

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

WATERING FACILITY

(No.)
CODE 614

DEFINITION

A device (tank, trough, or other watertight container) for providing animals access to water.

PURPOSE

To provide watering facilities for livestock and/or wildlife at selected locations in order to:

- Protect and enhance vegetative cover through proper distribution of grazing,
- Provide erosion control through better grassland management, or
- Protect streams, ponds and water supplies from contamination by providing alternative access to water.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where there is a need for new or improved watering facilities.

Practice Standard 648, Wildlife Watering Facility, will be followed if the primary purpose of the practice is for wildlife.

CRITERIA

Water Quality. The quality of the water must be sufficient for use by the intended animal. **Table 1** lists the State of New Mexico livestock water standard, as of February 2000. If it is suspected that any of the levels in **Table 1** are exceeded, the cooperator shall test the proposed water source for those contaminants.

The maximum recommended level of nitrate (NO₃) is 45 mg/l. The following maximum recommended level for total dissolved solids (TDS) applies:

- Small animals - 3,000 Mg/L,
- Poultry - 5,000 Mg/L,
- Other livestock - 7,000 Mg/L.

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

Capacity. A watering facility shall have enough capacity to meet the water requirements of the animals as outlined in the specifications. This will include the storage volume necessary to carry over between periods of replenishment.

Table I
State of New Mexico Livestock Water Standard

<u>Contaminant</u>	<u>Quantity</u>	<u>Unit</u>
Dissolved Aluminum	5.0	Mg/L
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

Windmill supplied facilities shall have at least a 10-day total storage capacity. Motor and engine powered facilities shall have at least a 5-day total

Standard - 614 - 2

storage capacity. The minimum capacity for a trough shall be a 1-day supply. Recharge time for troughs shall be within one day.

Capacity for water requirements shall be computed at the design water elevation. Capacity for payment shall be computed to include the 2 inches of minimum freeboard.

The installation shall have a capacity to provide seasonal high daily water requirements for the number and species of animals to be supplied as shown in **Table 2**.

Table 2
Livestock Daily Water Consumption

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

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.

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.

MATERIALS AND CONSTRUCTION

All materials shall have a life expectancy that meets or exceeds the planned useful life of the installation. A watering facility may be designed and constructed from any of the following materials:

- Reinforced concrete,
- Reinforced concrete floor with steel walls,
- Rubble masonry,
- Fiberglass,
- Galvanized corrugated steel or steel plate with welded, bolted, or riveted joints,
- Appropriate rubberized materials such as tires,
- Special designs or materials as approved by the State Conservation Engineer.

Used Material. All used material, including refurbished tanks, 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.

Concrete made with water and aggregates and containing a minimum of six sacks of the specified type of cement per cubic yard will be accepted as meeting the strength requirement.

Reinforcing steel shall be covered by at least 2 inches of concrete.

Reinforcing Steel. See **Table 3** for size and spacing of steel. All splices shall be lapped a length at least 30 times the diameter of the reinforcing steel and be tied in place with iron tie wire. Reinforcing mesh shall be lapped at least 6 inches.

Masonry Concrete. Cement used in rubble masonry work shall be of a special masonry type designed by Portland Cement, or it shall contain a minimum of eight sacks of the specified cement per cubic yard of concrete.

Steel. Joints may be bolted, riveted, butt-welded, or the ends of the steel may be lapped and welded with a fillet weld on both sides.

For field fabricated tanks, bolted or riveted joints shall be lapped at least 2.0 inches. Holes for steel plate shall be drilled or punched for $\frac{3}{8}$ -inch diameter bolts or rivets spaced at 1 $\frac{1}{2}$ inch centers or for $\frac{1}{2}$ inch diameter bolts or rivets spaced at 2.0 inches on centers. Corrugated steel shall be bolted or riveted per the manufacturer or commercial fabricating plant.

All welded joints shall be continuous welds in accordance with good welding procedures.

Prior to the placement of concrete, the bottom 8.0 inches of the steel wall may (optional) be painted with asphalt. Prior to concrete placement, the assembled steel rim shall be leveled and temporarily held at the designed elevation with blocking. The walls shall be embedded a minimum of 4 inches into the reinforced concrete footing.

See **Table 4** for thickness and **Table 5** for weight.

Table 4
Steel Rim Tanks and Troughs

Black Sheet

Height Diameter	To 26 Inches	26 to 48 Inches	48 to 96 Inches (2)
To 12 feet	14 Ga.	12 Ga.	10 Ga.
12 to 30 Feet	12 Ga.	12 Ga.	10 Ga.
30 to 40 Feet	10 Ga.	10 Ga.	3/16"
Over 40 Feet	3/16"	3/16"	3/8"

Galvanized Sheet

Height Diameter	To 26 Inches	26 to 48 Inches	48 to 96 Inches (2)
To 12 feet	16 Ga.(1)	14 Ga.	12 Ga.
12 to 30 Feet	14 Ga.	14 Ga.	12 Ga.
30 to 40 Feet	14 Ga.	12 Ga.	10 Ga.
Over 40 Feet	12 Ga.	10 Ga.	3/16"

