SECTION 3

CONTRACTOR INFO

PA ONE CALL (DESIGN ONLY)

CONTRACTORS NOTIFICATION LIST

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GEOTEXTILE PHYSICAL REQUIREMENTS

SAFETY SHEETS

COLD AND HOT WEATHER CONCRETING

PRACTICE SPECIFICATIONS

Wodehouse, William - FPAC-NRCS-NGO, Bloomsburg, PA

From: POCS Web Ticket Confirmation <Delivery@pa1call.net>
Sent: Wednesday, December 8, 2021 2:02 PM
To: Wodehouse, William - FPAC-NRCS-NGO, Bloomsburg, PA
Subject: [External Email]POCS 12/08/21 14:01:52 20213422657-000 WR# 277320211208 New Excavation Final Design

WEBCFM 00000 POCS 12/08/21 14:01:52 20213422657-000 WR# 277320211208 NEW XCAV DSGN

==========PENNSYLVANIA UNDERGROUND UTILITY LINE PROTECTION REQUEST========== Serial Number--[20213422657]-[000] Channel#--[1354AWEB][0400][2019-08]
Message Type--[NEW][EXCAVATION][FINAL DESIGN]

County--[WAYNE] Municipality--[DAMASCUS TWP]
Work Site--[678 COCHECTON TURNPIKE TYLER HILL PA]
Nearest Intersection--[RUTLEDGEDALE RD]
Second Intersection--[SKY LAKE RD]
At Intersection--[N] Between Intersections--[Y]
Subdivision--[]
Location Information--
[]
Caller Lat/Lon--[41.698199/-75.168479] Mapped Type--[P] Mapped Lat/Lon--
[41.698409/-75.168628,41.698389/-75.167959,41.697809/-75.168040,
41.697929/-75.168816,41.698269/-75.168682]
Attachments--
[https://gcc02.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.pa811.org%2Fattachments%2F20213422657&data=04%7C01%7C%7Cd385b97c64c34bed807408d9ba7d22e1%7Ced5b36e701ee4ebc867ee03cfa0d4697%7C0%7C0%7C637745869340532981%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C2000&sdata=0Yns3UuYoeUch3bEgCxV6uLqfft7pZ8aeup3jzqST5A%3D&reserved=0]
Type of Work--[MANURE STORAGE STRUCTURE] Depth--[4FT]
Extent of Excavation--[100FT X 250FT] Method of Excavation--[DIGGING]
Equip Type--[EXCAVATOR]
Street--[ ] Sidewalk--[ ] Pub Prop--[ ] Pvt Prop--[X] Other--[DESIGN] Private Front--[ ] Rear--[ ] Left--[ ] Right--[X]

Project Dates--[ ] thru [ ] Response Due Date--[22-Dec-21]
Scheduled Excavation Date--[DESIGN]

Caller--[ANDY WODEHOUSE]
Caller Phone--[570-784-1062] Caller Ext--[127]
Excavator--[CHESAPEAKE BAY FOUNDATION C B F]
Address--[702 SAWMILL RD]
City--[BLOOMSBURG] State--[PA] Zip--[17815]
FAX--[570-387-7715] Caller Type--[B]

Email--[ANDY.WODEHOUSE@PA.USDA.GOV]
Work For--[CASSILYN SCHWEIGHOFER]
Project Contact--[ANDREW WODEHOUSE]
Project Contact Phone--[570-317-9473]
Best Time to Call--[8 AM TO 4 PM]
Project Contact Email--[ANDY.WODEHOUSE@USDA.GOV]

Prepared--[08-Dec-21] at [1400] by [AWODEHOUSE]
Remarks--
[]

DAM0 DAM=DAMASCUS TWP LV 0 LV =PENELEC PTD0 PTD=PPL ELEC DESIGN
TI 0 TI =VERIZON NORTH

Serial Number--[20213422657]-[000]

CONTRACTOR'S NOTIFICATION LIST

The following is a list of key steps in the construction of the project. You are required to notify the NRCS Field Office at least 24 hours before proceeding with each of the following construction phases. Failure to so may result in NRCS being unable to adequately check construction and verify that the installation meets NRCS standards.

NOTIFY NRCS 24 HOURS BEFORE:

Construction Phase:

1. Starting construction
2. Completion of foundation excavation
3. Starting placement of sub-base materials
4. Placement of concrete footer, walls, and floor
5. Backfilling of concrete walls
6. Starting timber framing
7. Installing and backfilling underground outlets
8. Final grading
9. Apply seeding to all disturbed areas
10. Project completion

The responsibility for notification will be reviewed and individual responsibilities will be assigned at the pre-construction conference.

Prior to the purchase of any materials, certification of their compliance to the specification shall be provided. Certification can be in the form of a signed statement that materials conform or from the markings on the materials themselves. Material literature supplied by manufacturer usually satisfies the certification requirement. The documentation for material certification shall be provided to the quality assurance representative.

CERTIFICATION OF CONFORMANCE

The undersigned primary manufacturer/supplier has furnished to:

Farmer's Name: CASSILYN SCHWEIGHOFER

Address 678 COCHECTON TURNPIKE

City/State/Zip TYLER HILL, pa 18469

Type of Structure: concrete work .

and hereby states that the quality of work and materials meets the requirements as set forth on NRCS contract drawings and Specifications No. 313, 367, 558 all as approved by the Natural Resources Conservation Service.

Name of
Manufacturer/Supplier: _____

Signature/Title/Date: _____

Description of items completed:

In addition, the landowner and/or the following subcontractors were also involved in the installation and they hereby certify their work meets the requirements of the drawings and/or specifications as stated previously.

Landowner
Signature/Date: _____

Description of items completed:
Subcontractor
Signature/Date: _____

Description of items completed:
Received By:

_____

Signature Title Date

Note: It is the primary manufacturer/supplier's responsibility to obtain and furnish all required signatures.

CERTIFICATION OF CONFORMANCE

The undersigned primary manufacturer/supplier has furnished to:

Farmer's Name: CASSYLIN SCHWEIGHOFER

Address 678 COCHECTON TURNPIKE

City/State/Zip TYLER HILL, PA 18469 .

Type of Structure; Timber framing .

and hereby states that the quality of work and materials meets the requirements as set forth on NRCS contract drawings and Specifications No. 367,558 all as approved by the Natural Resources Conservation Service.

Name of
Manufacturer/Supplier: _____

Signature/Title/Date: _____

Description of items completed:

In addition, the landowner and/or the following subcontractors were also involved in the installation and they hereby certify their work meets the requirements of the drawings and/or specifications as stated previously.

Landowner
Signature/Date: _____

Description of items completed:
Subcontractor
Signature/Date: _____

Description of items completed:
Received By:

_____

Signature Title Date

Note: It is the primary manufacturer/supplier's responsibility to obtain and furnish all required signatures.

