United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

POND

CODE 378

(no)

DEFINITION

A pond is a water impoundment made by constructing an embankment, by excavating a dugout, or by a combination of both.

In this standard, NRCS defines ponds constructed by the first method as embankment ponds, and those constructed by the second method as excavated ponds. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at the auxiliary spillway elevation is 3 feet or more above the lowest original ground along the centerline of the embankment.

PURPOSE

This practice is used to accomplish one or more of the following purposes–

- Store water for livestock
- Store water for fish and wildlife
- Store water for recreation
- Store water for fire control
- Store water for erosion control
- Store water for flow detention
- Improve water quality

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all excavated ponds. It also applies to embankment ponds that meet all of the criteria for low-hazard dams as listed below:

- The failure of the dam will not result in loss of life, damage to homes, commercial or industrial buildings, main highways, or railroads, or in interruption of the use or service of public utilities.
- The product of the storage times the effective height of the dam is less than 3,000 acre-feet2. Storage is the capacity of the reservoir in acre-feet below the elevation of the crest of the lowest auxiliary spillway or the elevation of the top of the dam if there is no open channel auxiliary spillway. The effective height of the dam is the difference in elevation, in feet, between the lowest open channel auxiliary spillway crest and the lowest point in the original cross section taken on the centerline of the dam. If there is no open channel auxiliary spillway, use the lowest point on the top of the dam instead of the lowest open channel auxiliary spillway crest.
- The effective height of the dam is 35 feet or less.

CRITERIA

General Criteria Applicable to All Purposes

Design a minimum sediment storage capacity equal to the design life of the structure, or provide for periodic cleanout. Protect the drainage area above the pond to prevent sedimentation from adversely affecting the design life.

Design measures necessary to prevent serious injury or loss of life in accordance with requirements of NRCS National Engineering Manual (NEM), Part 503, Safety.

Seed or sod the exposed surfaces of earthen embankments, earth spillways, borrow areas, and other areas disturbed during construction in accordance with the criteria in NRCS Conservation Practice Standard (CPS) Code 342, Critical Area Planting. When necessary to provide surface protection where climatic conditions preclude the use of seed or sod, use the criteria in CPS Code 484, Mulching, to install inorganic cover material such as gravel.

Cultural resources
Evaluate the existence of cultural resources in the project area and any project impacts on such resources. Provide conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

Site conditions
Select or modify the site to allow runoff from the design storm to safety pass through (1) a natural or constructed auxiliary spillway, (2) a combination of a principal spillway and an auxiliary spillway, or (3) a principal spillway.

Select a site that has an adequate supply of water for the intended purpose via surface runoff, groundwater, or a supplemental water source. Water quality must be suitable for its intended use.

Reservoir
Provide adequate storage volume to meet user demands for all intended purposes. Account for sedimentation, season of use, evaporation loss, and seepage loss when computing the storage volume.

Criteria Applicable to Embankment Ponds

Geological investigations
Use pits, trenches, borings, and reviews of existing data or other suitable means of investigation to characterize materials within the embankment foundation, auxiliary spillway, and borrow areas. Classify soil materials using the Unified Soil Classification System (ASTM D2487).

Foundation cutoff
Design a cutoff of relatively impervious material under the dam and up the abutments as required for preventing seepage. Locate the cutoff at, or upstream from, the centerline of the dam. Extend the cutoff deep enough to intercept flow and connect with a relatively impervious layer. The minimum depth of cutoff shall be 3 feet, as measured from the stripped or bare earth surface to bottom of the trench. Combine seepage control with the cutoff as needed. Use a cutoff bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. The minimum width at bottom of cutoff shall be 10 feet. Design cutoff side slopes no steeper than one horizontal to one vertical (1:1).

Seepage control
Include seepage control if (1) foundation cutoff does not intercept pervious layers, (2) seepage could create undesired wet areas, (3) embankment stability requires seepage control, or (4) special problems require drainage for a stable dam. Control seepage by (1) foundation, abutment, or embankment filters and drains; (2) reservoir blanketing; or (3) a combination of these measures.

Top width
Table 1 provides the minimum top widths for dams of various total heights. Total height is the vertical distance between the settled top of the dam and the lowest elevation at the downstream toe.