Corrugated Galvanized

Height Diameter	To 26 Inches	26 to 48 Inches	48 to 96 Inches (2)
To 12 feet	18 Ga.(1)	16 Ga.(1)	-
12 to 30 Feet	16 Ga.(1)	16 Ga.(1)	-
30 to 40 Feet	16 Ga.(1)	14 Ga.	-
Over 40 Feet	14 Ga.	12 Ga.	-

- (1) Tanks constructed of these materials (16 gauge or thinner) shall be rolled or reinforced on the top.
- (2) Tanks having heights greater than 8 feet shall be individually designed. These designs are to be reviewed and approved by the Resource Engineer servicing the field office,

Refurbished Tanks. Used steel tanks (oil, gasoline, etc.) shall be acceptable, providing the minimum thickness requirements in **Table 4** are satisfied. Tanks shall be refurbished at a commercial tank refurbishing facility. They shall be cleaned to bare metal and coated with an approved coating for potable water. They are to be certified by the facility as being suitable for the storage of livestock water. Alternative materials to used tanks are to be presented to the producer.

Fiberglass. The resins used may be Orthophthalic or Isophthalic polyester or other approved resins. Sufficient pigment shall be used in the resin to inhibit ultraviolet rays. The fiberglass reinforcing material shall be a commercial-grade glass fiber.

Prefabricated fiberglass storage tanks and troughs shall meet the thickness requirements of **Table 7**. Used storage tanks may be reconstructed with fiberglass by meeting all the requirements of a newly manufactured storage tank installation.

Table 7
CIRCULAR FIBERGLASS TANKS AND TROUGHS - Up to 20 ft. DIAMETER

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

All fiberglass troughs shall be reinforced at the top rim.

Any fiberglass tanks exceeding 20 feet in diameter shall be approved by the State Conservation Engineer and shall be certified by the manufacturer as meeting AWWA Standard D 120 or ASTM Standard D 3299.

Fiberglass structures shall be made of ultraviolet resistant materials or shall have a durable coating to protect the structure from deterioration due to sunlight.

Reinforced Concrete Walls. All reinforced concrete walls shall have a minimum thickness of 6 inches. Reinforcing shall be either No. 4 reinforcing steel bars spaced on 12-inch centers both ways, or No. 3 reinforcing steel bars spaced on 9-inch centers; 6-inch by 6-inch 6-gauge reinforcing mesh may be used in walls up to 4 feet in height. Vertical bars shall have an 18-inch leg

Standard - 614 - 4

projecting horizontally into the floor and extending to within 3 inches of the top of the wall.

Rubble Masonry Walls. Troughs or tanks, 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 (e.g. 5/8-inch diameter rod) 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.

Concrete Floors. Design of all concrete floors shall conform to **Table 3**.

Rubble Masonry Floors. 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.

Footings. Footings shall be at least 12 inches thick and 18 inches wide. The footing shall extend at least 12 inches outside the wall and at least 6 inches inside the wall.

The minimum footing width for concrete or rubble masonry walls shall be the minimum footing width plus the wall thickness.

Concrete and steel shall be placed continuously between footing and floor.

A construction joint can be made between footing and wall on reinforced concrete walls.

Inlet, Outlet, and Overflow Pipe. Use only new pipe for inlet, outlet, and overflow pipe. The pipe shall be placed and secured in place before the concrete is placed.

Automatic water level control and/or overflow facilities shall be provided as appropriate.

Plumbing shall be shielded to prevent damage by livestock.

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 the tank or trough. Inlet and outlet pipes must be of a diameter equal to or larger than that of the connecting pipeline.

Prefabricated Tanks. All joints must be of good quality and be watertight. Joints that are crimped or soldered are not acceptable.

Prefabricated tanks must meet the wall thickness requirements of **Table 4**.

Prefabricated Drinking Troughs. Trough size shall be a minimum capacity for a 1-day supply, a maximum of 12 feet in diameter, and a maximum height of 26 inches.

Recharge time shall be considered in sizing a trough to satisfy watering demand. Material for prefabricated metal troughs shall be corrugated galvanized sides and flat galvanized bottom with a 22-gauge minimum thickness.

All joints shall be of good quality and watertight. Trough rims must be reinforced or rolled.

Troughs placed above the ground shall be placed on a firm sand and gravel base, a minimum of 4 inches in thickness. When on-site materials exist, or can be reworked to provide a well-drained base, imported gravel drain materials will not be required. The bottom of the trough shall be at least 2 inches above the surrounding ground surface. To prevent damage to the trough bottom the surface of the base shall be smooth and without sharp protruding rocks. The base material shall surround the outside of the trough for a minimum of 4 feet.

When metal troughs are in contact with corrosive soils, they shall be asphalt or epoxy-coated.

Permanency, Anchoring, and Guarding.

Troughs and tanks shall be permanently installed. The determination as to whether a trough or tank is “permanently installed” will be left to the judgment of the engineer.