GENERAL NOTES

1. Prepare site, supply and install all components of the Ag Waste Management System to the dimensions, elevations, and locations shown on the drawings. The components of the system include the following:

   A. Heavy Use Area/Dry Stack Manure Waste Storage Structure with Timber Framed Roof
   B. Roof Runoff
   C. Underground Outlets
   D. All Excavation and Backfilling Required to Install All Components
   E. Access Rd
   F. Seed, Lime, Fertilizer, and Mulch all disturbed areas
   G. All Labor, Equipment, Tools, and Other Items Necessary and Incidental to the Work.

2. A copy of the specifications and drawings shall be on site during all phases of construction.

3. 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.

4. **All critical work that is indicated in the additional conditions and or drawings shall be done Monday through Friday between the hours of 8:00 am and 4:30 pm unless cleared by the assigned inspector.**

5. ONE CALL – **It is** the responsibility of the **Excavating Contractor** to comply with the provisions of the Pennsylvania One-Call Act (Utility Act) to check for underground utilities before performing any excavation work

6. Refer to the Contractor's Notification list for the required notification of Natural Resources Conservation Service (NRCS) field office during construction.

7. Refer to and comply with all requirements on the cover sheet of this design.

8. OSHA regulations shall be followed at all times.

9. A pre-construction conference between the landowner, Conservation District representatives, NRCS representatives, contractor(s), and applicable suppliers is required seven (7) days prior to starting work.

10. The contractor is responsible for the security of the job until the work has been certified by NRCS.

11. In the event rock is encountered during excavation, stop excavation and notify NRCS personnel (Project Design Engineer). NRCS must be notified in order to determine if or how the rock would be removed.

12. In the event unstable soils or seeps are encountered during excavation, stop excavation and notify NRCS personnel (Project Design Engineer). NRCS must be notified in order to determine the quantity of and the best method for removing the soil or water, to provide for a stable sub-base to build on.

TABLE C
Size and Grading Requirements for Coarse Aggregates
(Based on Laboratory Sieve Tests, Square Openings)

AASHTO Number	Total Percent Passing													
	100 mm (4")	90 mm (3 1/2")	63 mm (2 1/2")	50 mm (2")	37.5 mm (1 1/2")	25.0 mm (1")	19.0 mm (3/4")	12.5 mm (1/2")	9.5 mm (3/8")	4.75 mm (No. 4)	2.36 mm (No. 8)	1.18 mm (No. 16)	150 µm (No. 100)	75 µm (No. 200) ***
1	100	90-100	25-60		0-15		0-5							
3			100	90-100	35-70	0-15		0-5						
467				100	95-100		35-70		10-30	0-5				
5					100	90-100	20-55	0-10	0-5					
57					100	95-100		25-60		0-10	0-5			
67						100	90-100		20-55	0-10	0-5			
7							100	90-100	40-70	0-15	0-5			
8								100	85-100	10-30	0-10	0-5		
10									100	85-100			10-30	
2A**				100			52-100		36-70	24-50	16-38*	10-30		
OGS**				100			52-100		36-65	8-40		0-12		

* Applies only for bituminous mixtures.
** PENNDOT Number
*** For 75 µm (No. 200), see Table D.

Note A: A combination of No. 7 and No. 5 may be substituted for No. 57, provided that not more than 50% or less than 30% of the combination is No. 7 size.

Note B: Provide No. OGS material that has a minimum average coefficient of uniformity of 4.0. The average coefficient of uniformity is defined as the average of the sublots within each lot. Determine the coefficient of uniformity according to PTM No. 149 each time the gradation is determined. The required minimum coefficient of uniformity for individual samples is 3.5. If the coefficient of uniformity of any sample falls below 3.5, reject the lot. Do not use the coefficient of uniformity in the multiple deficiency formula.

TABLE A (English)
Geotextile Physical Requirements[1]

Fabric Properties	Test Method	Construction Class							
		Class 1	Class 2		Class 3[2]		Class 4		
		Subsurface Drainage	Erosion Control		Sediment Control		Separation	Stabilization	Reinforcement
			Type A	Type B	Type A	Type B	Type A	Type B	Type C
1. Grab Tensile Strength, lbs.	ASTM D 4632	158	200	90	200	90	270	400[6]	500[6]
2. Grab Tensile Elongation, %	ASTM D 4632	20 min	15-50	15 min	15-50	15 min	50 min	20 max	20 max
3. Burst Strength, psi	ASTM D 3786	189	320	140	320	140	430	—	—
4. Puncture, lbs. (5/16-inch flat-end rod)	ASTM D 4833	56	80	40	80	40	100	140	200
5. Trapezoid Tear Strength, lbs.	ASTM D 4533	56	50	30	50	30	100	—	—
6. Apparent Opening Size (AOS) Sieve No.	ASTM D 4751	(3), (4)	(3), (4)	(3), (4)	No. 20 max	No. 20 max	(3), (4)	> No. 30	>No. 30
7. Permeability, K, cm/sec	ASTM D 4491	K fabric ≥10K soil[4]	K fabric ≥10K soil[4]	K fabric ≥10K soil[4]	K fabric ≥10K soil[4]	K fabric ≥10K soil[4]	K fabric ≥10K soil[4]	—	—
8. Permittivity, sec-1	ASTM D 4491	0.2	—	—	0.01	0.01	—	—	—
9. Seam Strength, lbs. [5]	ASTM D 4632	70	180	80	—	—	240	360	450
10. Ultraviolet Resistance Strength Retention, %	ASTM D 4355	70 @ 150 hrs	70 @ 150 hrs	70 @ 150 hrs	70 @ 150 hrs	70 @ 150 hrs	70 @ 150 hrs	70 @ 150 hrs	70 @ 150 hrs

(1) The numerical values indicate average minimum roll value or minimum to maximum range, except as noted.
(2) Average minimum roll value for Class 3 material in warp direction only.
(3) Soil with 50% or less particles by weight passing No. 200 sieve, AOS ≥ No. 30 sieve.
Soil with more than 50% particles by weight passing No. 200 sieve, AOS > No. 50 sieve.
(4) Design specified.
(5) Applies to both field and/or manufactured seams.
(6) Minimum grab tensile strength for the warp and fill direction at maximum elongation.

USDA United States Department of Agriculture

Fact Sheet #8

Febuary 2016

Manure Storage Maintenance and Safety

This fact sheet provides a checklist of common maintenance and safety issues found around existing manure storage facilities and promotes developing and reviewing a written safety plan focused on your manure waste management system.

The owner or farm operator is responsible for maintaining a safe environment for their family and all those working near their waste storage facility(s). Each year farm families suffer the loss of life, whether animals or, more tragically, humans that could be avoided with proper maintenance and safety training. Each farm operation should develop a written safety plan (Contact your local extension Agent for information or do an internet search). Review this plan with everyone working near the waste storage facility. Discuss potential hazards and the need to maintain safety devices and follow proper safety protocol. Consider upgrading older facilities with current safety signs and devices. Make repairs in a timely manner. Someone's life may depend upon it. Listed below are the more common safety issues and areas to check.

