWPA Standard C16, except that only non-CCA preservatives, suitable for use in aquatic habitats, can be used.

i. PLANT MATERIALS, including seed, shall be true to the type, name and size required on the drawings or in Section 7. Plants and seeds shall be viable and free from disease, injurious insects, mechanical injury, decay, or other defect that will decrease survivability. All bare rootstock shall have a root:stem ratio of at least 1:1 by volume. Bulbs and tubers shall be firm and rhizomes resilient. Balled and burlapped, multi-stem stock shall be pruned to one-half height prior to planting. Transport and storage of all stock shall be done in a manner that prevents windburn and drying. All local, state, and Federal regulations regarding plant shipments shall be complied with.

3. SITE ACCESS AND CLEARING

Only those areas, shown on the drawings, to be protected or actually required for access shall be cleared. Tree and brush removal shall be done in such a manner to prevent damage to other trees and property, and to minimize erosion. Unless otherwise specified in Section 7, all cleared materials, including trash, shall be burned or removed from the site. Burning shall comply with all state and local applicable regulations.

4. GRADING

Soil surfaces shall be graded to the lines or sections shown on the drawings and/or staked in the field. Surfaces which have been over-excavated shall be brought to the planned grade by replacement with

soils similar to, and at a density equal to, that of the adjacent soils. Unless otherwise set forth in Section 7, fill that is required to be imported to the site shall be similar to, and placed at a density equal to, that of the adjacent soils, except that areas to be vegetated shall receive topsoil approved by the Engineer. Excess soil material shall be disposed of as set forth in Section 7 or shown on the drawings.

Provide for water diversion and erosion control as set forth in plans and permits.

5. STRUCTURAL INSTALLATION

Structures shall be installed as set forth in Section 7, as shown on the drawings, and in such a manner as to minimize erosion and sedimentation.

Rock shall be placed by equipment on the surface and to the depths specified, and in such a manner as to avoid displacement or damage to the underlying materials or adjacent structures. Graded rock shall be delivered and placed in such a manner that will ensure that the in-place material is homogeneous with no one size dominating an area. Some hand placing may be necessary to provide a neat and uniform surface on grade.

Commercially manufactured structures, including but not limited to culverts, gabions, precast slabs, etc., shall be installed as required by the manufacturer for flowing water applications.

6. VEGEATATION

Vegetation shall be established at the locations shown on the drawings and/or staked in the field, and as set forth herein, in Section 7, and/or as shown on the drawings. Unless otherwise set forth in Section 7, all woody vegetation shall be planted between October 1 and April 15.

Unless otherwise approved by the Engineer, the application of seed, soil supplements, and mulch shall be done by mechanical methods that ensure uniform coverage.

7. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Riparian Forest Buffer (Code 391)

SCOPE

The work shall consist of furnishing planting stock and other materials, and installing all components of the riparian forest buffer.

Planting Trees and Shrubs

The maximum spacing for trees shall be roughly 15 feet by 15 feet (creating a minimum density of 200 tree seedlings per acre). At this low planting density, two- to three-year-old bare- root or containerized tree seedlings (3-4 inch pots), or larger planting stock, shall be used. Shrubs shall be planted at a closer spacing, usually six to eight feet, either in rows or in clumps.

At higher densities, a variety of plant materials are acceptable, including bare-root plants, containerized plants, balled-and-burlap plants, live stakes and cuttings, and direct seeding.

When tree shelters or tubes are used, shelters shall be made of a translucent, mesh, or netting material and be at least four feet tall, preferably five feet tall in areas of moderate to heavy deer pressure. Shelters bottoms shall be sealed at the bottom, either by being tapped 2” into the soil or by piling 2” of loose soils around the bottom of the shelter. Bird nets shall be used with solid shelters, and shall be removed before the saplings emerge from the shelter.

Shelters with perforated seams may be left on the trees. Shelters without perforated seams shall be split lengthwise or removed when sapling trunks are 1 ½ inches in diameter at the top of the shelter. This removal criteria also applies to metal stakes.

