Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WATERING FACILITY

CODE 614

(no)

DEFINITION

A watering facility is a means of providing drinking water to livestock or wildlife.

PURPOSE

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

- supply daily water requirements
- improve animal distribution
- provide a water source that is an alternative to a sensitive resource

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where there is a need for a watering facility for livestock or wildlife, where there is a source of water that is adequate in quantity and quality for the purpose, and where soils and topography are suitable for a facility.

CRITERIA

General Criteria Applicable to All Purposes

The installation and operation of this practice shall comply with all federal, state and local laws, rules, and regulations.

Capacity

Identify the type of livestock or wildlife that will be the primary user(s) of the facility. If the watering facility will supply water to different species of animals, provide sufficient water to meet the sum of the seasonal high daily water requirements of all the animals *as shown in Table 1.*

Table 1. Livestock Daily Water Consumption

Type of Livestock	***Gallons/Day/Head***
Beef Cattle & Horses	*10 to 15*
Dairy Cows (Drinking only)	*15*
Dairy Cows (Drinking and barn needs)	*35*
Hogs	*4*
Sheep and Goats	*1 to 2*

Refer to the National Range and Pasture Handbook (Chapter 6), State guidance, or university publications for information on livestock water quantity and quality requirements. For wildlife, base water quantity and quality requirements on targeted species needs.

See Biology Technical note 54 for additional guidance.
http://efotg.sc.egov.usda.gov/references/public/NM/bio54.pdf

User Needs
Design the watering facility so that access is adequate to accommodate the number of animals that will be drinking at the same time. Include design elements to meet the specific needs of the primary user(s). Examples of specific design needs would include accommodation for antler size, species, and ingress and egress requirements.

Materials and Appurtenances
Construct the watering facility from durable materials that meet or exceed the lifespan of the practice. Follow NRCS design procedures for the selected materials. Use industry standards where NRCS standards do not exist.

Stabilization of Disturbed Areas
Vegetate or stabilize areas disturbed by construction in accordance with the planned use of the facility. Use the criteria in NRCS Conservation Practice Standard (CPS) *Critical Area Planting (Code 342)* to establish vegetation. If establishment of vegetation is precluded by site conditions, use the criteria in NRCS CPS *Mulching (Code 484),* as appropriate.

Troughs and Tanks
Capacity
Design the watering facility with the storage volume necessary to provide water between periods of replenishment. Base the additional storage volume on the availability of water, replenishment rate, location, and planned operation.

Location
Locate the watering facility to meet the needs of the managed livestock or wildlife species. Select a site that will promote even grazing distribution and reduce grazing pressure on sensitive areas. Where multiple watering facilities are planned, place the watering facilities at distances that are appropriate for the species that will be managed.

Design fences associated with the watering facility to allow safe ingress and egress for area wildlife species.

To protect species that access water by skimming across the surface, make fencing materials highly visible with appropriate openings. Add permanent streamers or coverings to wire fences that extend across a watering facility to make them more visible to skimmers.

When there is no alternative but to place a trough that splits two pastures the following shall be adhered to: Trough size must be 12 feet in diameter or larger. One or two wires may be placed across the trough. A single wire will be spaced a minimum 18 inches above the high water line. A second wire may be placed 10 – 12 inches above the first. The wires across the drinker will be covered with PVC or HDPE pipe as a visual marker. Wire shall be tied on each side of trough with H braces adhering to criteria in NRCS CPS 382 Fence.

When possible, locate the watering facility away from streams, ponds, or riparian areas to minimize chance of contamination from fecal contamination or surface pollution.

When a watering facility is installed adjacent to a well, provide positive drainage away from the well head.

Foundation
Install the watering trough or water storage tank on a firm, level foundation that will not settle differentially. Examples of suitable foundation materials are bedrock, concrete, compacted gravel and stable, well-compacted soils. Where necessary, prepare the foundation by removal and disposal of materials that are not adequate to support the design loads.

Anchor or brace the watering facility to prevent overturning by wind and animals, if needed.

Refer to Above Ground Tank, Anchor Design Data program for sliding and overturning guidance.

https://ems-team.usda.gov/sites/NRCS_NewMexico/engineering/Design%20Spreadsheet/Forms/AllItems.aspx

Tanks

Analyze the foundation conditions and provide a design that will ensure the stability of the storage tank. For a vertical storage tank with a tank height greater than the tank diameter, also analyze the potential for overturning and identify the anchoring requirements. The *Above Ground Tank, Anchor Design Data program may be used.*

Use NRCS design procedures, or manufacturer's guidelines to ensure that buried tanks will withstand all earth and vehicle loads anticipated for the site.

