

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
ARIZONA**

**WATERING FACILITY
(No.)**

CODE 614

DEFINITION

A permanent or portable device to provide an adequate amount and quality of drinking water for livestock and/or wildlife.

number and species of the livestock and/or wildlife planned to use the facility. Include the storage volume necessary to provide water between periods of replenishment.

PURPOSE

To provide access to drinking water for livestock and/or wildlife in order to:

- Meet daily water requirements
- Improve animal distribution

CONDITIONS WHERE PRACTICE APPLIES

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

CRITERIA

General Criteria Applicable To All Purposes

Design Conservation Practices on an individual basis to meet site conditions and functional requirements.

Design subsidiary components and/or structures to meet all applicable Natural Resource Conservation Service (NRCS) conservation practice standards. When NRCS design criteria are not available, use industry standard design criteria or manufacturer's recommendations.

Laws and Regulations. This practice must conform to all federal, state, tribal, and local laws, rules, or regulations. *Laws and regulations of particular concern include those involving water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.*

The owner is responsible for securing necessary permits and water rights, complying with all laws and regulations, and meeting legal requirements applicable to the installation, operation, and maintenance of this practice and associated structures.

Water Quantity. Design watering facilities with adequate capacity and supply to meet the seasonal daily water requirements for the

<i>Minimum Daily Water Requirements for Livestock (gallons per head per day)</i>	
<i>Cattle</i>	<i>12 to 20</i>
<i>Horses</i>	<i>10 to 15</i>
<i>Dairy Cows (Drinking Only)</i>	<i>15 to 20</i>
<i>Dairy Cows (Drinking & Barn needs)</i>	<i>30 to 35</i>
<i>Hogs</i>	<i>4 to 8</i>
<i>Sheep and Goats</i>	<i>1 to 2</i>

<i>Minimum Daily Water Requirements for Wildlife (gallons per animal per day)</i>	
<i>Mule deer</i>	<i>1-2</i>
<i>Antelope</i>	<i>1-2</i>
<i>Elk</i>	<i>5-8</i>
<i>Quail (gallons/flock/day)</i>	<i>1-2</i>
<i>Wild turkey(gallons/flock/summer)</i>	<i>500</i>
<i>Mourning dove (gallons/flock/day)</i>	<i>2-5</i>
<i>Pheasant (gallons/flock/day)</i>	<i>2-5</i>

For additional information, refer to the National Range and Pasture Handbook for guidance on livestock water quantity and quality requirements. For wildlife, base water quantity and quality requirements on targeted species needs.

Storage Requirements: *Storage for each pasture shall be as follows:*

<i>Source/Power</i>	<i>Minimum</i>	<i>Recommended</i>
<i>Reliable source¹</i>	<i>3 times the daily water requirements</i>	<i>7 times the daily water requirements</i>
<i>Unreliable source²</i>	<i>7 times the daily water requirements</i>	<i>14 times the daily water requirements</i>

¹*Electric pumps, well, perennial stream/river, reservoir, spring, etc.*

²Windmill, Solar Pumps, Water harvesting catchment, etc,

The minimum storage capacity for drinkers shall be 12 hours. Refill time for drinkers shall not exceed 4 hours.

Location. Locate facilities to promote even grazing distribution and reduce grazing pressure on sensitive areas. *Base the distribution and spacing of facilities on topography, required travel distance to water and the home range, territory size and distribution of the target species.*

Locate stock watering places such that livestock do not have to travel more than one mile nor less than one-half mile between forage and dependable water on gentle slopes. In rough areas, the greatest distance from forage to water should not exceed one-half mile nor be less than one-quarter mile.

For wildlife only facilities, use the following criteria for distribution.