Multi-stemmed shrubs may be protected with shelters made from woven-wire metal or UV- resistant plastic fence materials, or acceptable wood materials. Shrub shelters shall be at least four feet tall, preferably five feet tall in areas of moderate to heavy deer pressure. Shrub shelters shall be at least three feet in diameter, to accomodate the growth and natural spread of multi-stemmed shrubs. Shrub shelters shall be securely anchored using at least two durable stakes.

All shelters shall be securely anchored with durable stake(s). Wooden stakes shall be hardwood, a minimum dimension of one inch by one inch, and shall not include sapwood.

Planting Trees and Shrubs to Reduce Excess Amounts of Sediment, Organic Material, Nutrients and Pesticides in Surface Runoff and Shallow Ground Water Flow

The first two rows adjacent to the stream or water body shall be deciduous broad-leaved trees (hardwoods). Both trees and shrubs may be planted beyond the first two rows. Coniferous trees shall be limited to a maximum of 20 percent of the total number of trees planted, and shall not be planted in the first two rows adjacent to the stream or water body. All trees and shrubs shall be native to the U.S., and preferably native to Pennsylvania. *Tree and Shrub Information for PA NRCS* contains information which will help with plant selection for riparian forest buffers.

ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

SITE SPECIFIC CONSTRUCTION SPECIFICATIONS

Refer to site-specific plans and structural drawings for applicable construction specifications. Standard construction specifications from the PA Technical Guide are attached to this report.

SITE SPECIFIC CONSTRUCTION SPECIFICATIONS

Waste Storage Structures (Additional Conditions for PA-313 Construction Specification

1. A copy of the specifications and drawings shall be on site during all phases of construction.
2. A pre-construction meeting between Farmer, Contractor, and Engineer shall be required prior to any construction work.
3. The design for the waste storage structure is provided in the drawings. The structure contractor may provide an alternative design that meets the site conditions as shown in drawings, including the limits for backfill and drainage. The design submitted shall be sealed by an engineer licensed in Pennsylvania. The design drawings and steel schedule shall be submitted at or before the pre-construction conference.
4. The unloading area shall be as required by the approved standard details for the tank design. If the tank design requires a concrete unloading pad, any necessary preparation of the base for the pad will be the responsibility of the excavation contractor. If no concrete pad is required due to extra reinforcing steel in the wall, the area shall have reinforced gravel pad installed.
5. It is the responsibility of the Contractor to implement all measures necessary to protect work-in-progress from environmental conditions such as temperature extremes, surface and ground water, etc.
6. Compost filter sock should be placed downhill from any earth disturbance.
7. Embankments and disturbed areas surrounding the facility shall be treated to control erosion.
8. Strip all topsoil. Excavate the manure storage structure to the dimensions and elevations specified in the drawings. All fill and cut slopes shall be compacted in horizontal lifts with a smooth vibratory roller. Distribute excess fill on site. Finish grades may be adjusted slightly to better balance cut and fills (with approval of the Owner).
9. Foundation must be prepared in such a way that the structure is installed on uniform foundation. If any rock or unsuitable material such as large quantities of limestone or gravel is encountered, this material shall be removed and undercut to a depth of 2 feet below the finished bottom elevation and replaced with suitable clay/silt soil compacted in its place. Foundations consisting of bedrock with joints, fractures, or solution channels shall be treated or separation distance provided consisting of a minimum of 1 foot of impermeable soil between the floor slab and the bedrock or an alternative that will achieve equal protection. An alternative is to use a 15 ml plastic membrane. This liner shall be overlapped by 4' at the seams and underlain with a limestone sand to prevent puncturing. Clean crushed stone shall be on top of the plastic membrane to

allow subsurface drainage to enter the perimeter drain and to give the structure a uniform foundation. While foundation is being prepared, contractor shall provide adequate drainage for foundation. After the foundation has been excavated and unsuitable material has been replaced with suitable material, it should be disked, watered and recompacted with a smooth vibratory roller.