- Check to see if your safety fence is being properly maintained at the manure storage and loading hoppers.
  - o Replace fence/posts that have been damaged.
  - o Check the gates to verify they close properly and can be latched and locked.
  - o Tighten loose fence and repair damaged sections.
  - o The minimum height of fence should be 4.5 feet. Higher fence may be appropriate for some sites.
- Check to see if your warning signs are still in place and add as needed.
  - o One or more of the following signs should be posted at all appropriate locations. Examples include "DROWNING HAZARD," "DURING AGITATION, DEADLY GASES POSSIBLE," "NO DUMPING OVER FENCE," "DEADLY MANURE GASES POSSIBLE, DEATH MAY BE IMMEDIATE." See NRCS Fact Sheet #4 for additional information and sources.
  - o Appropriate locations include all manure storage access points and on each side or several spaced around the perimeter.
- Check your manure push-off/loading access areas for safety concerns.
  - o Verify that the safety bar or cage installed to keep equipment from falling in is still solid and properly anchored. If not, replace or repair. If none exists, install a safety device.
    - When not in use, there must be a separate gate that is in front of the equipment barrier that limits human and animal access. If there is none, install a gate.

o Verify that the gate can close and be latched when not in use. If it broken, or jammed, have it fixed and properly cleaned. Make sure that the maximum square opening does not exceed 6 inches by 6 inches or 4 inches between vertical members. Adjust gate and/or add coverings to reduce opening size or gap as needed.

o Verify that no one is using a skid loader or other equipment to dump manure directly over the safety fence around the storage. Typical safety fencing will not keep equipment out of the storage.

- Loading is only to be done at the designated push-off locations.
- Consider installing a new curb (at least 24-inches high) and top with a fence higher than the equipment can reach, or install a curb located 30-inches from the tank wall to eliminate the possibility of lifting manure over the fence. These measures will reduce the possibility of improper loading; however, they may not completely prevent access by moving equipment or animals.

- Discuss your emergency manure loading plan for materials (waste feed, snowpack, or frozen manure) that can't be loaded or pushed in at your normal access points with all equipment operators.
  - Consider additional push-off structures that can accommodate these materials.
  - Add a safe access location(s) designed for lifting manure over the manure storage tank wall that is strong enough to hold a tipping loader. A chain link fence is not adequate.
  - Provide short-term storage location(s) elsewhere. Do not store in a watercourse or water flow path.
  - If you plan to load at the agitation or pumpout location, keep the load low going over the wall. Add an extra wheel barrier or swinging bar across opening to keep equipment from entering. Make sure animals are not in the area and the gate is closed and locked after the operation has been completed.

- Review your safety plan prior to agitating, transferring, and pumping manure out of a manure storage. This is especially critical when you have inexperienced personnel involved in the process.
  - Make sure all animals are out of the area when the unloading access gates are opened or the lids are removed from an access hole.
  - After placing the pump, secure gates or plates around equipment to minimize access to storage.
  - If you use gypsum as a bedding additive or as an antiskid on cattle walkways, be aware that during agitation, extremely high levels of deadly Hydrogen Sulfide (H_2S) gas may be emitted. Keep everyone away from the area prior to start-up. Operator should be aware of setting and wind direction. Access points surrounded by buildings and/or no wind or wind blowing from agitation area can carry toxic H_2S. Wait for better conditions. Ventilate area with clean air. Consider using a self-contained breathing apparatus or having a meter to warn the operator that dangerous levels of manure gases are present. Always watch from a safe distance.
  - If your pump controls require standing next to pump and/or behind the power unit, consider extending the controls to move them and the operator a safe distance away from the manure storage or access point.
  - Fully remove the pump and move it away from the storage to make repairs or unclog the intake. Working on the pump while it is in the pit is extremely dangerous. Remember to close the gate or replace grates during this process.
  - Replace grates over agitation openings if they become damaged. If grates are not practical, add safety fence and gates around the opening(s).
  - Remind all manure haulers that your manure has gypsum and that excessive H_2S gas hazards must be considered.
- Review your safety plan prior to going inside the fence adjacent to an earthen or High Density Polyethylene (HDPE)-lined facility to do maintenance.
  - HDPE-lined slopes are slippery and fallen individuals will require help getting out.
  - Have someone outside the fence to get help. Have a rope and floatation device ready to toss over the fence to the fallen individual. The rescue person must stay outside of the fence to avoid the same situation.
- Review your safety plan before entering a plugged loading hopper or going down inside a covered underground storage or reception pit. These are "Confined Spaces" and entry without taking precautions has resulted in deaths.
  - Never enter these spaces without prior ventilation and use of a self-contained breathing apparatus.
  - Even with prior ventilation the air needs to be checked with a calibrated meter.
  - Vertical access will require a harness, rope, and hoisting system to pull out a fallen person.
  - Require a second person stationed outside to get help if a properly planned entry goes bad.
  - Do not enter a storage to rescue a co-worker as this often results in multiple fatalities.
  - Have a system to contact your local emergency response personal.

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 #10 January 2016

Safety and Emergency Response for Manure Management Systems

This Fact Sheet is an NRCS update to the Safety Section of the Manure Management for Environmental Protection, Document MM2, dated 11/2001.

Storing animal manure on farms is very common in Pennsylvania. Many dairy, beef, veal, swine, and poultry operations are installing manure storage systems with the potential, under certain circumstances, for safety risks. Experience indicates that when an accident does occur, it sometimes involves two or three fatalities. Large numbers of livestock may also perish.

Some manure storage systems are more hazardous than others. Below-ground storages, or pits, are more hazardous than above-ground storages. Systems that are covered by lids, caps, or slotted floors are more hazardous than uncovered systems. The most dangerous storages are pits within buildings or directly beneath livestock. Pump-out access pits with lids or caps can also be very hazardous.

Safety Hazards

Under certain circumstances, manure storage hazards include gases that are toxic (hydrogen sulfide), asphyxiant (carbon dioxide), corrosive (ammonia), and explosive (methane), and may include an atmosphere that contains insufficient oxygen to sustain life. Drowning is also a possibility. With solid covered or slatted covered pit storages, the danger from gases is most severe when manure is being agitated or pumped out. At other times, little gas is produced, and natural air movements or ventilation from fans can at times prevent hazardous gas buildup and oxygen levels from becoming dangerously low. With open storages and above-ground tanks, oxygen depletion and toxic and explosive gas buildup are less likely (with the exception of sulfur-containing additives such as gypsum), so the major potential hazard normally associated with such systems is drowning. The use of gypsum as an animal bedding or for non-slip alley footing dramatically increases the amount of hydrogen sulfide produced by the manure. In some cases the presence of gypsum has increased the hydrogen sulfide gas content by a factor of 100 fold (this applies to both covered storages and open-top storages).

Maximum safe gas concentrations, or threshold limit values (TLV), have been established for an 8-hour exposure for humans by the American Conference of Government Industrial Hygienists. TLVs are expressed in parts per million (ppm). Safe gas levels for animals have not been established, but animal responses to gases are known to be similar to human responses. Animals, however, suffer more continuous exposure and may be adversely affected over time by a lower level of gas than affects humans. This is of particular concern with small or lightweight animals, such as newborn pigs.