Distance Between Available Water for Wildlife (miles)	
Mule deer	1 to 3
Antelope	2 to 3
Elk	1 to 3
Quail	0.5 to 1
Wild turkey	1 to 2
Mourning dove	3 to 5
Pheasant	0.5 to 1

Facility Design. Design the watering facility to provide adequate access to the animals planned to use the facility. *Facilities shall be protected from livestock or wildlife entering or falling into the tank or drinker by providing water to its full capacity or by other structural measures. No special provisions are required for drinkers less than 2 feet in height.*

Incorporate *wildlife* escape features into the watering facility design, or use a *wildlife* escape ramp attached to the water facility. *The ramps shall be usable at all water levels possible within the facility, be fully enclosed to prevent animal passage or entrapment under the ramp and ramp sides shall meet the trough walls. For large watering facilities, use multiple ramps to maintain a maximum ramp spacing of 30-feet. See Arizona Tech Note (TN), AZ-9-2 Biology-*

Escape Ramp, "Watering Facility Escape Ramp Design" for minimum design criteria.

Include design elements to meet the specific needs of the animals that are planned to use the watering facility, both livestock and wildlife.

Protect areas around watering facilities where animal concentrations or overflow from the watering facility will cause resource concerns. Use criteria in NRCS Conservation Practice Standard 561, Heavy Use Area Protection to design the protection.

Provide adequate drainage measures around watering facilities. Use grading, graveling, paving or other treatment methods to provide firm footing, eliminate ponding water, and reduce erosion in areas adjacent to the watering facility that will be trampled by livestock and other large animals.

Foundation. Install permanent watering facilities on a firm, level foundation that will not settle differentially. Examples of suitable foundation materials are bedrock, compacted gravel, railroad ties, and stable, well compacted native soils. *Clear all trees, brush and rubbish from the foundation area prior to placement of the facility.*

Anchoring. Design and install all watering facilities to prevent *sliding and overturning* by wind and animals, *particularly when they are empty. If possible, the water surface shall be left open or unobstructed, such that no wire or posts cross the water surface.*

Any one of the following anchoring methods or a combination thereof is acceptable when supported by appropriate documentation or design calculations.

- Concrete, water or "other" ballast materials, placed inside the facility provided a stability analysis to support the selected depth of ballast is included with the design documents.
- Three or more equally spaced posts (steel or wood) anchored in concrete or buried at least 30 inches into soil, with the tops extending above ground to at least two third the height but not above the rim of the facility;
- Three or more equally spaced, new galvanized steel guy wires or cables, with a minimum of 3 galvanized cable clips on each end or splice, secured to the facility with eye-bolts, welded connections or grooves and anchored by concrete blocks, steel plates, railroad ties or earth anchors (Provide

manufacturer literature in project file if this method is used).

Materials. Design watering facilities and all valves, exposed pipes and controls to withstand or be protected from damage by livestock, wildlife, freezing, and ice damage.

Construct watering facilities from durable materials that have a life expectancy that meets or exceeds the planned useful life of the installation. Follow appropriate NRCS design procedures for the material being used or applicable industry standards where NRCS standards do not exist.

Pipe and Appurtenances. Use the criteria in NRCS Arizona Conservation Practice Standard 516, Livestock Pipeline, to design piping associated with the watering facility. Include backflow prevention devices on facilities connected to wells, domestic or municipal water systems (refer to Arizona Conservation Practice 533, Pumping Plant).

Use fittings, such as couplers, reducers, bends, tees, risers, valves and appurtenances that are made of material(s) recommended for use with the pipe.

Install an overflow pipe or automatic float to provide 2 inches minimum (4 inches maximum) freeboard in the tank or trough. Select overflow and outlet pipes with a diameter equal to or larger than that of the inlet pipe.

Corrosion Protection. Where corrosion may be an issue on galvanized pipe, threaded connections, fittings or other materials, apply protective measures per Arizona Conservation Practice Standard 430, Irrigation Pipeline. Alternately, use drawn or hard temper type K or L copper pipe that complies with ASTM B88 in lieu of galvanized steel pipe.

Roof. When a roof is placed over the watering facility to provide shade or evaporation control, design the roof for site specific snow and wind loads (refer to local or state building code requirements). Ensure that the roof supports (posts or columns) are durable enough to withstand anticipated livestock and wildlife activities. Roofs may be inverted to provide a rainwater catchment area to augment water supplies.