10. The perimeter drain and outlet must be installed and operational before the walls are poured.
11. A 4-inch layer of clean stone shall be placed on top of the foundation and compacted.
12. Pervious geotextile is not required on top of the clean stone under the storage structure.
13. Masonry Blocks or chairs shall be used to hold welded wire fabric in place. Blocks or chairs shall be placed at spacing equal to half the width of the welded wire fabric.
14. All concrete and reinforcing work shall conform to American Concrete Institute's "Standard Building Code Requirements for Reinforced Concrete, (ACI 318-19), and to the Pennsylvania NRCS PA313S Waste Storage Structure Construction Specification.
15. All concrete shall develop a minimum 28-day strength F'c of 4000 psi. All concrete shall have 3/4 inch maximum aggregate size and maximum water-cement ratio of 0.45. Slump shall be 3 to 6 inches (without superplasticizers, if any). Superplasticizers (ASTM C494, Type F or G) may be added to concrete that has a 2 to 4 inch slump, and the slump shall not exceed 7 1/2 inches with the addition of a superplasticizer. All concrete shall be furnished with the proper admixture to obtain 6% +/- 1% of air entrainment.
16. Concrete is to be mechanically vibrated. Cure concrete at air temperatures of 40° F to 90° F.
17. Procedures for cold weather concreting must be followed when, for more than 3 consecutive days, the following conditions exist: 1) the average daily air temperature is less than 40 °F and 2) the air temperature is less than 50 °F for more than half of any 24 hour period. All procedures for cold weather concreting must follow ACI 306 and be approved by the engineer.
18. Reinforcing steel to meet ASTM Specifications A-615, latest revision grade 60. All welded wire fabric shall meet A-185, latest revision.
19. When connecting two sections of waterstop, the ends must be heat welded or tied together and sealed with a watertight caulking.
20. All concrete shall be reinforced with the same steel as shown in similar sections unless specifically called out as "not reinforced".
21. The following minimum concrete cover shall be provided for reinforcement unless otherwise noted: Where cast against earth - 3 inches. Walls and slabs (exposed to earth or weather) - 1-1/2 inches. Other - 2 inches.
22. Place concrete in the forms in horizontal lifts of no more than 5 feet when a super plasticizer is used, and no more than 2 feet when a super plasticizer is not used. Do not allow the concrete to drop more than 12 feet when a super plasticizer is used, and no more than 4 feet when a super plasticizer is not used. Consolidate each lift by vibrating.

23. All concrete must be properly cured with the option of using curing compound at 1 gallon per 150 square feet. If curing compound is used, it shall meet ASTM C-309 and be sprayed on as soon as the concrete can be walked on (slabs) or after all wall ties are parged both inside and outside (walls). Wall forms may be taken off 24 hours after the end of the pour if the temperature is above 50° F.

24. Backfilling may occur 14 days after the final pour. Select best native material previously excavated from site for the 4 feet next to the walls from footing to surface. Place fill in lifts of 8 inches. Compaction within 4 feet of the wall may only be done with equipment less than one ton. Avoid backfill containing large rocks, hard or frozen soil chunks, construction debris, or large amounts of clay. Where slab on grade or driveway will be placed on this backfill, compact to 100% standard proctor. Compact to 95% in all other areas. Grade backfill so that storm runoff is directed away from the structure.

25. A fence is required around the storage structure to prevent unauthorized access. Gate(s) must be installed for convenient access. Approved fencing shall be chain link or approved equal. The mesh shall be 9 gauge, 5 feet high, double dip galvanized. Posts shall be 8 feet C-C, galvanized inside and outside and the line posts shall be 2 inches (Sch 20). Gateposts shall be 2-1/2 inches (Sch. 40). Posts shall be bolted to the outside of the wall. Posts must be capped at the time of installation. A minimum of 3 warning signs stating "Drowning Hazard" shall be placed around the Manure storage. A "During Agitation, Deadly Gases Possible" warning sign shall be placed at the pumpout opening. Also a "Never Dump Over the Fence warning sign shall be placed at the pumpout/pushoff opening.