Design a minimum width of 16 feet for one-way traffic and 26 feet for two-way traffic for the top of dams used as public roads. Design guardrails or other safety measures where necessary and follow the requirements of the responsible road authority. For dams less than 20 feet in total height, maintenance considerations or construction equipment limitations may require increased top widths from the minimum shown in table 1.

Table 1. Minimum top width for dams.

Total height of dam *(feet)*	Top width *(feet)*
24.9 of less	12
25–34.9	14
35 or more	15

Side slopes
Design each side slope with a ratio of three horizontal to one vertical (3.0:1) or flatter. As required, design benches or flatten side slopes to assure stability of all slopes for all loading conditions.

Slope protection
Design special measures such as berms, rock riprap, sand-gravel, soil cement, or special vegetation as needed to protect the slopes of the dam from wave erosion. Use NRCS Engineering Technical Release (TR) 210 56, A Guide for Design and Layout of Vegetative Wave Protection for Earth Dam Embankments, and TR-210-69, Riprap for Slope Protection against Wave Action, as applicable.

Freeboard
Design a minimum of 1.0 feet of freeboard between design high-water-flow elevation in the auxiliary spillway and the top of the settled embankment. Design a minimum 2.0 feet of elevation difference between the crest of the auxiliary spillway and the top of the settled embankment. Design a minimum of 1.0 feet of freeboard above the peak elevation of the routed design hydrograph to the top of the settled embankment, when the pond has no auxiliary spillway.

Settlement
Increase the height of the dam by the amount needed to ensure that the settled top elevation of the dam equals or exceeds the design top elevation. Design a minimum of 5 percent of the total height of the dam associated with each dam cross section, except where detailed soil testing and laboratory analyses or experience in the area shows that a lesser amount is adequate.

Principal spillway and pipe conduit through the embankment
Design a pipe conduit with needed appurtenances through the dam, except where rock, concrete, or other types of lined spillways are used, or where a vegetated or earth spillway can safely handle the rate and duration of base flow.

The crest elevation of the inlet or riser shall be such that full flow will be generated in the barrel before there is discharge through the auxiliary spillway. Design a minimum of 1.0-foot difference between the crest elevation of the auxiliary spillway and the crest of the elevation of the principal spillway.

Provide an antivortex device for a pipe conduit designed for pressure flow. Design the inlet and outlet to function for the full range of flow and hydraulic head anticipated.

As a minimum, the principal spillway shall safely pass runoff from a 2 year-24 hour rainfall event before the auxiliary spillway crest begins to flow.

Design adequate pipe conduit capacity to discharge long-duration, continuous, or frequent flows without causing flow through the auxiliary spillway. Design a principal spillway pipe with a minimum inside diameter of 8 inches. Design a continuous pipe (no joints allowed inside embankment) with a minimum inside diameter of 1-1/4 inches for water supply pipes or for pipes used for any other purpose.

Design pipe conduits using ductile iron, welded steel, corrugated steel, corrugated aluminum, reinforced concrete (pre-cast or site-cast), or plastic. Do not use cast iron or unreinforced concrete pipe if the dam is 20 feet or greater in total height.

Design and install pipe conduits to withstand all external and internal loads without yielding, buckling, or cracking. Design rigid pipe for a positive projecting condition. Design flexible pipe conduits in accordance with the requirements of NRCS National Engineering Handbook (NEH), Part 636, Chapter 52, Structural Design of Flexible Conduits. In lieu of a detailed analysis, the maximum fill heights in Table 3 are to be followed.

Slope of Pipe
Barrel of pipe shall be graded to allow for pipe to fully drain after settlement of the embankment. The maximum barrel slope without a break in grade shall be 7 percent. When the grade exceeds 7 percent and an elbow is used at the upper end of the outlet section of pipe, the slope of the outlet pipe shall be not greater than 4 percent nor less than 3 percent.

Design connections of flexible pipe to rigid pipe or other structures to accommodate differential movements and stress concentrations. Design and install all pipe conduits to be watertight using couplings, gaskets, caulking, water stops, or welding. Design joints to remain watertight under all internal and external loading including pipe elongation due to foundation settlement.