The concentrations of gases in manure storages can be measured with special instruments, but such instruments are reliable only if they are carefully maintained, stored, calibrated, and operated by trained personnel. Some instruments cost only a few hundred dollars. Using gas detection instruments is the best way to monitor a hazardous environment. Never enter a confined space without proper testing and safety equipment. Emergency procedures are outlined at the end of this document.

Hydrogen sulfide (H_2S), the most hazardous manure gas, is associated with most fatalities in manure storages. H_2S can cause death within seconds at high concentrations. The TLV is 10 ppm. It is colorless and heavier than air, accumulating near the bottom of the storage (this gas can flow out of a storage and continue to hug the ground and adjacent low areas). Though some concentrations (100 to 150 ppm) can be identified by a rotten-egg odor, hydrogen sulfide deadens one's sense of smell and its odor is often masked by other smells common to livestock facilities. Lethal concentrations of 500 to 600 ppm are thus difficult to detect. Gas amounts can increase a thousand fold during agitation and emptying of a manure facility. The presence of gypsum additives increases H_2S production to extremely high levels.

Carbon Dioxide (CO_2), while a nontoxic gas itself, displaces oxygen and therefore can asphyxiate humans and animals. The TLV is 25 ppm. Being both colorless and odorless, carbon dioxide is impossible to detect without gas detection equipment.

Ammonia (NH_3) can severely damage the eyes, throat, and lungs. It combines with moisture in the eyes and respiratory tract to form an alkaline solution that causes severe burns. Its TLV is 25 ppm. NH_3 is lighter than air and has a strong bleach-like odor. Because of its irritating nature, people usually leave a contaminated area. Therefore, it is not suspected to have caused any human deaths. Constant, low-level exposure to ammonia has a discomforting effect on humans and livestock.

Methane (CH_4) is a highly-flammable and explosive gas. The TLV for methane is 1000 ppm. Like carbon dioxide, it is odorless, colorless, asphyxiating, and impossible to detect without gas detection instruments. Methane is lighter than air and rises out of storage areas to collect under hoods, roof ridges, and corners. It is most likely to accumulate during hot weather, especially if ventilation is poor. Methane explosions have resulted from someone lighting a torch or from short circuits in electrical system.

Oxygen (O_2) deficient atmosphere occurs when oxygen is displaced by another gas to less than 19.5% by volume of the total air. Normally, oxygen in air is 20.8% by volume. When oxygen is at 16% by volume of the air, a person becomes disorientated and has impaired judgement. At 14% by volume of the air, a person has rapid fatigue and faulty judgement. At 6% by volume of air, a person can have difficulty in breathing and death will occur within minutes. The oxygen percent should be measured at all levels of a manure storage to ensure that there is no oxygen deficiency.

Design and Construction Recommendations

Many safety hazards can be minimized by properly designing and constructing a manure storage facility. Several recommendations to consider when building a storage are listed below. Many of the recommendations should also be incorporated into existing storages.

- Keep in-barn pits for liquid manure to a minimum.
- Install fences to restrict access for people and animals. Keep fence gates and access locations locked.
- Gypsum for bedding or creating non-slip surfaces should never be loaded into storages located within buildings (and covered storages). Extreme caution and continuous use of gas monitoring equipment shall be used when agitating open, outdoor storages with gypsum.
- Locate pump-out openings for manure pits outside of buildings. Use heavy covers or grates for pit access points and keep them in place.
- Equip ventilation systems with an alarm to indicate power failure, and provide a backup ventilation system.
- Walls of open storages adjacent to barnyards should extend two feet above barnyard elevation.
- If the manure storage is outdoors, provide a gas trap or other device in pipes running to the storage to prevent gases in the storage structure from reentering the building, especially during pit agitation.
- Install a fence around open storages, ponds, treatment basins, and lagoons. The fence should be tight enough to keep out small children.
- Warning signs should be placed near storages and above-ground tanks, and a rescue pole and rope should be located conspicuously in the area.

Operating Recommendations

Manure storage hazards can be further reduced by consistently following recommended operating procedures. You should adopt all of the following practices that apply to your operation.

- Test the pit atmosphere for toxic gases and oxygen levels.
- Never enter a pit without proper ventilation. When going in, wear an air-supplied respirator or a self-contained breathing apparatus (SCBA), as well as a safety harness attached to a rope attended by at least two people at the entrance to the pit. Any person utilizing this equipment must be trained in advance. Attaching the safety rope to a winch or hoist is also recommended. Cartridge-type masks are not safe.
- Keep people and animals out of any building where manure is being agitated or emptied. Provide strong mechanical ventilation during agitation and pumping, and for a few hours after pumping has stopped. If an animal collapses during pit agitation, do not try to rescue it immediately. Turn the pump off and ventilate the building until the gases have had a chance to escape.

- Never fill a manure pit completely, but allow 1- to 2-feet of air space to accommodate concentrations of gas. Lower the level of liquid manure in a storage facility before starting agitation to reduce the possibility of gas being forced above floor level.
- Keep the agitator below the liquid surface because gas is released in greater volumes with vigorous surface agitation.
- Forbid smoking, open flames, or spark-producing operations in the immediate vicinity of the storage area. Keep all guards and safety shields in place on pumps, pump hoppers, tank wagons, and power units, and maintain electrical motors, fixtures, and wiring in good condition.
- Do not leave temporary access ladders leaning against above-ground tanks. Permanent ladders on the outside of above-ground tanks should terminate above the reach of people or should have locked entry guards.
- Do not walk, ride, or allow animals on the crust surface of open-air storages. Like ice, the crust is not uniformly solid and can break through suddenly.
- Warn visitors and guests of manure storage hazards. Owners are legally responsible for their safety while they are on their property.
- Only dump or scrape manure into storages at locations designed for that purpose. Install safe access locations for lifting manure over tank walls, or install safety guard push-in structures for safely loading manure into storages.
- Never dump manure over the top of chain link or other fences.
- Become familiar with and follow the Occupational Safety and Health Administration (OSHA) regulations and recommended practices for confined spaces (OSHA 1910.146). While production agriculture was excluded from these regulations, any farmer with an employee could be cited for a violation under the General Duty Clause of the OSHA Act, Public Law 91-596. The General Duty Clause requires employers to provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm. A confined space, such as a manure storage, may fit this clause. A confined space is defined by OSHA as a space that (1) is large enough for an employee to enter fully and perform assigned work; (2) is not designed for continuous occupancy by the employee; and (3) has a limited or restricted means of entry or exit.

Emergency Procedure

Emergencies result from ignoring or not knowing the hazards of manure storages and the recommended safety practices. Generally, someone enters a pit without a self-contained breathing apparatus (or is not properly trained in its use) and passes out almost immediately from toxic gases or oxygen deficiency. The tragedy can be compounded when would-be rescuers, family, coworkers, emergency personnel, panic and follow the first victim into the pit.