26. All disturbed areas shall be seeded and mulched.

<u>Roof And Covers (Additional Conditions for PA-367 Construction Specification)</u>

1. This item shall consist of the installation of the roof systems for the hua and Stacking Structure.

2. See the construction notes listed in the drawings.

3. This item and its components shall meet the criteria listed in the PA-382 Construction Specification

<u>Fencing (Additional Conditions for PA-382 Construction Specification)</u>

1. This item shall consist of the installation of the fence for the waste storage structure, roofed hua, buffer fence, and animal trail.

2. Any additional interior gates or fencing shall be installed at the landowners expense.

3. THE BUFFER FENCE MUST BE A MINIMUM OF 35' BACK FROM THE TOP OF BANK ON BOTH SIDES OF THE STREAM.

4. This item and its components shall meet the criteria listed in the PA-382 Construction Specification.

Access Road (Additional Conditions for PA-575 Construction Specification)

1. This item shall consist of the installation of the access road as shown on the plans.
2. These items and its components shall meet the criteria shown on the drawings and listed in the PA-575 Construction Specification.
3. All material shall be compacted in 6 inch maximum lifts with a vibratory roller. Top the access roads with stone dust as shown on the detail drawing for animal comfort.

Trails and Walkways (Additional Conditions for PA-575 Construction Specification)

1. This item shall consist of the installation of reinforced gravel animal trails.
2. These items and its components shall meet the criteria shown on the drawings and listed in the PA-587 Construction Specification.
3. All material shall be compacted in 6 inch maximum lifts with a vibratory roller. Top the animal trails with stone dust as shown on the detail drawing for animal comfort.

Subsurface Drain (Additional Conditions for PA-606 Construction Specification)

1. This item shall consist of the installation of the perimeter drain for the waste storage structure, reception pit, underhouse storage, and stacking area.
2. This item and its components shall meet the criteria shown on the drawings and listed in the PA-606 Construction Specification.

Underground Outlet (Additional Conditions for PA-620 Construction Specification)

1. This item shall consist of the installation of the perimeter drain outlet for the waste storage structure, underhouse storage, reception pit, stacking area, underground outlets for roof water drains, and underground outlet for the surface inlets.
2. These items and its components shall meet the criteria shown on the drawings and listed in the PA-620 Construction Specification.

Waste Transfer (Additional Conditions for PA-634 Construction Specification)

1. This item shall consist of the installation of pump transfer pipe from the reception pit to the proposed round storage.
2. Materials used shall be as specified on drawings. Substitutions may be allowed if the proposed material is presented to the engineer of record a minimum of 14 days prior to installation. Time spent researching substituted materials may be charged to the contractor.
3. Minimum trench width excavation, as shown on the plans, shall be observed. Backfill shall be as specified on drawings.
4. For pump transfer lines, all fittings and valves shall be pressure rated to match or exceed that of the pipe specified. THRUST BLOCKS SHALL BE INSTALLED AS SHOWN AND DETAILED. ANY TURN IN THE PIPE OVER 5 DEGREES SHALL HAVE A THRUST BLOCK.

5. Manure transfer pipes must be properly bedded and supported near the manure storage structures to prevent settling and possible damage to the pipe.

6. These items and its components shall meet the criteria shown on the drawings and listed in the PA-634 Construction Specification.

Roof Runoff Structure (Additional Conditions for PA-558 Construction Specification)

1. This item shall consist of the installation of the roof gutters and downspouts for the proposed roofed hua and roofed stacking area. It will also include the gutters on the existing barn and the proposed barn as shown. The gutter outlets will outlet into the proposed gravel infiltration trenches.

2. All gutters shall be 6" Aluminum box gutters installed at a 1/16" per foot slope. All downspouts shall be 3"x4" or 4"x5". See details and number of downspouts needed.

