

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION

313A - WASTE STORAGE FACILITY - SHOTCRETE STRUCTURE

I. SCOPE

The work shall consist of furnishing material for/and constructing a waste storage structure to the lines, grades, elevations, and dimensions as shown on the drawings.

II. FOUNDATION PREPARATION

The entire foundation area shall be cleared of all trees, brush, roots, sod, soil containing excess amounts of organic matter, and other objectionable materials and disposed of at sites away from the area of work.

Clearing and disposal methods shall be in accordance with applicable state and county laws with due regard to the safety of persons and property.

III. EXCAVATION

Excavated materials may be used in fill areas. Excess material shall be wasted at locations noted on the drawings or as staked in the field.

IV. EMBANKMENTS

Construction of embankments required for this practice shall conform to the requirements of Construction Specification No. 703 - Earthfill.

V. SHOTCRETE MIX

The proportion of water added to the mixture shall be accurately controlled to produce thorough and uniform hydration of the shotcrete. The consistency of the shotcrete shall be such that the surface of the shotcrete in place shall have a rich, glossy appearance and that the shotcrete shall adhere to the supporting surface without flowing, slumping or sloughing.

For application to vertical surfaces the mix proportions shall be adjusted so that the placed shotcrete will adhere without sagging or sloughing. For adjustment consistency, the addition of fly ash or diatomaceous earth to the mixture in amount not greater than 3 percent (by weight) of cement will be permitted.

The proportions of the shotcrete mix shall be controlled on the basis of the weight of each component material except that water may be measured by volume.

Batching and mixing equipment shall include weighing equipment accurate to within 0.4 percent of scale capacity, a power-driven mortar mixer capable of thoroughly mixing the materials at a rate adequate to insure uniform feeding of the mixture to the placing equipment, and a feeding apparatus capable of supplying the mixture to the placing equipment at an adequate and uniform rate.

For dry mix process shotcrete, the cement and sand shall be mixed by at least 25 revolutions of the mixer drum before being fed into the placing equipment. The dry mix should be used promptly after mixing and any material that is not placed within 45 minutes after mixing shall be wasted.

For wet mix process shotcrete, the cement, sand, and water shall be thoroughly mixed in the mixer drum sufficiently to produce shotcrete of the required consistency that is uniform within each batch and uniform from batch-to-batch when discharged into the placing equipment.

The entire contents of the mixer shall be discharged from the drum before materials for a succeeding batch are placed therein.

VI. EQUIPMENT

The placing equipment for dry mix process shotcrete shall be designed and equipped to receive the dry mix, introduce it into a stream of compressed air, convey it pneumatically through a delivery hose to a nozzle at the point of discharge, inject water under pressure into the suspended stream of dry sand and cement within the nozzle, and spray the resulting shotcrete mix onto the surface of the work at a uniform rate and at a controlled velocity. The placing equipment shall be equipped with accurate gages to indicate the air pressure and water pressure and with devices capable of accurately controlling the air pressure at any level between 50 p.s.i. and 80 p.s.i., and water pressure at

any level between 50 p.s.i. and 100 p.s.i., and the rate of application of water at the nozzle.

The placing equipment for wet mix shotcrete shall be designed and equipped to receive the shotcrete from the mixer, convey it through a delivery hose to a nozzle at the point of discharge, accelerate it in the nozzle by means of compressed air, and spray it onto the surface of the work. It shall be capable of delivering shotcrete to the nozzle uniformly and continuously and discharging it from the nozzle at a uniform rate and at a controlled velocity sufficient for all parts of the work. The length of the discharge hose shall not exceed 350 feet.

VII. PLACEMENT

During placement of the shotcrete, the air pressure shall be adjusted as required to control rebound and density of shotcrete. For a given application, once the optimum operating pressures have been established, they shall be maintained constant throughout the application. For dry mix shotcrete, the air pressure at the material outlet or air-inlet shall be not less than 40 p.s.i. plus 5 p.s.i. for each 50 feet length of the discharge hose greater than 100 feet and 5 p.s.i. for each 25 feet the nozzle is above gun (shotcrete delivery equipment). The water pressure at the nozzle shall be not less than 15 p.s.i. greater than the air pressure at the material outlet or air-inlet on the gun.