When someone collapses in a pit, gases are so concentrated that it is extremely dangerous for anyone else to enter without a self-contained breathing apparatus and proper training. The only reasonable immediate action is to ventilate the storage area and notify rescue personnel who can bring the proper equipment. Barn fans and silo blowers may be activated to provide ventilation, but do not lower fans into the pit because of the possibility of a methane explosion.

Before entering a confined space manure storage, gas detection equipment must be used to determine hazardous gas concentrations and oxygen levels. This should be done prior to and during entry because extremely toxic gases often accumulate from decomposing manure and safe oxygen levels are often depleted. A gas monitor with remote sampling enables measurements to be taken by workers located safely outside the storage facility. These measurements can also be used to establish ventilation times and rates before workers enter the manure storage. The gas and oxygen measurement results would be used with ANSI/ASABE S607, Ventilating Manure Storages to Reduce Entry Risk, to establish ventilation times before entry for a specific manure storage facility. Once a worker has entered the facility, gas sensors allow for constant monitoring of the atmosphere while the person is in the storage. Additional information is presented in Fact Sheet E 52 titled "Confined Space Manure Gas Monitoring" written by Penn State Cooperative Extension.

In any rescue attempt, the rescuer should have a self-contained breathing apparatus, proper training, and a safety harness with a lifeline. The lifeline should be attended by at least two people outside the storage unit. Rescuers should never place their own masks on a victim or remove their own lifelines. Ropes, carriers, and oxygen for victims can be lowered into the pit if necessary. Victims should be brought out as quickly as possible, administered to by emergency services personnel, and transported to an emergency room.

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.

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 ess 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

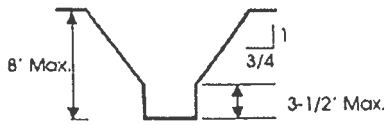


Figure 4. Type A Soil
Unsupported, Vertically Sided Lower Portion, Maximum 12 Feet

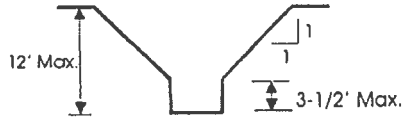


Figure 5. Type B Soil
Simple Slope

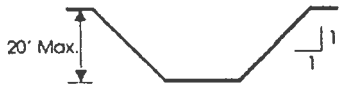
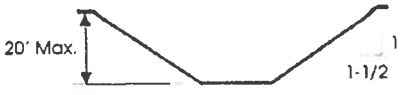


Figure 6. Type C Soil
Simple Slope



Fact Sheet

COLD WEATHER CONCRETING (ACI-306R-88 Summary)

USDA
Natural Resources
Conservation Service

-Definition of Cold Weather (1.1)

As per ACI-306R report, cold weather is defined as: a period for more than 3 consecutive days the average daily air temperature is less than 40^0 F, and the air temperature is not greater the 50^0 F for more than half (12hrs.) of any of the 3 days. *"The average daily air temperature is the average of the highest and the lowest temperatures occurring during the period from midnight to midnight."*

-Objectives (1.3)

The objectives for cold weather concreting are to;

- prevent damage to concrete from early stage freezing. As concrete gains maturity the mixing water combines with the cement during hydration decreasing the degree of saturation below the critical level. The critical level is the degree of saturation where a single cycle of freezing could cause damage to the concrete.
- assure that the concrete develops essential strength for safe removal of forms and safe loading of the structure during construction and after.
- limit rapid changes of temperature before the concrete has obtained sufficient strength to withstand induced thermal stresses.
- provide protection that warrant normal strength development and the intended serviceability of the structure.

"Short-term construction economy should not be obtained at the expense of long-term durability."

Principles (1.4)

Concrete that has attained a compressive strength of at least 500-psi will not be damaged by exposure to a single freezing cycle. Concrete that is protected will obtain its potential strength despite subsequent exposure to cold weather. Except within heated enclosures little or no external supply of moisture is required. Calcium chloride should not be used to accelerate setting because of increased chances of corrosion to re-enforcing metal.

-Economy (1.5)

The owner must decide whether the extra costs in cold weather concreting are more profitable or cost effective than waiting for milder weather. Neglect of protection against freezing in the early stages can cause immediate destruction or weakening of the concrete.

-Planning (2.1)

Plans to prevent early freezing of fresh concrete and maintaining temperatures above the recommended minimums should be made well before freezing temperatures are expected to occur. The necessary equipment and materials should be at the work site before cold weather is likely to occur, not after the fresh concrete begins to approach the freezing point.

-Protection during fall and spring (2.2)

During Fall and Spring when temperatures are not defined as cold weather, all concrete surfaces should be protected from freezing, for at least the first 24-hours after placement, when heavy frost or freezing is forecast at the job site.

-Concrete temperature (2.3)

The concrete temperature at the time of placement should not be lower than the values given in Table 3.1, also the concrete temperature should be maintained at the recommended placement temperature for the required protection period.

Air Temperature	Concrete Temperature
Minimum concrete temperature as placed and maintained	
ALL	**55 F**
Minimum concrete temperature as mixed for indicated air temperature	
Above 30F	60F
0-30F	65F

Table 3.1- Recommended concrete temperatures

-Preparation before concreting (4.1, 4.3, 4.4)

Preparation for concreting primarily consists of insuring that all surfaces that will be in contact with the freshly poured concrete are at temperatures that will not cause freezing or prolonged setting. All snow, ice and frost must be removed prior to placement of the concrete. Concrete will not be placed on frozen subgrade. The subgrade can be thawed, sometimes, by covering it with insulating material for a few days prior to concrete placement.

-Protection to prevent early-age freezing (5.1)

Prevention of early-age freezing must be provided immediately after concrete placement. Arrangements for covering, housing or heating of newly placed concrete should be made before placement. Protective materials must be on-site ready for installation to prevent corners and edges from freezing. In cold weather, the temperature of newly placed concrete should be kept as close to the values given in Table 3.1 and the corners and edges are more vulnerable to freezing and are more difficult to maintain at the optimal temperature.

-Length of protection period (5.3)

The length of the required protection period depends on the type and amount of cement used and whether an accelerator is used. The length of protection may be reduced by: (1) using Type III cement; (2) using an accelerating admixture **(non-chloride)**; or (3) using 100 lb/yd^3 of cement in excess of the design cement content. Table 5.3 gives the minimum length of protection, in days at the temperatures given in Line 1 of Table 3.1.

Fact Sheet

Line	Service category	Type I or II cement	Type III or 100lb/yd^3 of additional cement
1	No load not exposed	2	1
2	No load, exposed	3	2
3	Partial load, exposed	6	4

Table 5.3- Length of protection period for concrete placed during cold weather (Days)

-Stripping forms (5.4)

The protection afforded by forms may require that the forms remain in-place for the full length of the protection period recommended in Table 5.3. The minimum time before stripping the forms is best determined by past experiences and current job conditions. If the newly placed concrete is in a heated enclosure, form removal and exposure to low daily temperatures may cause damage to corners and edges. Also, in the case of structures subjected to hydrostatic pressure, hasty removal of forms may dislodge the form ties creating water channels.