3. These items and its components shall meet the criteria shown on the drawings and listed in the PA-620 Construction Specification.

Structure For Water Control (Additional Conditions for PA-587 Construction Specification)

1. This item shall consist of the installation of the drop box structure with removable traffic rated grate.

2. The drop box shall be precast concrete.

3. These items and its components shall meet the criteria shown on the drawings and listed in the PA-587 Construction Specification.

Obstruction Removal (Additional Conditions for PA-500 Construction Specification)

1. This item shall consist of the removal of the existing concrete and roof in the proposed hua area.

2. The concrete may be broken up and used as fill for the new barn or on the outside slopes of the hua or reception pit. The roof shall be hauled off site unless the farmer wants some of the materials.

3. These items and its components shall meet the criteria shown on the drawings and listed in the PA-500 Construction Specification.

Waste Facility Closure (Additional Conditions for PA-360 Construction Specification)

1. This item shall consist of the closure and decommissioning of the existing underhouse storage that is currently used to store the existing dairy manure.

2. The manure must be all removed. The farmer will remove as much manure as he can with his pump. Once the top is removed from the storage, the farmer and contractor will work together to removed the rest of the manure. As a minimum the floor of the existing storage must be broken up and then backfilled with compacted granular material. THE INPECTOR MUST SEE THE BROKEN UP FLOOR PRIOR TO BACKFILL.

3. These items and its components shall meet the criteria shown on the drawings and listed in the PA-360 Construction Specification.

Pumping Plant (Additional Conditions for PA-553 Construction Specification)

1. This item shall consist of the pto driven pump to pump manure from the reception pit to the round tank.
2. The pump must be able to pump the manure at least 500 gpm with 19′ of elevation head and 300′ of length.
3. These items and its components shall meet the criteria shown on the drawings and listed in the PA-533 Construction Specification.

Stream Crossing(Additional Conditions for PA-578 Construction Specification)

1. This item shall consist of the stream crossing as shown on the detail drawings.
2. The stream crossing will be a combination of precast slats and reinforced gravel as shown on the detail drawing.
3. These items and its components shall meet the criteria shown on the drawings and listed in the PA-578 Construction Specification.

Riparian Forest Buffer(Additional Conditions for PA-391 Construction Specification)

1. This item shall consist of the Riparian Forest Buffer as shown on the detail drawings.
2. The approximate acreage is 2.6 acres. The fence shall be kept at least 35 feet back from the stream bank. The trees shall be planted according to the 391 specification. Trees will be planted at approx. 194 trees per acre.
3. These items and its components shall meet the criteria shown on the drawings and listed in the PA-391 Construction Specification.

QUALITY ASSURANCE PLAN

Inspections must be made in order to certify that the manure storage facility and related appurtenances were built according to the Pennsylvania Technical Guide. Included in this Design Packet are the Construction Specifications, and it is advised that the owner use these and make his own inspections to ensure that construction meets the Pennsylvania Technical Guide.

Refer to the design drawings for a list of inspections planned by TeamAg.

The following inspections are recommended by TeamAg, subject to changes at the discretion of the certifying engineer:

Circular Manure Storage and Underhouse Storage

1. Inspect the sub-grade of manure storage structures prior to placement of drainfill stone. Seeps or unstable areas shall be addressed at this point. (Refer to site-specific construction specifications for subgrade testing requirements). IF ROCK IS ENCOUNTERED, THE PLAN IS FOR THE SITE TO BE OVEREXCAVATED AND A 1 FT. THICK SOIL LINER INSTALLED. The test pits did not reveal any rock.
2. Inspect the placement of rebar the floor and footing of the storage structure. Also inspect pouring the floor and footing concrete. (Refer to recommended concrete testing protocol.)
3. Inspect the placement of the rebar for the storage structure walls. Also inspect pouring the storage structure walls. (Refer to recommended concrete testing protocol.)
4. Prior to backfilling the walls, inspection of the concrete walls will be completed.
5. The backfill of the walls at the pushoff, pumpoff, and pump transfer must be granular material or gravel compacted as shown.
6. Inspect the overall grading for surface water and installation of related BMPs.
7. Fence and Warning Signs.
8. A final inspection meeting shall be arranged with the landowner and contractor to address safety concerns, warning signs, and operation and maintenance of facilities. Completion of As-Built plans.