Fixed steel or floating foam rubber covers can be used in open storage tanks to control

evaporation. Galvanized steel roofing can be used on either a wooden or a steel frame to cover an open tank. Make floating covers of low-density, closed cell (EPDM) synthetic rubber a minimum of 3/16 inch thickness for tank diameters up to 20 feet. Cut holes ½ inch diameter through the cover on 4 foot centers to allow water to drain through the cover and air to escape from below. Attach a 1-inch thick rubber ring around the edge of the sheet to prevent wind problems. Tie guy wires across the top of the tank to keep floating covers from blowing out of the tank when nearly full of water.

Install an 18 inch diameter (minimum) access manhole installed in the top of covered storage tanks

Wildlife Facilities. Because each facility is unique to species, habitat, topography and climate, watering facilities must be planned for a primary wildlife species and installation adapted to a specific site. Types of facilities include:

1. Rain Traps – impervious catchments with storage tank and drinking facilities.
2. Dugouts and pits supplied by surface runoff, stream diversion or spring flow.
3. Drinking troughs supplied from a pipeline.

Recommended water storage capacity (tank size) as determined by average annual rainfall:

Average Rainfall (inches)	Capacity Required (gallons)
0 to 8	750
8 or more	500

The design of a practice is the application of Field Office Technical Guide practice standards, practical experience and judgment in the development of a solution to the problem or the objective. All computations and decisions made during the design of a practice are to be checked by another qualified individual and appropriate notations made. Ensure that the design computations, calculations or analysis meet the following criteria:

1. Calculate design flow based on number of livestock served, days of storage, tank and trough sizes, conveyance capabilities, etc.
2. Determine material type, size, capacity or storage requirements.
3. Design fittings and appurtenance (valves, gates, vents, etc.) to withstand the maximum hydraulic, including transients, and static pressures.

4. Material estimates (material volume computations), includes estimates of foundation, facilities, fittings and appurtenances, concrete, and vegetative components.
5. Design subsidiary and applicable components in accordance with applicable conservation practice standards (i.e., pipelines designed to meet the requirements of Conservation Practice 516, Livestock Pipeline, etc.);

Installation and Basis of Acceptance. For construction that does not meet State, or Tribal criteria or requirements where deficient construction materials were used, NRCS may consider a waiver request for approval of construction after it has received a signed and sealed construction and/or material exemption from a licensed engineer in the state where the work is to be implemented. Required exemption shall be for installation of materials that do not meet minimum quality criteria as found in applicable Standards, Specifications, ASTM's, AWWA standards, etc.

For facilities that do not meet any of the limitations or criteria included in this standard, Provide individual designs prepared and/or approved by a registered engineer in the state where the work is to be implemented..

Additional Criteria in Federally Listed, Proposed or Candidate Species' Habitat Applicable To All Purposes

This practice is not likely to adversely affect listed species or their critical habitat if the following conservation measures are implemented.

- Provide off-site water supply for livestock and wildlife to maintain or improve streamside vegetation.
- Immediately clean any grease, oil, or other contaminant spills and remove from the site.
- Minimize soil and vegetation disturbance during practice installation. Remove only targeted species and leave native herbaceous layer undisturbed to allow for re-growth.
- Avoid planting of non native plants in disturbed areas. NRCS will consult with FWS if the planting of non native plants is unavoidable.
- Minimize upland soil compaction during practice installation by scheduling installation during dry periods.
- Use existing roads and limit cross country travel.

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- Where clearing of vegetation is determined to be necessary during planned construction or maintenance, limit the width of clearance to 25 feet maximum.
- Flag individuals of a listed plant species for protection during construction.
- Plan alignments for pipelines, fences etc. so as to avoid areas known to be occupied by listed species or where known habitat features such as burrows and nests are present.
- Do not demolish or remove existing vegetation, habitat structures, covers or nest materials located within a 250 feet wide undisturbed buffer.
- Locate water facilities 250 feet away from predator perches such as power lines, windmills, snags, etc.
- Conduct a pre-installation, pedestrian survey for wildlife that may be trapped within a temporarily fenced construction area. Trapped wildlife will be allowed to escape prior to construction.
- Complete practice outside the periods considered as critical for the covered species.
- Screen inlets and outlets to prevent non-native fish and amphibians from spreading into other habitats.
- Runoff from installed impervious surfaces will not drain into adjacent listed species aquatic habitat.
- Clean equipment used in practice implementation (vehicles, farm equipment, and tools) before entering and leaving project site to prevent the spread of non-native plant/animals or disease