Design a concrete cradle or bedding for pipe conduits if needed to reduce or limit structural loading on pipe and improve support of the pipe.

Design outlet structures, such as cantilever pipe outlet sections and impact basins, to dissipate energy as needed.

Riser
The minimum diameter of the riser shall be 24” or 1.25 time the diameter of the barrel, whichever is larger. The riser base shall be reinforced concrete with the following exception. Structural steel riser bases may be used only on remote sites where access and availability warrant its use. Buoyancy of the riser shall be determined with a minimum factor of safety of 3.0 against flotation in all cases.

Corrosion protection
Provide protective coatings for all steel pipe and couplings in areas that have traditionally experienced pipe corrosion or in embankments with saturated soil resistivity less than 4,000 Ohm-cm or soil pH less than 5. Protective coatings may include asphalt, polymer over galvanizing, aluminized coating, or coal tar enamel.

Ultraviolet protection
Use ultraviolet-resistant materials for all plastic pipe or provide coating or shielding to protect plastic pipe exposed to direct sunlight.

Cathodic protection
Provide cathodic protection for coated welded steel and galvanized corrugated metal pipe where soil and resistivity studies indicate that the pipe needs a protective coating and where the need and importance of the structure warrant additional protection and longevity. If the original design and installation did not include cathodic protection, consider establishing electrical continuity in the form of joint-bridging straps on pipes that have protective coatings. Add cathodic protection later if monitoring indicates the need.

Filter diaphragms
When the effective height of the dam is 15 feet or greater and the storage of the dam is 50 acre-ft. or more, provide filter diaphragms to control seepage on all pipes extending through the embankment with inverts below the peak elevation of the routed design hydrograph. Design filter diaphragms or alternative

measures as needed to control seepage on pipes extending through all other embankments or for pipes with inverts above the peak elevation of the routed design hydrograph.

Design the filter diaphragm in accordance with the requirements of NEH, Part 628, Chapter 45, Filter Diaphragms. Locate the filter diaphragm immediately downstream of the cutoff trench, but downstream of the centerline of the dam if the foundation cutoff is upstream of the centerline or if there is no cutoff trench.

To improve filter diaphragm performance, provide a drain outlet for the filter diaphragm at the downstream toe of the embankment. Protect the outlet from surface erosion and animal intrusion.

Ensure filter diaphragm functions both as a filter for adjacent base soils and as a drain for seepage that it intercepts. Materials for the filter diaphragm shall meet the requirements of NEH Part 628, Chapter 45, Filter Diaphragms, Section 628.4503(d), Filter and Drain Gradation.

Anti-Seep Collars

When using anti-seep collars in lieu of a filter diaphragm, ensure a watertight connection to the pipe. Limit the maximum spacing of the anti-seep collars to 14 times the minimum projection of the collar measured perpendicular to the pipe, or 25 feet, whichever is less. Locate anti- seep collars no closer than 10 feet apart. Use a collar material that is compatible with the pipe material.

When using anti-seep collars, design the collars to increase the seepage path along the pipe within the fill by at least 15 percent.

Trash guard

Install a trash guard at the riser inlet to prevent clogging of the conduit, unless the watershed does not contain trash or debris that could clog the conduit.

Pool Drain

Provide a pipe with a suitable drawdown valve to drain the pool area if needed for proper pond management or if required by State law. The designer may use the principal spillway conduit as a pond drain if it is located where it can perform this function.

Auxiliary spillways

A dam must have an open channel auxiliary spillway, unless the principal spillway is large enough to pass the peak discharge from the routed design hydrograph and the trash that comes to it without overtopping the dam. The minimum criteria for acceptable use of a closed conduit principal spillway without an auxiliary spillway consist of a conduit with a cross-sectional area of 3 square feet or more, an inlet that will not clog, and an elbow designed to facilitate the passage of trash.

Design the minimum capacity of a natural or constructed auxiliary spillway to pass the peak flow expected from a total design storm of the frequency and duration shown in Table 2, less any reduction creditable to the conduit discharge and detention storage.