-Temperature drop after removal of protection (5.5)

Concrete should be cooled gradually to reduce differential strains between the interior and exterior of the structure. This can be accomplished by slowly reducing the applied heat or by leaving the insulation materials until the concrete has reached equilibrium with ambient temperatures.

-Form removal requirements (6.10)

Recommendations made are based on job conditions that meet the following requirements:

- Concrete internal temperature is at least 50 F after placement.
- Facilities are available to maintain the concrete temperature at 50 F throughout the structure.
- Reshores are left in place as long as necessary to safeguard all members of the structure.
- The concrete is made of Type I or II Portland cement.
- Proper curing is used to avoid drying in heated enclosures.

-Materials and methods of protection (7.2)

In some cases the use of natural heat of hydration may only require the use of insulating material. In extreme cases, it may be necessary to us enclosure and heating units to maintain the required temperature.

The heat of hydration is mostly generated during the first 3 days. The heat may be retained on unformed surfaces using insulating blankets and by using insulated forms. The insulation must be kept in close contact with the concrete or the form surface. Suitable protection from wind, moisture and heat loss are required. Corners and edges are particularly vulnerable, therefore the thickness of the insulation should be about three times the thickness used for walls or slabs. Commonly used insulating materials follow, definitions are listed in Chapter 7 ACI-306R:

- Polystyrene foam sheets
- Urethane foam
- Foamed vinyl blankets
- Mineral wool or cellulose fibers
- Straw
- Blanket or batt insulation

The heat of hydration will gradually decrease with age. It may be necessary to use enclosures and heating units to maintain the required temperature for the required protection period. Enclosures conserve heat, keep out cold air, and if secured properly block the wind. They can be made with any suitable material such as wood, canvas or plastic sheet. Enclosures must capable of withstanding wind and snow loads and be reasonably air tight. Sufficient space between the concrete and the enclosure to allow circulation of warmed air. If combustion heaters are used, venting is required to prevent reactions between exhaust gasses and exposed concrete surfaces that will result in a weak concrete surface. Also, heaters and vents should be placed so as not to cause overheating or drying of concrete. The operation of combustion heaters should be supervised continuously and fire fighting equipment should be available at the job site at all times. **Warning, exhaust gasses poses a serious health threat in an enclosed structure. Never enter without properly venting before hand.**

-NOTE:

This fact sheet does not include all information set forth in the ACI-306. Consult the latest edition for further details. A complete catalog of all ACI publications is available from:

American Concrete Institute
Box 19150, Redford Station
Detroit, Michigan 48219

GUIDELINES FOR COLD WEATHER CONCRETING

This document is to be used as a supplement to the current PA Fact Sheet #2—Cold Weather Concreting—ACI 306R-16. This document is intended to provide additional guidance, for cold weather concreting procedures, in the Northeast Counties that receive engineering guidance from the NRCS Bloomsburg Technical Office. This document is only to be used for Heavy Use Area and Stacking Structure type of construction. This document does not apply to "liquid" storage structures (Tanks or Paint Tray Style Storages). Cold weather concreting on "liquid" structures is discouraged and shall be discussed with the NRCS engineering staff in Bloomsburg in detail prior to planning construction.

Cold Weather Concreting shall be discussed at the preconstruction meeting, no matter what time of year the meeting is held and discussed again 2 weeks prior to concrete placement. The landowner shall be involved in these conversations to help make a decision if it is worth the extra expense and effort to provide the added level of protection during cold weather concrete procedures or wait until milder weather.

Roles & Responsibilities:

It is the contractor's responsibility to submit a "Cold Weather Concrete Plan" to the assigned primary inspector for the given project. This plan shall be provided to the inspector at least 2 weeks prior to the concrete placement. The concrete mix design shall also be submitted to the inspector at this time. The primary inspector shall review the submitted Cold Weather Concrete Plan and also the Concrete Design Mix. If revisions to the Cold Weather Plan are required, then the contractor will do so. If changes to the design mix are required, the contractor shall work with the concrete plant to make the needed changes. The revised documents shall be resubmitted to the inspector for further review. Concrete cannot be ordered and construction cannot begin until the inspector approves all submitted documents.

Design Mix:

Concrete with a slump lower than normal (less than 4") is particularly desirable in cold weather for flatwork; bleeding of water is minimized and set occurs earlier. Bleed water, during cold weather, could affect the concrete surface strength. It is assumed that concrete with at least 600 #/cu.yd of cement content is being used for cold weather placement.

Conditions of Subgrade & Reinforcement:

Concrete shall not be placed on "frosty" or frozen subgrade material or reinforcement. The subgrade and reinforcement shall be covered with insulating material for a few days before the concrete placement. In some cases, external heat must be applied. Steel forms for walls, especially, shall be heated by some means prior to concrete placement. There shall not be any snow or ice on the forms prior to placement of concrete. Tops of wall forms shall be covered to prohibit snow and ice from occupying space intended for concrete. Snow and ice at the bottom of the forms will also expose the freshly placed concrete to low temperatures.

Protecting Concrete During Cold Weather:

TABLE 1 shall be used to determine if the Contractor's Cold Weather Concrete Plan is sufficient for the forecasted weather conditions. The table shows what thermal resistance value (R-Value) is required at expected low air temperatures, for any of the first 3 days of the curing period; However, Concrete shall be protected for a minimum of 7 days. It is assumed that the ground (subgrade) temperature is well above freezing.

TABLE 1A -5" SLAB THICKNESS

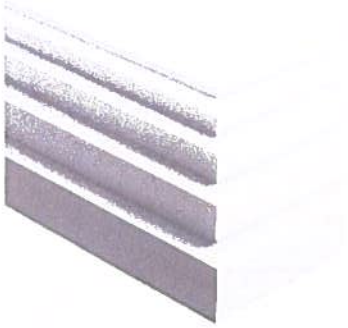
EXPECTED LOW TEMP FOR 1ST 3 DAYS OF CURING (DEGREES)	REQUIRED R-VALUE (hr-sqft-F/Btu)	REQUIRED SAWDUST (INCHES)	REQUIRED STRAW (INCHES)
40	4	2	3
35	7	3	4.5
30	8	4	5.5
25	9	4.5	6.5
20	11	5	7
<20	ADDITIONAL HEAT REQUIRED ENCLOSURE REQUIRED CONSULT WITH DESIGN ENGINEER		

TABLE 1B -8" WALL THICKNESS

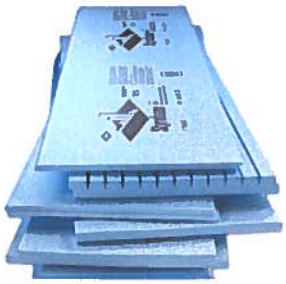
EXPECTED LOW TEMP FOR 1ST 3 DAYS OF CURING (DEGREES)	REQUIRED R-VALUE (hr-sqft-F/Btu)
40	3
35	4
30	5
25	6
20	7
<20	ADDITIONAL HEAT REQUIRED ENCLOSURE REQUIRED CONSULT WITH DESIGN ENGINEER

Insulating Materials:

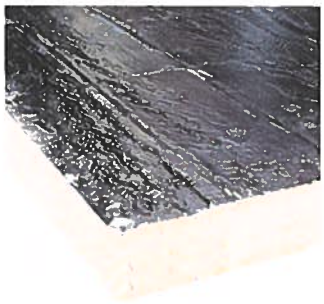
A. Blankets: Concrete "Blankets" typically have an R-Value between 2 & 8; R value of blankets need confirmed prior to use.
B. Polystyrene foam or Polyurethane sheets; R value needs verified according to manufacturer data sheets.