Additional Criteria for Steel Rim Tank or Trough with Concrete Floor

Minimum Wall Thickness (Tank Height < 4 ft.):

Tank Dia (ft)	Black Sheet	Galvanized Sheet	Corrugated Sheet
≤ 30'	12 gauge	12 gauge	12 gauge
30.1'-40'	10 gauge	12 gauge	12 gauge

Tank Height (4 feet – 8 feet)

Tank Dia (ft)	Black Sheet	Galvanized Sheet	Corrugated Sheet
≤ 30'	10 gauge	12 gauge	12 gauge
30.1'-40'	3/16 inch	10 gauge	10 gauge

Minimum reinforcing steel requirements are as follows:

Diameter (feet)	Floor Area (sq. ft.)	Minimum Steel Requirements
Under 20	0 to 320	No. 4 on 10 ½" centers
20 to 30	320 to 710	No. 4 on 8" centers
30.1 to 40	710 to 1,260	No. 4 on 6 ½" centers

A site specific design prepared by a licensed PE is required if the tank height is more than 8 feet or the diameter is more than 40 feet,

Additional Criteria for Fiberglass Tanks and Troughs

Use fiberglass material and wall thickness per the provisions in NRCS AZ Construction Specification CS-AZ-86 Watering Facilities.

Additional Criteria for Freestanding Galvanized Steel Tanks and Troughs

The minimum wall thickness for galvanized steel (Black, Galvanized, or Corrugated Sheet) tanks or troughs shall be as follows:

Tank Height Less than 4 feet

Tank Diameter (ft)	Galvanized Sheet	Corrugated Sheet
Under 8	20 gauge	20 gauge
8 – 30	14 gauge	16 gauge
30.1-40	12 gauge	14 gauge

Tank Height (4 feet – 8 feet)

Tank Diameter (ft)	Galvanized Sheet	Corrugated Sheet
Under 30	12 gauge	12 gauge
30.1-40	12 gauge	10 gauge

A site specific design prepared by a licensed PE is required if the tank height is more than 8 feet or the diameter is more than 40 feet,

Additional Criteria for Polyethylene (PE) Tanks and Troughs

Use polyethylene material and wall thickness per the provisions in NRCS AZ Construction Specification CS-AZ-86 Watering Facilities.

Partial burial of a PE tank as a substitute for anchoring requirements, is not permitted. PE

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tanks specifically manufactured for underground applications may be allowed provided they are installed (buried) per manufacturer recommendations (manufacturer documentation is required for case file). See Purdue University Extension Publication PPP-77 for additional information.

Additional Criteria for Used Heavy Equipment Tire Trough.

Use Used Heavy Equipment Tire Trough material and wall thickness per the provisions in NRCS AZ Construction Specification CS-AZ-86 Watering Facilities.

Additional Criteria for Reinforced Concrete Tank and Trough

Troughs: Commercially manufactured precast concrete troughs are acceptable provided that manufacturer's product brochures, product specifications and data sheet, installation instructions etc. are properly documented and provided in the project folder.

Tanks: Rectangular reinforced concrete water storage tanks shall be designed in accordance with the most recent edition of the Midwest Plan Service (MWPS) publication MWPS-36, "Rectangular Concrete Manure Storages".

Circular reinforced concrete water storage tanks shall be designed in accordance with the most recent edition of the Midwest Plan Service (MWPS) publication TR-9, "Circular Concrete Manure Tanks". Designs in accordance with the Portland Cement Association (PCA) publication "Circular Concrete Tanks Without Pre-stressing, 1993 are also acceptable.

Additional Criteria for Used Steel (Gasoline) Tank and Trough

Refer to NRCS AZ Construction Specification CS-AZ-86 Watering Facilities for material properties and wall thickness criteria for used steel (gasoline) tank and trough.