A troughs or tank shall be adequately anchored so that it cannot be moved by livestock or wind, particularly when they are empty. This can be done in, but is not limited to, the following:

- Concrete ballast at least 4 inches thick placed inside the tank or trough,
- Three or more equally spaced posts welded or bolted to facility and anchored in concrete or buried at least 30 inches into soil,
- Three or more equally spaced 3/8-inch-diameter guy wires secured to the facility with bolts or welded and anchored, or
- Two cross members of 1 ½-inch-diameter steel pipes bolted to four equally spaced posts. The posts shall be standard steel posts or a minimum 4-inch-diameter juniper, pinon, or treated pine, and shall be set at least 30 inches deep,

They shall be guarded to prevent entry by livestock.

The supplier shall certify all materials as being suitable for the storage of livestock water.

PLANS AND SPECIFICATIONS

Plans and specifications for installing a watering facility shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. If the watering facility is a component of a system that includes additional conservation practices, the information necessary to construct these additional practices will also be conveyed on the plans.

Development of plans will be guided by Engineering Field Manual, Chapter 5, and shall be in accordance with National Engineering Manual, Parts 541 and 542.

The plan shall include, but not be limited to, the specifications for this practice.

Standard drawings listed in the NEM, or other approved drawings, can be used.

Applicable data cards listed in the New Mexico NRCS Forms Catalogue may be used.

This practice may adversely affect cultural resources and must comply with GM 420, Part 401.

OPERATION AND MAINTENANCE

An O&M plan specific to the type of installed watering facility shall be provided to the landowner.

REFERENCES

- Concrete, ACI 318, American Concrete Institute
Engineering Field Handbook
General Manual, NRCS
Groundwater; Freeze R. Allen, 1973, pp388
Manual of Steel Construction, American Institute of Steel Construction
Masonry, Building Code Requirement for Masonry Structures, ACI 530, American Concrete Institute
National Engineering Manual
NRCS Engineering Field Handbook
NRCS, NHCP, Code 516, Pipeline
NRCS, NHCP, Code 561, Heavy Use Area Protection
NRCS, NHCP, Code 587, Structure for Water Control
NRCS, NHCP, Code 648, Wildlife Watering Facility
State of New Mexico, Standards for Interstate and Intrastate Surface Waters, February 2000, pp30
Timber, National Design Specification for Wood, American Forest and Paper Association

Table 3
STEEL REINFORCEMENT REQUIREMENTS & CONCRETE FLOOR THICKNESS

Diameter of Circular Tank (Feet)	Floor Area (Square Feet)	Concrete Floor Thickness (Inches)	Minimum Steel Reinforcement
0 to 20	0 to 315	4	6" x 6", 10 gauge reinforcing mesh, or No. 2 reinforcing bars spaced on 12-inch centers
20 to 30	315 to 706	6	6" x 6", 6 gauge reinforcing mesh, or No. 3 reinforcing bars, spaced on 12"-centers both ways.
30 to 40	706 to 1256	6	No. 3 reinforcing bars spaced at 9" both ways or No. 4 reinforcing bars spaced at 12" C.C. both ways.
40 plus	1256 and up	8	No. 4 reinforcing bars spaced at 9" C.C. both ways.

Table 5
Weights For Sheet Metal
(Pounds Per Square Foot)

Gage	Uncoated Black Sheet Steel	Galvanized Flat Steel	Galvanized Corrugated Steel		
			2 1/2 by 1/2	2 2/3 by 1/2	3 by 3/4
000 (3/8")	15.00	-	-	-	-
3 (1/4")	10.20	-	-	-	-
7 (3/16")	7.65	-	-	-	-
8 (3/16")	-	7.03	-	-	-
10	5.63	5.78	6.31	6.31	-
12	4.38	4.53	4.94	4.94	5.23
14	3.13	3.28	3.58	3.58	3.79
16	-	2.66	2.90	2.90	3.07
18	-	-	2.35	2.35	2.49

Standard 2 1/2" corrugated sheets have 9 corrugations exclusive of side lap and cover a width of 24 inches; therefore, the corrugation pitch measures approximately 2 2/3 inches. Thickness equivalent for 8-gage galvanized sheet is 0.1681. Weights for 3/16 inch galvanized sheet are not listed in common tables. Use 8-gage where tables call for 3/16 inch.

Table 6
SHEET METAL GAGES IN DECIMAL AND APPROXIMATE FRACTION OF INCH

Gage Number	Uncoated Steel Sheets and Light Plates		Uncoated Black Corrugated Steel		Galvanized Corrugated Steel	
	Decimal	Approximate Fraction	Decimal	Approximate Fraction	Decimal	Approximate Fraction
10	0.1345	1/8	0.1345	1/8	-	-
12	0.1046	7/64	0.1046	7/64	-	-
14	0.0747	5/64	0.0747	5/64	0.0785	5/64
16	0.0598	1/16	0.0598	1/16	0.0635	1/16