Stabilization

For a fixed trough, protect the area around the watering facility where animal concentrations or overflow from the watering facility will cause resource concerns. Use NRCS CPS *Heavy Use Area Protection (Code 561)* to design the protection.

For a portable facility, move the trough frequently to prevent damage from animal concentrations.

Appurtenances

Use the criteria in NRCS CPS *Livestock Pipeline (Code 516)* to select the components needed to attach the water supply to the trough. Include backflow prevention devices on facilities connected to wells or to domestic or municipal water systems.

Provide a stable outlet for the overflow pipe when an overflow pipe is included in the design. Protect the outlet from damage. Direct overflow from the trough to another beneficial use or to the original watercourse, where possible.

Overflow must be held to a minimum and shall be piped to a stable and suitable point of release. The point of release and appropriate buffer shall be fenced to exclude livestock.

Topography must be evaluated to minimize water erosion from overflow.

Overflow pipes must be of a diameter equal to or larger than the inlet pipe. On drinking troughs where automatic float control devices are used, overflow devices are not needed.

An overflow pipe or automatic float shall be installed to provide 2 inches minimum freeboard in both tanks and troughs. Inlet and outlet pipes must be of a diameter equal to or larger than that of the connecting pipeline.

Structures less than 12 feet in diameter and 26 inches tall shall be treated as troughs.

For expanded definitions of the criteria and considerations contained in this standard please review the NRCS publication "Watering

Systems for Serious Graziers" at the following web address:
http://www.mo.nrcs.usda.gov/news/pubs_download/out/Watering%20Systemslow.pdf

Where water is supplied under pressure to the watering facility, use an automatic water level control or float valve to control the flow of water to the facility in order to reduce energy use and prevent overflows.

As needed, install a float valve on a gravity-fed trough to avoid draining the water source.

Protect valves and controls from damage by livestock, wildlife, freezing, and ice.

Water Quality. The quality of the water must be sufficient for use by the intended animal. Table 2 lists the NMAC section 20.6.4 water quality standards for livestock as of February 2007. If it is suspected that these levels are exceeded, the cooperator shall test the proposed water source for contaminants.

The maximum recommended level of nitrite + nitrate is 132 mg/l. The following maximum recommended level for total dissolved solids (TDS) applies:

- *Small animals - 3,000 mg/L*
- *Poultry, swine, & pregnant/lactating cows - 5,000 mg/L*
- *Other livestock - 7,000 mg/L*

SOURCE: U.S. Environmental Agency, 1973b.

Table 2. State of New Mexico Livestock Water Standard

Contaminant	***Quantity***	***Unit***
Dissolved Arsenic	*0.2*	*mg/L*
Dissolved Boron	*5.0*	*mg/L*
Dissolved Cadmium	*0.05*	*mg/L*
Dissolved Chromium	*1.0*	*mg/L*
Dissolved Cobalt	*1.0*	*mg/L*
Dissolved Copper	*0.5*	*mg/L*
Dissolved Lead	*0.1*	*mg/L*
Total Mercury	*0.01*	*mg/L*
Dissolved Selenium	*0.05*	*mg/L*
Dissolved Vanadium	*0.1*	*mg/L*
Dissolved Zinc	*25.0*	*mg/L*
Radium-226+ Radium-228	*30*	*pCi/L*
Tritium	*20,000*	*pCi/L*
Total gross alpha (including radium-226, but excluding radon and uranium	*15*	*pCi/L*

Design Criteria

Capacity

Design windmill and solar powered supply facilities to have at least a 10-day total storage capacity and motor/engine powered facilities to have at least a 5-day total storage capacity. Troughs shall have a minimum 1-day storage capacity and a recharge period of one day.

Capacity for water requirements shall be computed at the design water elevation.

Layout

The site shall be well drained. Areas adjacent to the watering facility that will be trampled by livestock shall be graded, graveled, paved, or otherwise treated to provide firm footing, eliminate water puddles, and reduce erosion. Design of the protective surface around the watering facility shall be in accordance with NRCS Conservation Practice Standard 561, Heavy Use Area Protection.