CONSIDERATIONS

Design fences associated with the watering facilities to allow safe access and exit for area wildlife species (see *Arizona conservation practice Standard 382, Fence*). To protect bats and other species that access water by skimming across the surface, fencing material should not extend across the water surface. If fencing or anchoring across the water is necessary it should be made highly visible by

avoiding the use of single wire fences and using fencing materials such as woven wire, posts or by adding streamers or coverings on the fence.

For watering facilities that will be accessible to wildlife, give consideration to the effects the location of the facility will have on target and non-target species. Also consider the effect of introducing a new water source within the ecosystem in the vicinity of the facility. This should include things such as the concentration of grazing, predation, entrapment, drowning, disease transmission, hunting and expansion of the wildlife populations beyond the carrying capacity of available habitat.

Consider the following guidelines for materials commonly used for watering facilities.

Concrete	3000-psi compressive strength
Galvanized Steel	20-gage thickness (minimum)
Plastic	Ultraviolet Resistance
Fiberglass	Ultraviolet Resistance

Where water is supplied continuously or under pressure to the watering facility, consider the use of automatic water level controls to control the flow of water to the facility and to prevent unnecessary overflows.

Consider leaving adequate water for wildlife when livestock are not using the watering facility.

Consider the use of animal-activated devices to supply water, such as nose-valves. Freeze-proof drinkers, float boxes, or electric heaters may be used.

Consider installing multiple watering troughs when storage requirements for troughs exceed 1000 gallons and site conditions limit construction of a large single facility.

Watering facilities often collect debris and algae and should be cleaned on a regular basis. *Fish like goldfish and mosquito fish can be used to control algae and insect larvae, but should not be used near areas with native fish populations. Consult the Arizona Game and Fish Department before stocking these species.* Consider increasing the pipe sizes for inlets and outlets to reduce the chances of clogging. Maintenance of a watering facility can be made easier by providing a method to completely drain the watering facility.

Steep slopes leading to watering facilities can cause erosion problems from overuse by animals as well as problems with piping and valves from excess pressure. Choose the location of watering facilities to minimize these problems from steep topography

Design alternatives presented to the client should address resource and ecological concerns, economics and acceptable level of risk for design criteria as it relates to hazards to life or property.

Water Quality. *Livestock watering facilities will be located so they do not cause impairment of surface water quality in riparian areas and their associated streams, lakes, cienegas (wet meadows) and springs.*

Recommended water quality standards for livestock¹:

Total dissolved solids (TDS) (mg/L)	2,500
Calcium (mg/L)	500
Magnesium (mg/L)	250
Sodium (mg/L)	1,000
Arsenic (mg/L)	1.0
Bicarbonate (mg/L)	500
Chloride (mg/L)	1,500
Fluoride (mg/L)	1.0
Nitrate (mg/L)	200
Nitrite	n/a
Sulfate (mg/L)	500
Range of pH	8.0-8.5
Salinity threshold concentrations in PPM:	
Horses	6,435
Dairy cattle	7,150
Beef cattle	10,000
Sheep	12,900

¹Table 6-8, National Range and Pasture Handbook

Information on water sampling and testing is available from the Arizona Department of Health Services, Licensure and Certification Program at 602-364-0720 or from the ADHS website at: <http://www.hs.state.az.us/lab/license/env.htm>.

PLANS AND SPECIFICATIONS

Use Arizona drawing templates to the extent possible. These may be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions.

Construction plans shall include all components needed for the safe operation of the proposed improvements such as railing, fencing, or warning signs as appropriate. The plans shall address operations near existing utilities, trench excavations and any other items related to construction of the structure that may pose a safety risk to those involved.