Roofed HUA and Roofed Stacking

1. Inspect the sub-grade of the Roofed HUA and Roofed Stacking prior to placement of drainfill stone. Seeps or unstable areas shall be addressed at this point. (Refer to site-specific construction specifications for subgrade testing requirements)
2. Inspect the placement of rebar in the wall and footer of the roofed hua and stacking. Also inspect pouring the floor and footing concrete. (Refer to recommended concrete testing protocol.)
3. Prior to backfilling the walls, inspection of the concrete walls will be completed
4. Inspect method of fill placement especially inside the retaining walls. All fill on inside must be compacted as shown on the detail drawings.

5. Inspect the overall grading for surface water and installation of related BMPs.
6. Inspect Roof Installation, Bracing, and Fasteners.
7. A final inspection meeting shall be arranged with the landowner and contractor to address any concerns. Completion of As-Built plans.

Waste Transfer Components

1. Measure length and document diameter of pump transfer pipe. Document type of pipe and applicable ASTM numbers. Show changes in horizontal alignment on plan view. Thrust Blocks as required.

Perimeter Drains

1. Measure length and document diameter of perimeter drains and outlet pipes. Document type of pipe and applicable ASTM numbers. Show changes in horizontal alignment on plan view.

Fence

1. Inspect the high tensile cattle walkway fence during installation. Record length of fence.
2. Verify number of strands, height, and spacing of wires.
3. Verify line and corner post spacing meet the materials specifications in the drawings.
4. Inspect the cattle lot confinement fence meets the post and rail requirements specified in the drawings.
5. Verify the type and height of the gates.

Access Road and Animal Trails

1. Measure length and width of animal walkways and access roads.
2. Document type of geotextile used, depth, gradation, and type of stone.
3. Must top animal trails and access roads with stone dust.

Storm Water Pipes

1. Document installation of stormwater practices and underground outlets.
2. Measure length and document diameter of storm water pipe. Document type of pipe and applicable ASTM numbers. Show changes in horizontal alignment on plan view.
3. Document type of animal guards and outlet protection.
4. Inspect installation of infiltration trench prior to covering.
5. Measure gutters and note number of downspouts and sizes.

Stream Crossing

1. Document location and concrete slats used and reinforced gravel dimensions.

Riparian Forest Buffer

1. Document planting spacing and types of trees.

Closure of Existing Storage

1. Document manure is removed from existing storage.
2. Document floor is broken up prior to backfilling.
3. Backfill compacted in 4 inch lifts with mechanical tamper or trench compactor.

All inspections will be performed by one of the following:

Robert Sweppenheiser II, P.E. – TeamAg Inc.

Bryson Hunter – Engineering Technician, TeamAg Inc.

Liz Rivera – Engineering Technician, TeamAg Inc.

Adam Keller, P.E. –Engineer, TeamAg Inc.

Cameron Renehan, P.E. –Engineer, TeamAg, Inc.

Keith Hodge, P.E –Engineer, TeamAg, Inc.

Eric Sauder, E.I.T. – Engineering Technician, TeamAg, Inc.

Sonny Albright – E.I.T – TeamAg, Inc.

Or other personnel as determined by PM

Note: Contractor and/or Owner should call TeamAg Inc. at least 48 hours before any concrete pours – Rob Sweppenheiser (607)-426-2500 or Sarah Xenophon 570-294-5229 or TeamAg 717-721-6795.