EXPANDED POLYSTYRENE FOAM (EPS)
(Similar to the foam used for
for packing "peanuts")
R=3.6 to 4.0 per inch of thickness



EXTRUDED POLYSTYRENE FOAM (XPS)
(Blue board or pink board)
R=4.5-5.0 per inch of thickness



POLYISOCYANURATE /
POLYURETHANE BOARD
(Foil Faced)
R=7.0-8.0 per inch of thickness

C. Sawdust: Typical R-Value is 2.22 per 1" thickness
D. Straw or Hay: Typical R-Value is 1.5 per 1" thickness.

Straw, Hay, and Sawdust (Materials) need to be dry. Any moisture in the materials beyond normal may result in it freezing and providing a lesser degree of protection. If using these materials for flatwork protection; a layer of plastic shall be installed on the concrete surface prior to the material. After the required thickness of the material is placed, it needs covered with another layer of plastic or a tarp and weighted down to prevent it from blowing off. Do not install the initial layer of plastic until the concrete has set enough; otherwise the plastic will stick to the concrete.

Corners and edges are particularly vulnerable during cold weather. Therefore, the thickness of insulation for these parts shall be about 3X the thickness that is required for slabs or walls. It is recommended to extend the protection a minimum of 2' beyond the edges of footing and slabs.

Concrete placed for footings or slabs shall be covered, with the needed protection, as soon as the concrete can be walked on. Concrete placed in wall forms shall be covered, with the needed protection, immediately after concrete placement. Insulation shall be kept in close contact with the concrete form surface to be effective.

Protection Period:

All concrete (Footings, Slabs, and Walls) shall be protected for no less than 7 days for proper curing purposes. Wall forms shall remain in place for a minimum of 7 days as well. Curing compound does not need to be used during cold weather concreting, due to the insulating material being left on for a minimum of 7 days. Many curing compound manufacturers do not recommend that this product be used at cold temperatures. The use of non-chloride "accelerators" are welcome as an added measure of early set and strength gain. The use of accelerators will not decrease the protection period; 7 days is still the minimum protection period.

At the end of the protection period, concrete should be cooled gradually to reduce the risk of "thermal shock". Gradual cooling reduces the risk of cracking. This can be accomplished by allowing the insulating material to remain in place until the concrete has essentially reached equilibrium with the outside air temperature.

Consult with the design engineer for the allowable time of "loading" the concrete structures. Depending on the weather conditions; the curing time before backfilling, driving on slabs with skid steers, or allowing animal traffic may vary.

RGD
3/21

GUIDELINES FOR HOT WEATHER CONCRETING
(FOR ALL CONCRETE)

This document is intended to provide general information and guidance, for hot weather concreting procedures, in the Northeast Counties that receive engineering direction from the NRCS Bloomsburg Technical Office. Thoroughly discuss hot weather concreting during site showings so accurate bid prices can be achieved for the project. Hot weather concreting is discouraged and shall be discussed with the NRCS engineering staff in Bloomsburg in detail prior to planning construction.

If there is a chance of encountering hot weather conditions during construction; Hot Weather Concreting shall be discussed at the preconstruction meeting and discussed again 2 weeks prior to concrete placement. The landowner shall be involved in these conversations to help make a decision if it is worth the extra expense and effort to provide the added level of protection during hot weather concrete procedures or wait until more favorable weather. Proper measures need to be in place for the placement and curing of the concrete.

Definition & Concerns:

As per ACI 305R; Hot weather is any combination of the following conditions that tends to impair the quality of freshly mixed or hardened concrete by accelerating the rate of moisture loss and rate of cement hydration, or otherwise causing detrimental results:

- High ambient temperature
- High concrete temperature
- Low relative humidity
- Wind speed
- Solar radiation

Hot weather concreting is any period of high temperature in which special precautions need to be taken to ensure proper handling, placing, finishing, and curing of concrete. The exact temperature where special precautions should be taken varies. Advanced planning is required for concrete placed in ambient conditions that are at or above 75°F (Portland Concrete Association). This is generally the temperature that starts to affect the efficiency of the cementitious system. Evaporation rate is a more accurate indicator of hot weather conditions for concrete.

Hot weather can cause an increased water demand, an increased rate of slump loss and tendency to add water at the job site, faster set-up time, difficulty in maintaining air entrainment, and more shrinkage cracking. All of these can reduce long term strength, reduce durability, and increase permeability.

Roles & Responsibilities:

If there is a chance of encountering hot weather conditions during construction; It is the contractor's responsibility to submit a "Hot Weather Concrete Plan" to the assigned primary inspector for the given project. This plan shall be provided to the inspector at least 2 weeks prior to the concrete placement. The concrete mix design shall also be submitted to the inspector at this time. The primary inspector shall review the submitted Hot Weather Concrete Plan and the concrete mix design. If revisions to the Hot Weather Plan are required, then the contractor will do so. If changes to the mix design are required, the contractor shall work with the concrete plant to make the needed changes. The revised documents shall be resubmitted to the inspector for further review. Concrete cannot be ordered, and construction cannot begin until the inspector approves all submitted documents. The inspector shall work with the design engineer in making these decisions. The design engineer shall approve all concrete mix designs that have portland cement replacements, as described later in this document.

The inspection staff shall provide timely inspections. Inspect steel, forms, and foundation the day before the actual placement, so the contractor has time to remedy any oversights well in advance of concrete placement. Avoid work delays caused by untimely inspections. The inspector shall get proper approval for working during early or late concrete placements. If the assigned inspector cannot be available for a concrete placement, they are responsible for finding a qualified back-up inspector. Allowing early or late starts without inspection shall not be allowed.

The inspection staff shall have a concrete thermometer and slump equipment ready in case any issues develop. The inspector shall check the delivery tickets and compare the ticket information with the mix design that has already been approved. The batch ticket shall indicate how much free water can be added; if this is not shown on the batch ticket then no water can be added on-site.

Possibilities for Avoiding or Preventing Issues:

The contractors have a lot of flexibility on how they plan to address concerns about hot weather and its effect on the final product. Some typical options include:

- Delay placement to a cooler day, especially when high winds and low relative humidity are anticipated
- Move placement start time to early morning or late evening
- Pre-wet sub-base, to reduce moisture loss
- Wet forms and steel to cool materials
- Make sure excess water drains away; concrete shall not be placed on standing water
- Have extra crew members to reduce placement time
- Schedule more equipment; have multiple pump trucks to accelerate delivery schedule
- Erect sunshades and wind barriers to protect the fresh concrete

Precautionary measures required on a windy, sunny day will be stricter than those required on a calm, humid day, even if the air temperatures are identical.