Shooting strips shall be used at corners, edges, and on surfaces where necessary to obtain true lines and proper thickness. Where practicable, ground wires shall be installed as guides to accurately establish the specified contour of the finished surface of mortar. Ground wires shall be set and used as guides for templates in forming curved and molded surfaces. When shotcrete is to be placed on horizontal or sloping surfaces, headers, and ground wires shall be provided to the extent necessary to insure control of slab thickness. Ground wires shall be tightened and kept taut, secure, and true to line and plane during placement of shotcrete and shall be removed when placement of shotcrete is completed.

Header boards will be required where the drawings indicate a square edge and as required. The surface of all such devices shall be thoroughly cleaned and a form release agent applied before shotcrete is placed, and shall be structurally adequate and of such design that rebound or accumulated loose sand can freely escape or be readily removed.

The placing nozzle shall be held between 2 and 6 feet from and approximately normal to the surface of the work. Corners shall be filled first.

Shotcrete shall be applied in a single thickness or to layer thickness no greater than that which will cause sagging, shoughing or dropout. Sags and sloughs shall be cut out and regunned. Replacement shall be accomplished before previously place shotcrete has completely set. When shotcrete is placed on a vertical surface, application shall be started at the bottom and be completed at the top.

In any case when the placing of shotcrete is interrupted for more than 1 hour, the edge of the layer shall be sloped off at an angle of approximately 45 to the surface being shot, and the sloped portion shall be covered with a double layer of 6 ounce burlap and kept continuously moist until the application of shotcrete is resumed. Before applying new material, the sloped portion shall be thoroughly cleaned and wetted by means of an air and water blast or equally effective method approved by the Engineer.

Material that rebounds and accumulates on shooting strips, header boards or subgrade surfaces ahead of the shotcrete being placed shall be removed.

In no case shall shotcrete be applied over rebound debris. Rebound debris shall not be reused in mortar on any portion of the work and shall be disposed of as the work progresses.

Rebound material shall be carefully swept off the finished shotcrete surface before it becomes too hard for removal.

Shotcrete shall not be screened. After the shotcrete has been placed to the depth required, the surface shall be checked with a straight edge or template and any low spot shall be brought up to specified grade by placing additional shotcrete. Finishing of shotcrete surfaces by means of floats or trowels is not required.

VIII. CURING

Shotcrete shall be prevented from drying for at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period or until curing compound is applied. Moisture shall be maintained by sprinkling, flooding or fog spraying, or by covering with continuously moistened canvas, or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Header boards left in place during the curing period shall be kept wet.

Water or covering shall be applied in such a way that the shotcrete surface is not eroded or otherwise damaged.

Water for curing shall be clean and free from any substances that will cause discoloration of the shotcrete where finished surfaces will be exposed to view.

Except as otherwise specified under Hot Weather Placement, except for surfaces to which additional shotcrete is to be applied, shotcrete may be coated with curing compound in lieu of the continued application of moisture.

The curing compound shall be sprayed on the moist surfaces as soon as rebound had been removed and any required repairs are completed or as soon as water curing is discontinued.

The curing compound shall be thoroughly mixed immediately before applying and shall be applied at a uniform rate of not less than 1 gallon per 100 square feet of surface. It shall not check, crack or peel, and shall be free from pinholes or other imperfections.

Curing compound shall not be applied to subgrade surfaces or other surfaces requiring bond with subsequently placed shotcrete, such as construction joints, reinforcing steel and other embedded items.

Surfaces subjected to heavy rainfall or running water within 3 hours after the curing compound has been applied, or surfaces damaged by subsequent construction operations during the curing period, shall be resprayed in the same manner as for the original applications.

IX. REPLACEMENT REPAIRS

When shotcrete has "drummy" areas, voids, sand pocket or is damaged or otherwise defective, the defective portions shall be removed and replaced. The Engineer will determine the required extent of removal, replacement or repair.

Repairs shall be made with shotcrete conforming to this specification. When removal of defective shotcrete is required, the sound shotcrete at the edges of removed sections shall be trimmed to a slope of approximately 45 with the surface of the work and shall be thoroughly moistened prior to placement of the new shotcrete.

Any portions of the work having a thickness less than those specified may be repaired by the placement of additional layers of shotcrete, provided that such repair is expressly authorized.

Curing shall be applied to repaired areas immediately after the repairs are completed.