Table 3. Steel Reinforcement Requirements and Concrete Floor Thickness

Diameter of Tank (ft)	Floor Area (sf)	Floor Thickness (in)	Min. Steel Reinforcement
0 to 20	0 -315	6	#4 rebar, 10.5" center-to-center both ways
20 to 30	315 - 706	6	#4 rebar, 8" center-to-center both ways
30 to 39	706 to 1194	6	#4 rebar 6" center-to-center both ways

The watering facility shall be protected from freezing and ice damage. Freeze-proof troughs, float boxes, or electric heaters may be used.

When a roof is placed over the watering facility to provide shade, the roof shall be designed for appropriate snow and wind loads. The roof supports (posts or columns) shall be durable enough to withstand anticipated livestock and wildlife activities.

A watering facility may be designed and constructed from the following materials:

- *Reinforced concrete*
- *Rubble masonry*
- *Galvanized corrugated steel or steel plate with welded, bolted, or riveted joints*
- *Fiberglass*
- *Polyethylene*
- *Used heavy equipment tires*
- *Special designs or materials as approved by the State Conservation Engineer.*

All material, used and unused, must comply with NEM Part 512.

Reinforced Concrete
All concrete shall be proportioned, mixed, placed and cured as required to produce a 28-day strength of at least 3,000 pounds per square inch. Table 3 lists minimum size and spacing of steel reinforcement.

All reinforced concrete walls shall have a minimum thickness of 6 inches. Reinforcing steel bars shall be no. 4 or larger, spaced on 12-inch centers both ways. Reinforcing mesh may not be used.

Refer to Steel Rim Storage Tank for design guidance.

https://ems-team.usda.gov/sites/NRCS_NewMexico/engineering/Design%20Spreadsheet/Forms/AllItems.aspx

Rubble Masonry
Trough or tank walls, constructed of rubble masonry and less than 20 feet in diameter or 315 squares feet in floor area, and/or having a water depth of 2 feet or less, shall have a wall thickness of at least 8 inches. Those with a diameter larger than 20 feet or 315 square feet in floor area, and/or with a water depth greater than 2 feet, shall have a thickness of at least 12 inches.

Rubble masonry walls with water depth greater than 2 feet shall be supported with adjustable coupling bands uniformly spaced at intervals not to exceed 18 inches. The band shall be of any shape, but each band shall have a minimum cross-section of 0.3 square inches, be made of steel, and must extend around the perimeter of circular tanks. For square or rectangular tanks, bands must have one coupling for each wall and the band must be bent square at the corners.

Rubble masonry floors may be used with rubble masonry walls and shall be as thick as the wall. Rubble masonry floors shall not be used with steel walls or reinforced concrete walls.

Steel

Steel tanks shall meet the minimum requirements in Table 4. All joints must be of good quality and be watertight. Joints that are crimped or soldered are not acceptable. Used steel tanks shall be acceptable, provided that the minimum thickness requirements in Table 4 are satisfied. ***Table 4*** *is based on flat steel. The minimum thickness for prefabricated troughs made of corrugated steel is 20 gauge.*

Table 4. Steel Rim Tanks and Troughs

Height	*< 2ft*	*2-4 ft*	*4- 8ft **
Diameter	***Black Sheet***		
< 12ft	*14 ga*	*12 ga*	*10 ga*
12-30 ft	*12 ga*	*12 ga*	*10 ga*
30-40 ft	*10 ga*	*10 ga*	*3/16”*
Diameter	***Galvanized Sheet***		
< 12 ft	*16 ga ***	*14 ga*	*12 ga*
12-30 ft	*14 ga*	*14 ga*	*12 ga*
30-40 ft	*14 ga*	*12 ga*	*10 ga*

Tanks having heights greater than 8 feet shall be individually designed. Approval for all used steel tanks shall be made by Area Engineer or engineer with appropriate approval authority.

***Tanks constructed of these materials shall be rolled or reinforced on the top.*

Fiberglass

Prefabricated fiberglass storage tanks and troughs shall meet the thickness requirements of ***Table 5****. Used storage tanks may be reconstructed of fiberglass by meeting all the requirements of a newly manufactured storage tank.*

Table 5. Circular Fiberglass Tanks and Troughs - (Diameter: 20 feet maximum)

Height (feet)	***Wall and Bottom Thickness (inch)***
0 to 6.0	*1/4*
6.1 to 12.0	*5/16*
12.1 to 16	*3/8*

Any fiberglass tanks exceeding 20 feet in diameter shall be approved by the State Conservation Engineer.