Design the auxiliary spillway to safely pass the peak flow through the auxiliary spillway, or route the storm runoff through the reservoir. Start the routing either with the water surface at the elevation of the crest of the principal spillway or at the water surface after 10 days' drawdown, whichever is higher. Compute the 10-day drawdown from the crest of the auxiliary spillway or from the elevation attained from impounding the entire design storm, whichever is lower. Design the auxiliary spillway to pass the design flow at a safe velocity to a point downstream where the flow will not endanger the dam.

Physical Layout

A constructed auxiliary spillway consists of an inlet channel, a control section, and an exit channel. Design the auxiliary spillway with a trapezoidal cross section. Locate the auxiliary spillway in undisturbed or compacted earth or in-situ rock. Design for stable side slopes for the material in which the spillway is to be constructed. Design with a minimum bottom width of 10 feet and length of 25 feet.

Design a level inlet channel upstream from the control section for the distance needed to protect and maintain the crest elevation of the spillway. If necessary, curve the inlet channel upstream of the level section to fit existing topography. Design the exit channel grade in accordance with NEH Part 628, Chapter 50, Earth Spillway Design, or with equivalent procedures.

Structural auxiliary spillways
When used for principal spillways or auxiliary spillways, design chute spillways or drop spillways according to the principles set forth in NEH, Part 650, Engineering Field Handbook; and NEH, Section 5, Hydraulics; Section 11, Drop Spillways; and Section 14, Chute Spillways. Design a structural spillway with the minimum capacity required to pass the peak flow expected from a total design storm of the frequency and duration shown in table 2, less any reduction creditable to the conduit discharge and detention storage.

Criteria for Excavated Ponds

Runoff
Design a minimum of 1.0 feet of freeboard above the peak elevation of the routed design hydrograph. Design a pipe and auxiliary spillway that will meet the capacity requirements of table 2. Consider runoff flow patterns when locating the excavated pond and placing the spoil.

Side slopes
Design stable side slopes in the excavated area no steeper than two horizontal to one (2:1) vertical.

Watering Ramp
When wildlife or livestock need access to stored water, use the criteria in NRCS CPS Code 614, Watering Facility, to design a watering ramp.

Inlet protection
Protect the side slopes from erosion where surface water enters the pond in a natural or excavated channel.

Excavated material
Place the material excavated from the pond so that its weight does not endanger the stability of the pond side slopes and so that the soil will not wash back into the pond by rainfall.

Dispose of excavated material in one of the following ways:

- Uniformly spread to a height that does not exceed 3 feet, with the top graded to a continuous slope away from the pond.
- Uniformly place or shape reasonably well, with side slopes assuming a natural angle of repose. Place excavated material at a distance equal to the depth of the pond, but not less than 12 feet from the edge of the pond.
- Shape to a designed form that blends visually with the landscape.
- Provide for low embankment construction and leveling of surrounding landscape.
- Haul material offsite.

Table 2. Minimum auxiliary spillway capacity

		Minimum design storm[2]	
Effective height of dam[1] *(feet)*	Storage[3] *(acre- feet)*	Frequency *(years)*	Minimum duration *(hours)*
20 or less	< than 50	10	24
20 or less	> than 50	25	24
> than 20	< than 50	25	24
> than 20	> than 50	50	24

[1]. Defined under “Conditions where Practice Applies.”

[2]. Select rain distribution based on climatological region.

[3]. Total storage as measured at the crest of the auxiliary spillway.

CONSIDERATIONS

General Considerations

Principal Spillway and Auxiliary Spillway Hydrograph

A properly design pond has many design elements that must be considered. Considerations include:

- Resource concerns and purpose of structure
- Upstream and Downstream flooding impacts
- Topography of site, available abutment heights, available Stage Storage
- Soils and Current/Future Vegetative state of Auxiliary spillways sited on erosive soils or in regions that are less likely to create a vigorous stand of grass should flow less often than those in regions that support higher frequency of spillway flowing.
    - It is recommended that Principal Spillways be designed based on Auxiliary Spillway soils.
        - CL, CL/CH, CH soils with PI>25, Principal Spillway Hydrograph of 5yr-24-hr
        - CL, CL/CH, Ch soils with 15≤PI≤25, Principal Spillway Hydrograph of 10yr-24hr
        - SM, SC, SP, ML, CL with PI<15 Principal Spillway Hydrograph of 50yr-24hr
    - It is good engineering practice to consider site conditions of the auxiliary spillway. Consideration may include, but not limited to:
        - Remove undesirable soils in the bottom of the auxiliary spillway and replace with soils to support flow frequency
        - Include top soiling or placement of high organic material to promote vegetation.
        - Inclusion of hard armoring or turf reinforcement mats.
        - Detailed analysis of soil stability, structure integrity and erosion of spillway.
        - Limit flow depth of the level control section of the auxiliary spillway (Hp) Max to not more than:
        - CL, CL/CH, CH soils with PI>25, 3.0 foot.
        - CL, CL/CH, Ch soils with 15≤PI≤25, 2.0 foot
        - SM, SC, SP, ML, CL with PI<15 soils not more than 1.0 foot.
        - Any curvature of the auxiliary spillway should be upstream from the level section. However, when long level sections are needed for auxiliary spillway stability, only 25 feet upstream from the control section need to be in straight alignment with the outlet. The spillway channel downstream from the control section should be straight. When it is necessary that curvature be used downstream from the control section, it should be far enough downstream that flow will not come in contact with the back slope of the embankment.
        - Principal Spillway Drop Risers should be properly designed to ensure that:

Earth fill Dam

Dams can be constructed as a homogenous or as zoned embankment. In either case considerations should be given to:

- The area on which a dam is to be built, should consist of material that has sufficient bearing strength to support the dam without excessive consolidation. The foundation should consist of or be underlain by, relatively impervious material which will prevent excessive passage of water.
- The borrow source soil properties. Ideally a borrow source is of adequate size and of uniform material properties to provide all earth fill needed.
- Construction operations should also be considered when siting a borrow source to minimize travel

distances and costs
- Impacts to wetlands and environmental considerations
- Impacts to the stability of the embankment by selecting a borrow source to close to the placement. Borrow sources should not be within 50 feet of the finished toe of the embankment.
- Local, State and Federal water right laws as pertain to volume of water permanently stored.

Visual resource design
Carefully consider the visual design of ponds in areas of high public visibility and those associated with recreation. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

Shape the embankment to blend with the natural topography. Shape the edge of the pond so that it is generally curvilinear rather than rectangular. Shape excavated material so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, add islands to provide visual interest and to attract wildlife.

Rehabilitation of Existing Structures
When an existing structure has met the end of its lifespan, the structure may be rehabilitated to extend its usefulness. Rehabilitation may include:

- Removal of sediment from the reservoir area – removed material should be treated with the same criteria for excavated ponds, as described above
- Replacement of principal spillway pipes – principal spillway pipes should be replaced if found be to worn, damaged or inadequate. Pipes can be replaced by excavation “cut and cover” or by slip-lining.
- Auxiliary Spillways should be inspected, analyzed and if found to be deficient, be modified and stabilized as needed
- Hydrology and Hydraulics should be analyzed with current design criteria and material properties.
- Existing embankments should be inspected and if needed, a geological investigation performed to determine the adequacy of material when compared to current design criteria.
- Reference National Engineering Manual (NEM) Part 501.22, Applicable Standards for additional requirements for rehabilitation.

Fish and wildlife
Locate and construct ponds to minimize the impacts to existing fish and wildlife habitat.

When feasible, retain structures such as trees in the upper reaches of the pond and stumps in the pool area. Shape upper reaches of the pond to provide shallow areas and wetland habitat.

If operations include stocking fish, use CPS Code 399, Fishpond Management.

Livestock Water
When livestock watering is a resource concern, consider:

- Increasing the sum of total gallons to be consumed per time period, net evaporation loss and seepage losses by 50%
- Additional storage for sediment deposited in the reservoir for its design life.

Refer to NRCS CPS Code 614, Watering Facility, for additional information and criteria.

Vegetation
Stockpile topsoil for placement on disturbed areas to facilitate revegetation.

Consider selecting and placing vegetation to improve fish habitat, wildlife habitat and species diversity.