	DAVID KAUFFMAN ESTIMATED QUANTITIES		
	ESTIMATED QUANTITIES - CONTRACTOR RESPONSIBLE FOR VERIFYING QUANTITIES		
CODE	**ITEM**	**UNIT**	**QUANTITY**
	EXCAVATION		
	SEEDING AND MULCHING, E&S CONTROL	each	1
	RECTANGULAR MANURE STORAGE - 11-4" X 70'-4"' x 10' Deep, 7,971 CF		
313	Cut - Common Excavation	cu.yds	470
313	#57 Stone Under Concrete Floor	tons	25
313	Compacted Backfill	cu.yds	220
313	Final Grading and Spread Excess Fill - On Site	cu.yds	250
	ROUND MANURE STORAGE - 10'X72' - 40,715 CU. FT.		
313	Cut - Common Excavation	cu.yds	1,950
313	#57 Stone Under Concrete Floor	tons	90
313	Compacted Backfill	cu.yds	740
313	Final Grading and Spread Excess Fill - On Site	cu.yds	1,210
	Reception Pit - 11'-4"x38'-4" x 10' Deep, 4,342 CF		
313	Cut - Common Excavation	cu.yds	245
313	#57 Stone Under Concrete Floor	tons	15
313	Compacted Backfill	cu.yds	125
313	Final Grading and Spread Excess Fill - On Site	cu.yds	120
	ROOFED STACKING STRUCTURE 48'x50' OUTSIDE WALL, 2,400 SQ. FT.		
313	#57 Stone Under Floor Slab and Wall Footers	tons	65
313	Cut - Common Excavation, Volume Displaced	cu.yds	300
313	Compacted Backfill	cu.yds	300
	ROOFED HEAVY USE AREA FOR HEIFERS AND CALVES, 50'x72' TOTAL, HUA AREA 2,856 SQ. FT. NOT INCLUDING SLATTED AREA OVER UNDERBARN STORAGE		
561	Cut - Common Excavation, Volume Displaced	cu.yds	350
561	Backfill of Cut Material for Walls	cu.yds	220
561	Grading and Extra Compacted Fill From Tank Excavation	cu.yds	500
561	#57 Stone under concrete	tons	75
500	Obstruction Removal Roof and Concrete	sq. ft.	2,770
	UNDERGROUND PIPES		
606	4" Perforated Pipe and #57 Stone, Rectangular Pit (Underhouse) Perimeter Drain	ft	180
620	4" PVC Pipe AND #57 Stone, Rectangular Tank (Underhouse) Perimeter Drain Outlet	ft	300
606	4" Perforated Pipe and #57 Stone, Round Tank Perimeter Drain	ft	240
620	4" PVC Pipe AND #57 Stone, Round Tank Perimeter Drain Outlet	ft	300
606	4" Perforated Pipe and #57 Stone, Reception Pit Perimeter Drain	ft	115