Fiberglass structures shall be made of ultraviolet resistant materials or shall have a durable coating to protect the structure from deterioration due to sunlight. Tank must also be dark enough to prevent growth of algae inside the tank.

Only fiberglass tanks specifically designed and manufactured for underground installation may be installed as such.

Polyethylene

Prefabricated polyethylene tanks shall meet the following standards and regulations: ASTM D1998, Standard Specification for Polyethylene Upright Storage Tanks; NSF/ANSI Standard 61; and FDA Regulation 21 CFR 177.152. The tank must be designed to handle liquid with a specific gravity of 1.0 or greater. The tank must also be designed to prevent UV damage and algae growth. Tanks installed underground must be designed and manufactured specifically for underground use.

Used tires

Thoroughly clean and rinse heavy equipment tires used as troughs before use as they may be contaminated with chemicals such as ethylene glycol or calcium chloride. Only tires without aftermarket chemical puncture sealer shall be installed.

Anchoring and Guarding
Troughs and tanks shall be permanently installed and adequately anchored to prevent movement at all times by wind and livestock and prevent entry by livestock.

Escape Features
For a site west of the 100th meridian, incorporate escape features for wildlife into the design of an open-surface watering facility. For a site east of the 100th meridian, install escape features where local knowledge and experience indicate that wildlife may be at risk of drowning.

An effective escape device must:

- Meet the inside wall of the tank or trough
- Reach to the bottom of the trough or tank so it will be effective even if the water levels drop sharply
- Be firmly secured to the trough rim
- Be built of durable material with a rough surface animals can grip
- Have a slope no steeper than 45 degrees
- Be located to cause minimal interference with livestock

Provide one escape device for every 30 linear feet of rim.

Refer to *Water for Wildlife – A Handbook forRanchers and Range Managers*, Bat Conservation International, for additional information on escape features.

From page 8 of the Handbook, ExpandedMetal Structures:

- Thirteen gauge expanded metal with ½-inch or ¾-inch mesh is highly recommended
- Ramps should have vertical sides flush with the sides of the trough.

  Refer to Figures 1, 2a, 2b for Cutting, Bending and placement of Expanded Metal Grating.

Watering Ramps
Where livestock or wildlife will drink directly from a pond or stream, use a watering ramp to provide a stabilized access to the water.

Evaluate the existing and proposed fences, grazing patterns, shoreline slope, and water depth when choosing the optimum location for the ramp.

Width
Make the ramp wide enough to accommodate the expected usage.

Length
Extend the ramp into the stream or pond far enough to achieve the desired depth.

Surface drainage
Divert surface runoff from the approach to the ramp.

Slope
Make the slope of the watering ramp consistent with planned animal usage but not steeper than 3:1.

Side slopes
Make all side slope cuts and fills stable for the soil materials on the site. Make the side slopes of cuts or fills in soil materials no steeper than 2 horizontal to 1 vertical (2:1). Make rock cuts or fills no steeper than 1.5 horizontal to 1 vertical (1.5:1).

Foundation

Where necessary, prepare the foundation by removal and disposal of material that are not adequate to support the design loads.

Surface material

Use the criteria in NRCS CPS *Heavy Use Area Protection (Code 561)* to design the ramp surface. The selected material must be of adequate quality to withstand underwater conditions.

Access

Use fencing or other barriers to delineate the boundaries of the ramp. Use NRCS CPS *Fence (Code 382)* for the design and construction of a fence. Barriers must be of sufficient size, strength, and quality to meet the intended use of the facility.

Ramps in Streams

Use the criteria in NRCS CPS *Stream Crossing (Code 578)* for the design and construction of a ford crossing except as noted above.

Locate the watering ramp so that it does not impede the movement of aquatic organisms in the stream.

Ramps in Ponds

A minimum water depth of 3 feet, measured from the designed permanent water level, is recommended. Where the pond depth is greater than 3 feet at the ramp location, it may be necessary to excavate the ramp into the pond bank to provide a stable base at the lower end. Extend the ramp a minimum of 0.5 feet above the designed permanent water level.

CONSIDERATIONS

General Considerations

Not all species need or benefit from supplemental water.

Consider impacts to both target and non-target wildlife species before installation of a watering facility. Observed or documented use of a facility by wildlife does not necessarily indicate net benefits. Introducing a new water source within an ecosystem can have effects such as the concentration of grazing, predation, entrapment, drowning, disease transmission, and expansion of the wildlife populations beyond the carrying capacity of the available habitat. Providing a water source for wildlife could enhance the habitat for species that compete with or prey on at-risk species.