Development of plans and specifications for watering facilities will be guided by the *National Engineering Handbook, Part 641, Drafting and Drawing*, and shall be in accordance with the *National Engineering Manual, Parts 541 and 542*. They shall provide the minimum information necessary to install the facility and show site specific details in accordance with this standard. Construction documents shall describe the requirements for applying the practice to achieve its intended use. As a minimum this shall include the following:

- Project location map, including section, township and range, North arrow, cooperator/owner acknowledgement and certification signature blocks, engineering job class (cover sheet).
- References that the owner/cooperator are responsible for all permits, rights-of-way, easements and the contact, coordination and location determination of any existing utilities or clearances (buried utility disclaimer).
- A map or aerial photograph showing the location of the facility, practice or system in reference to a known or established benchmark or reference point with the location, description and elevation clearly shown. Topographical features and/or controls shall be shown, showing tie in with existing or other planned practices.
- Field surveys and notes, soil investigations or geologic soil boring locations and soil classifications, earthwork or material estimates/quantities (foundation materials or requirements).
- System overview and layout (i.e., location and orientation of practice in relation to existing or planned facilities; identify the water source and type; connections to tanks or facilities; overflow or drain locations; vegetative requirements; construction/installation criteria, including State and Federal [OSHA] safety requirements, etc.).
- Section or detail drawings showing the facility (including material type, thickness, diameter, height, capacity), necessary appurtenances (such as foundations, pipes [inlet, outlet and

overflow] and valves), anchoring system, wildlife escape ramp, and stabilization of any areas disturbed by the installation of the facility.

- Appurtenance or fitting details (i.e., valves, air vents, manholes, drain valves, air release valves, pressure relief valves, backflow prevention, etc.) as required, for proper system functionality.
- Construction notes, details or specifications describing the installation of the facility to clarify a component and furnish instructions or site specific requirements,
- Use Arizona Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions. Fill in blanks and add items from the specifications to make them fit the job as needed.
- All designs completed by non-NRCS personal shall meet minimum State licensing board requirements and NRCS requirements and criteria as outlined in the *General Manual*, the *National Engineering Manual* (including *Arizona Supplements*), and the *National Engineering Handbook*.

ONCE ALL PARTIES HAVE ACCEPTED AND SIGNED THE PLANS AND SPECIFICATIONS, NO CHANGES SHALL BE MADE TO THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR APPROVAL OF NRCS.

OPERATION AND MAINTENANCE

Provide a site and project specific *Operation and Maintenance (O&M)* plan specific to the type of watering facility to be installed to the landowner, cooperator or operator responsible for operation and maintenance. The O&M plan shall be commensurate with the size and complexity of the project. The plan shall document needed actions, including reference to periodic inspections and the prompt repair or replacement of damaged components, and should provide specific instructions for operating and maintaining facilities to ensure they function properly and adequately throughout their expected life. As a minimum, include the following items in the plan:

- a monitoring schedule to ensure maintenance of adequate inflow and outflow;
- checking for leaks and repair as necessary;
- if present, the checking of the automatic water level device to ensure proper operation;

- checking to ensure that adjacent areas are protected against erosion;
- if present, checking to ensure the outlet pipe is freely operating and not causing erosion problems;
- A schedule for periodic *flushing and* cleaning of the facility.
- *Checking for corrosion and electrolysis and draining steel tanks and troughs as needed to remove sediment that can cause corrosion;*
- *Checking coatings on metal, fiberglass and plastic tanks and re-coating as needed to maintain effective ultraviolet resistance;*
- *Maintaining wildlife escape ramps;*
- *Maintaining appurtenance features (valves, piping, floats, drains, fences, etc.) in functional and protected conditions;*
- *Eradicate or otherwise remove all rodents or burrowing animals that have or may potentially damage any part of the delivery or application facilities. Immediately repair any damage caused by their activity;*
- *Immediately repair any damage resulting from vandalism, vehicles, livestock or wildlife;*
- *Preparing guidance for winter weather to allow for ice expansion without damage (if applicable);*
- *Checking and maintaining anchorage of freestanding tanks and troughs;*
- *Algae and iron sludge accumulation should be addressed in areas with known water quality problems. Chemicals such as copper sulfate and chlorine can be recommended as needed, as long as local rules and regulations are followed.*
- *Inspect for safety of people or animals using the area near the structure.*
- *Check all timber or lumber sections for decay and other damage, especially, sections in contact with earth or other materials. Promptly repair any damaged sections and apply protective coatings, as needed.*

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- National Planning Procedures Handbook

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