CODE	ITEM	UNIT	QUANTITY
620	4" PVC Pipe AND #57 Stone, Reception Pit Perimeter Drain Outlet	ft	220
606	4" Perforated Pipe and #57 Stone, Stacking Area Perimeter Drain	ft	51
620	4" PVC Pipe AND #57 Stone, Stacking Perimeter Drain Outlet	ft	110
606	4" Perforated Pipe and #57 Stone, HUA 6' Retaining Wall Perimeter Drain	ft	75
620	4" PVC Pipe AND #57 Stone, HUA 6' Retaining Wall Perimeter Drain Outlet to Drop Box Transfer Pipe	ft	20
620	6" PVC SDR 35 Roof Water Drains Total Including Risers	ft	700
620	8" PVC SDR 35 Roof Water Drains, Combined before infiltration trench	ft	150
620	6" Steel Pipe Risers DS-4 and DS-7	ft	20
620	Animal Guard	each	3
587	Surface Inlet with Grate - 2' x 4' Surface Inlet With Traffic Rated Removable Grate	each	1
620	12" HDPE Smooth Interior	ft	260
468	Riprap Outlet Protection Apron	sq. ft.	80
	WASTE FACILITY CLOSURE		
360	Decommission Existing Underhouse Storage, Approx. 1,300 sq. ft. With Varying Depths Up To 10'	each	1
	ROOF INFILTRATION TRENCHES		
558	Roof Water Infiltration Trench 25'x43'=1,075 sq. ft.	sq ft	1,075
	WASTE TRANSFER		
634	6" SDR-26 Pump Transfer	ft	270
634	Valve System at Reception Pit	each	1
	Pumping Plant		
533	PTO Pump For Transfer from Reception Pit to Concrete Tank	each	1
	ACCESS ROAD		
560	Reinforced Gravel Access Road - 15'x75, Total of 1,125 sq. ft.	sq. ft.	1,125
	Animal Trail		
560	Reinforced Gravel Animal Trail - 12'x430'=5,160 sq. ft.	sq. ft.	5,160
560	Reinforced Gravel Animal Trail - 15'x80'=1,200 sq. ft.	sq. ft.	1,200
	FORESTED BUFFER		
391	Plant and Establish Forested Buffer According to Specification	Ac.	2.6
	FENCE		
382	4 Strand Fence for Animal Trail including a 10' and 12' Spring Gate	ft	860
382	4 Strand Fence for Animal Trail including a 25' Spring Gate Across North End of Concrete Entrance to Roofed HUA	ft	225
382	4 Strand Fence for Buffer	ft	2,900
	STREAM CROSSING		
578	Reinforced Gravel Banks 12x64'=768 sq. ft.	sq ft	768
578	Concrete Slats 12'x24'=288 sq. ft.	sq ft	288
			EXCAVATIO

CODE	ITEM	UNIT	QUANTITY
	CONCRETE		
313	Concrete Testing	each	8
	RECTANGULAR MANURE STORAGE - 11-4" X 70'-4"' x 10' Deep, 7,968 CF		
313	Concrete Flatwork and Footers	sq.ft	1,022
313	10' High Walls	cu.yds	55
313	Pre-Cast Components, Slat Area and Pump Out Panel	sq. ft.	852
	ROUND MANURE STORAGE - 10'X72' - 40,715 CU. FT.		
313	Concrete Flatwork and Footers	sq.ft	4,497
313	10' High Walls	cu.yds	65
561	Pumpoff Pad	sq. ft.	144
382	Chain-link Fence and gate	ft	232
	Reception Pit 11'-4"x38'-4" x 10' Deep, 4,342 CF		
313	Concrete Flatwork and Footers	sq.ft	574
313	10' High Walls	cu.yds	35
313	Pre-Cast Components, Solid Lid and Pumpout	sq. ft.	468
	ROOFED STACKING STRUCTURE 48'x50' OUTSIDE WALL, 2,400 SQ. FT.		
313	Concrete - Flatwork	sq.ft	2,400
313	6' Wall - 4 ft above grade	cy	60
367	Roof Structure, 55'x50'	sq.ft	2,750
	ROOFED HEAVY USE AREA FOR HEIFERS AND CALVES, 50'x72' TOTAL, HUA AREA 2,856 SQ. FT. NOT INCLUDING SLATTED AREA OVER UNDERHOUSE STORAGE		
561	Concrete - Flatwork 2,674 sq. ft.	sq.ft	2,674
561	Concrete -1,120 Sq. Ft. entrance pad	sq.ft	1,120
561	6' Roof Support walls, 8' Roof Support Walls, Ramp Curbs, 18" High Feeder Curbs	cu.yds	90
382	3 Railed HUA 2" Steel Pipe Safety Fence	ft	171
382	HUA Steel Tube Gates, 1-12', 1-10', 1-13'	ft	38
367	Roof Structure, 55' X73'	sq.ft	4,015
	Roof Runoff Structure		
558	Roof Gutters on Stacking	ft	100
558	Roof Gutters on HUA	ft	148
558	Roof Gutters on Existing Barn	ft	194
558	Roof Gutters on Proposed Barn Addition	ft	224