Mix Design & Placement:

Aggregates are the greatest part of the concrete mixture. Keeping the aggregates shaded and moist when being stored can be an effective means to achieving lower concrete temperature. The temperature of the water used in the concrete mixture will also play a major part in the overall concrete temperature; store water in tanks away from the sun or cool the water with ice or liquid nitrogen. If ice is used; the ice must be completely melted by the time mixing is complete.

Using slower hydrating cements will help with controlling heat development in the concrete and should result in lower peak temperatures; there will be less thermal expansion, and the risk of thermal cracking will be reduced. Concrete mixtures that obtain high strength at an early age will develop high concrete temperature during initial curing. These concrete mixtures should be provided thermal protection to ensure gradual cooling at a rate that will not cause them to crack.

Using partial replacements for the portland cement like fly ash and other pozzolans, and ground granulated blast-furnace slag is allowed. These portland cement substitutes are known for having both a slower setting rate and early strength gain to the concrete, which is desirable in hot weather concreting. Concrete containing the slower setting cements will be less likely to have plastic-shrinkage cracking. The design engineer must approve any concrete designs having portland cement replacements.

Various types of chemical admixtures have been found beneficial in offsetting some of the undesirable characteristics of concrete placed during periods of high ambient temperatures. The benefits may include lower mixing water demand or extended periods of use. Admixture effectiveness depends on the chemical reactions of the cement being used. Set retardation and water reducing admixtures can be used to reduce set time or increase slump and workability. Shrinkage reducing admixtures are also allowed. Consider adding the air entrainment admixture at the site and holding back some water to aid in the mixing of the air entrainment once in the truck. All admixtures shall be included in the mix design and have been approved by the inspector prior to placement. The concrete company shall provide a history report showing satisfactory performance, at the expected hot weather conditions, before a certain admixture can be used.

Adding water and remixing of concrete which has lost enough workability to become unplaceable, known as "retempering" is prohibited. Water additions, in excess of the mix design water cement ratio, to compensate for loss of workability is prohibited.

Discharge the concrete as soon as the concrete truck arrives at the job site. Prolonged mixing in hot weather increases the temperature of the concrete, which makes it set faster and shortens the placing and finishing time. Concrete shall also 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. In hot weather or under conditions contributing to quick stiffening of the concrete or when the temperature of the concrete is 85°F or above as delivered at the job site; the time between the introduction of the cement to the aggregates and completion of truck discharge shall not exceed 45 minutes. If these conditions are encountered, the concrete plant shall be notified to take the necessary precautions.

The supplier shall maintain the temperature of concrete below 90°F during transportation, mixing, and conveying. Concrete with a temperature above 90°F at the job site shall not be placed. The inspector shall have an immediate conversation with the contractor and landowner about not accepting a load of concrete and the ramifications that can take place if the concrete is placed and later found to not be acceptable for the intended purpose. The contractor and landowner need to be involved in the final decision before the load of concrete is rejected.

In hot weather, it is usually necessary to place formed concrete in shallower layers than usual, to assure vibration well into the layer below and that the elapsed time between layers be minimized to avoid cold joints.

Curing and Protection:

Proper curing of concrete, during hot weather, is critical. Early curing is critical and lack of it is increasingly detrimental as temperatures rise.

All concrete (Footings, Slabs, and Walls) shall be protected for no less than 7-days for proper curing purposes. This 7-day curing time is the same for concrete with and without pozzolans and chemical admixtures. A 7-day minimum duration of curing will often be sufficient to attain approximately 70% of the specified compressive strength. If a change in curing method is made during this period, it should be done only after the concrete is 3 days old. (ACI 305R & ACI 308R-18). At the end of the curing period (7 days), any covering that is used should be left in place without wetting for several days (4 days is suggested) so that the concrete surface will dry slowly and be less subject to surface shrinkage cracking. The effects of drying can also be minimized by applying a sprayable curing compound at the end of the moist-curing period. Strategies for achieving this shall be discussed with the contractor prior to placement.

Some options for curing include:

- Spray with curing compound as soon as possible upon final finish. Consider applying a second coat of curing compound if it is windy. Curing compounds shall contain a heat reflecting white pigmented compound. Curing compound shall be applied heavier than manufacture's recommendations to ensure uniform coverage and proper curing.
- Wet curing is the most preferred method for curing concrete during hot weather.
- Exposed surfaces shall be continuously moistened by means of fog spray or otherwise protected from drying immediately prior to placement and during curing.

Curing of flatwork concrete; Of the different curing procedures, wet-curing is the best method for developing the strength of concrete and minimizing early drying shrinkage. This can be provided by ponding, covering with clean sand kept continuously wet, or continuous sprinkling. A more practical method of wet-curing is covering the prewetted concrete with impervious sheeting or absorptive mats or fabric kept continuously wet with a soaker hose or similar means. These materials shall be kept in contact with the concrete surface at all times. The temperature of water used for curing must be as close as possible to that of the concrete to avoid thermal shock.

Curing of concrete in forms; ACI 305R suggests that forms should be covered and kept continuously moist during the early curing period (first 3-days). If this idea is found to be impractical by the contractor; the contractor can cure with curing compound or shall come up with another acceptable means of curing concrete in forms. Ideas shall be discussed with the inspector.

If the curing compound option is chosen for formed concrete, the form tie holes shall be parged and curing compound applied, within 1 hour of stripping forms. Sufficient staff need to be available to be able to achieve this timeframe or strip forms in the early morning or late day, so the concrete is not exposed to the sun and hot temperatures; then parge tie holes and apply the curing compound as soon as possible.

Leaving forms on for 7-days, as a means of curing, may not be a good idea during hot weather, as forms may generate an excessive amount of heat and negatively affect the curing process. It is best to strip the forms after 24-hrs of placement and provide curing by other means.

The concrete shall also be protected against thermal shrinkage-cracking from rapid temperature drops, particularly during the first 24 hours. Early cracking due to the thermal shrinkage is generally more severe in the spring and fall. This is because the temperature differential for each 24-hour period is greater during these times of year. This is a concern when there is a wide day and night temperature difference. The contractor shall come up with a means of protecting the concrete in these circumstances.

No equipment shall be allowed on concrete slabs or floors until the concrete has cured for a minimum of 7 days. This includes any motorized material handling equipment, pallets of forms, etc. Skid loaders used for transporting concrete into forms shall not be allowed on slabs or floors for a minimum of 14 days.

WASTE STORAGE STRUCTURE CONSTRUCTION SPECIFICATION

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 85°F 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-P_3 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:

CONSTRUCTION SPECIFICATION
367. ROOFS and COVERS

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 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 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.

Construction Specification

620. UNDERGROUND OUTLET

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.

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.

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

d. CONCRETE and related materials shall meet the requirements set forth in Conctruction 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:

SECTION 4

CONSTRUCTION DRAWINGS