X. COLD WEATHER PLACEMENT AND HOT WEATHER PLACEMENT

Requirements as specified in Construction Specification, 701-concrete, shall apply should either hot or cold weather condition exist.

XI. CONTRACTION AND CONSTRUCTION JOINTS

Contraction joints, at least 1/4 inch wide, shall be cut transversely in shotcrete to a depth of about 1/3 the thickness of the lining, at a uniform spacing not greater than 10 feet. Construction joints shall be at right angles to the lining. Contraction and construction joints shall be tooled so the edges will have a smooth finish.

XII. MATERIALS

Shotcrete used in sloped linings shall be so proportioned that it is stiff enough to stay-in-place on the side slopes. A dense, durable product will be required. The shotcrete mix shall be one that can be certified as a suitable to produce a minimum strength of at least 2,500 pounds per square inch, unless otherwise specified for the job.

The cement used shall be Portland Cement, Type II, or V, as specified for the job.

Fly ash or diatomaceous earth conforming to ASTM Specification C-618 may be added.

Water used in mixing shall be clean and free from harmful amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Aggregates shall conform to the requirements of ASTM Specification C-33 and the gradation shall be specified for the job.

The curing compound shall meet the requirement of ASTM Specification C-309.

XIII. STRUCTURAL BACKFILL

Backfill material shall contain no rocks greater than 2 inches. Compaction shall be accomplished by means of hand tamping or manually directed power tamper, or plate vibrators. Fill shall be placed in approximately horizontal layers. Hand compacted fill shall be placed

in layers not more than 4 inches thick before compaction. Fill shall be placed in a manner that will prevent damage to the conduit. The height of the fill adjacent to the conduit shall be increased at approximately the same rate on all sides. Water shall be added to the fill material, if necessary, to obtain the proper moisture for compaction; the material shall retain a ball shape when squeezed in the hand.

After the backfill operations have been completed, the surface area shall be graded to convey any surface runoff away from the structure.

XIV. INLET AND OUTLET STRUCTURES

The inlet and outlet structures shall conform to materials, sizes and installation as shown on the drawings. Bedding conditions and depths of cover shall be as shown on the drawings.

Pumpwells shall be constructed as shown on the drawings. Placement and compaction of the backfill around the pumpwell shall be accomplished in such a manner that the structure will not be damaged. The backfill will be compacted to approximately the same density required of the embankments.

XV. WARNING SIGN AND FENCING

A warning sign shall be pasted in a clean visible location to warn that the structure may contain poisonous gas. When shown on the drawings fencing shall conform to the requirements of Practice Specification 362- Fencing.

XVI. VEGETATIVE COVER

Unless otherwise specified, a protective cover of vegetation shall be established on the disturbed area. The planting of vegetative materials shall conform to the requirements of Practice Specification 342- Critical Area Planting.

XVII. SPECIAL MEASURES

Measures and construction methods shall be incorporated as needed and practical that enhance fish and wildlife values. Special attention shall be given to protecting visual resources and maintaining key shade, food and den trees.

XVIII. CONSTRUCTION OPERATIONS

Construction operations shall be done in such a manner that erosion and air water pollution are minimized and held within legal limits. The owner, operator, Contractor or other persons will conduct all work and

operations in accordance with proper safety codes for the type of construction being performed with due regards to the safety of all persons and property.

OPERATION AND MAINTENANCE ITEMS

A properly operated and maintained waste storage structure is an asset to your farm. This waste storage structure was designed and installed for temporary storage of animal wastes. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory perform. Here are some recommendations to help you develop a good operation and maintenance program.

Do not allow the operation of any equipment that exceeds the design limit on or within twenty feet of the structure.

Do not allow human entry into any enclosed structure without safety equipment, including ladders and breathing apparatus.

Maintain all pumps, agitators, piping, valves and all other electrical and mechanical equipment in good operating condition by following the manufacturers' recommendations.

Maintain grounding rods and wiring for all electrical equipment in good condition.

All fences, railings, and/or warning signs shall be maintained to provide warning and/or prevent unauthorized human or livestock entry.

Immediately repair any vandalism, vehicular or livestock damage to the structure, earthen areas surrounding the structure, or any appurtenances.

Maintain all lids, grated, and shields on openings to underground structures.

Immediately remove all foreign debris within the structure that may cause damage to pumps or agitators.

Other items specific to your project are listed on the "Practice Requirement" sheet.