Wildlife populations within desert or arid regions of the country can become dependent on supplemental watering facilities.

Consideration should be given to maintaining year-round water even if livestock is not present.

Consider designing the facility to benefit wildlife. Such designs would include providing ground-level access to water for species that cannot use raised structures such as troughs. Ground-level access can be provided through creation of an overflow collection area or a secondary ground-level water source.

Depending on the target species, planners may want to consider protecting these areas through the use of suitable fencing (marked as needed) that excludes livestock and larger wildlife species while allowing access of the site to small ground-dwelling species.

Consideration should also be given to prevention of disease transmission at watering facilities. Suitable controls/treatments for water-transmissible diseases and parasites should be considered if they are a problem locally.

When windmill, solar, or other potentially unreliable power source is used, supply additional daily water storage volume (3-5 days), provide a battery back-up system or provide an alternate water source. Use of a float valve on a system with one of these types of power supply may not be practical.

Consider the effects of water development on the balance or budget of water resources in the area of the new project. In some settings, this could be important and may result in effects to adjacent or associated habitats and species.

If there is the potential for small livestock, such as lambs or kids, to fall into the trough, provide a ledge or similar structure in the trough to provide an escape route or provide a second trough that has a shorter height.

Debris and algae can collect in watering facilities resulting in the need for frequent cleaning. Covers that shade the facility and reduce debris from falling into the facility, while still allowing animal access, will keep the water cooler, cleaner, and more palatable to animals.

When a roof is placed over the trough to provide shade, design the roof for appropriate snow and wind loads and ensure that it will be durable to withstand anticipated livestock and wildlife activities. Use the criteria in NRCS CPS *Roofs and Covers (Code 367)* to design the roof.

Where debris or algae is a problem, reduce the chances of clogging by increasing pipe sizes for inlets and outlets or by installing a feature such as an inverted elbow at the inlet to the overflow pipe. Maintenance of a watering facility can be made easier by providing a method to completely drain the watering facility. Protect the outlet of a drain from erosion.

Consider installation of a permanent means of ingress and egress for maintenance of a storage tank, if needed.

A watering facility located on a steep slope can have erosion problems from the animal traffic. The steep slopes may also cause problems with piping and valves from excess pressure. Choose the location of the watering facility to minimize problems caused by steep topography.

Watering ramps
Where livestock exclusion from a stream is part of the planned installation, consider installing a watering ramp that can be used if emergency access to water is needed. Use a gate to restrict access to the ramp.

The slope of the ramp can influence animal behavior. Steeper slopes tend to discourage loitering in the ramp area.

Select a surface material for the ramp that will discourage loitering but still provide a stable footing. The larger stone will make the hoof contact slightly uncomfortable.

Avoid locating watering ramps in shady places where possible.

It is difficult to put a fence in the middle of a stream. Where possible, extend the fence completely across the stream. Swinging gates can be used to restrict animal movement.

PLANS AND SPECIFICATIONS

Provide plans and specifications that describe the requirements for applying this practice to achieve its intended purpose. As a minimum, include:

- A map or aerial photograph showing the location of the facility and any associated pipelines
- Type and number of animals expected to use the facility
- Special conditions for access, as needed
- Foundation stability requirements.
- Site-specific detail drawings showing the facility and necessary appurtenances (foundations, pipes and valves, escape features, anchoring, etc.)
- Requirements for stabilization of any areas disturbed by the installation of the facility
- Fencing, as needed

- Materials and quantities
- Construction specifications describing the installation of the facility

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan and review it with the operator. The plan will describe the actions that must be taken to ensure that the facility functions properly for its design life. As a minimum, include the following items:

- Regularly check for damage to the facility. Check for leaks, site erosion, and damage to fences, heavy use areas, and appurtenances associated with the watering facility. Repair or replace damaged components, as needed.
- Check the performance of the automatic water level device, if present.
- Ensure that the outlet pipe is freely operating and is not causing erosion.
- Regularly clean the facility.
- Maintain the facility to ensure that there is adequate inflow and outflow.
- Prepare the facility for winter as dictated by the climate. This may include draining supply pipes, emptying tanks, or ensuring that float valves will not be damaged by ice.
- For a portable facility, include the plan for moving the facility and for monitoring/repair of the areas around the facility.

REFERENCES

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