Water quantity
Consider effects upon components of the water budget, especially—

- Effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and groundwater recharge.
- Variability of effects caused by seasonal or climatic changes.
- Effects on downstream flows and impacts to environment such as wetlands, aquifers, and social and economic impacts to downstream uses or users.

Water quality
Consider the effects of—

- Erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that runoff carries.
- Short-term and construction-related effects of this practice on the quality of downstream watercourses.
- Water-level control on the temperatures of downstream water to prevent undesired effects on aquatic and wildlife communities.
- Wetlands and water-related wildlife habitats.
- Water levels on soil nutrient processes such as plant nitrogen use or denitrification.
- Soil water level control on the salinity of soils, soil water, or downstream water.
- Potential for earth moving to uncover or redistribute toxic materials.
- Livestock grazing adjacent to the pond. Consider fencing to keep livestock activities out of direct contact with the pond and dam.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. As a minimum, include the following items:

- A plan view of the layout of the pond and appurtenant features
- Typical profiles and cross sections of the principal spillway, auxiliary spillway, dam, and appurtenant features as needed
- Structural drawings adequate to describe the construction requirements
- Requirements for vegetative establishment and/or mulching, as needed
- Safety features
- Site-specific construction and material requirements

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator.

As a minimum, include the following items in the operation and maintenance plan:

- Periodic inspections of all structures, earthen embankments, spillways, and other significant appurtenances
- Prompt repair or replacement of damaged components
- Prompt removal of sediment when it reaches predetermined storage elevations
- Periodic removal of trees, brush, and undesirable species
- Periodic inspection of safety components and immediate repair if necessary
- Maintenance of vegetative protection and immediate seeding of bare areas as needed

REFERENCES

American Society for Testing and Materials. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM D2487. West Conshohocken, PA.

USDA NRCS. Engineering Technical Releases, TR-210-60, Earth Dams and Reservoirs. Washington, DC.

USDA NRCS. National Engineering Handbook (NEH), Part 628, Dams. Washington, DC. USDA NRCS. NEH, Part 633, Soil Engineering. Washington, DC.

USDA NRCS. NEH, Part 636, Structural Engineering. Washington, DC. USDA NRCS. NEH, Part 650, Engineering Field Handbook. Washington, DC. USDA NRCS. National Engineering Manual. Washington, DC.

TABLE 3

Material	Diameter	Gauge or Thickness of Material	Max Depth of Fill (ft) Over Pipe
1. PVC 1120 or PVC 1220 1/	8”,10”,12”	SCHEDULE 40	13
		SCHEDULE 80	16
		2/ SDR 17	16
		SDR 21	14
		SDR 26	13
		SDR 51	5 3/
2. WELDED STEEL PIPE (Coal Tar or Asphalt Coated)	16”	.312”	25
	20”	.438”	25
3. CORRUGATED STEEL PIPE (Spiraled or Annular) (2-2/3” x 1/2” corrugation)	24” or less	16 ga	25
	30”	16 ga	20
		14 ga	25
	36”	14 ga	20
		12 ga	25
MAXIMUM LENGTH OF CANTILEVER OUTLET SECTION (FOR ALL GAUGES) SHALL BE 8 FT.	42”	12 ga	20
		10 ga	25
	48”	10 ga	25
4. CORRUGATED STEEL PIPE (Spiraled or Annular) (3” x 1” corrugations)	36”	16 ga	25
		14 ga*	25
	42”	16 ga	25
		14 ga	25
	48”	16 ga	20
		14 ga	25
		12 ga*	25
	54”	16 ga	20
		12 ga*	25
	60”	16 ga	15
		14 ga	20
		10 ga*	25
MAXIMUM LENGTH OF CANTILEVER OUTLET SECTIONS SHALL BE 5FT, EXCEPT THOSE INDICATED BY (*) WHICH MAY BE 8 FT.	66”	16 ga	15
		14 ga	20
		8 ga*	25
	72”	16 ga	15
		14 ga	20
		8 ga*	25

Material	Diameter	Gauge or Thickness of Material	Max Depth of Fill (ft) Over Pipe
5. ALUMINUM CORRUGATED METAL PIPE	Less than 21”	.060”	25
	24”	.060”	15
		.075”	20
		.105”	25
	30”	.075	15