

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

WATERING FACILITY

(No.)

CODE 614

DEFINITION

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

PURPOSE

To store or provide designated access to drinking water for livestock or wildlife to:

- 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

Conservation Practices shall be designed on an individual basis to meet site conditions and functional requirements. They shall be part of an approved and overall engineering plan for irrigation, drainage, wildlife, recreation, channel improvement, or similar purposes.

Design and implementation of subsidiary components and/or structures shall meet all applicable Natural Resource Conservation Service (NRCS) conservation practice standards. The criteria for the design of any components not specifically addressed in NRCS practice standards or specifications shall be consistent with sound engineering principles and/or manufacturer recommendations.

Laws and Regulations. *Plan, design, and construct watering facilities to comply with all federal, state, tribal and local laws, rules, and 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.

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.

<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>	1-2
<i>Antelope</i>	1-2
<i>Elk</i>	5-8
<i>Quail (gallons/flock/day)</i>	1-2
<i>Wild turkey (gallons/flock/summer)</i>	500
<i>Mourning dove (gallons/flock/day)</i>	2-5
<i>Pheasant (gallons/flock/day)</i>	2-5

For additional information, 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.

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.

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>

¹Electric 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 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.

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:

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

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

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. 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, *railroad ties*, 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.

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.

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.

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.

Escape Features. For a site west of the 100th meridian (*includes all of Arizona*), 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
- 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.

See *Arizona Tech Note (TN), AZ-9-2 Biology-Escape Ramp, "Watering Facility Escape Ramp Design" for minimum design criteria.* Refer to *Water for Wildlife – A Handbook for Ranchers and Range Managers*, Bat Conservation International, for additional information on escape features.

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.

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.
- 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
31-39	10 gauge	12 gauge	12 gauge

Minimum Wall Thickness (Tank Height 4 feet – 8 feet):

Tank Dia (ft)	Black Sheet	Galvanized Sheet	Corrugated Sheet
≤ 30	10 gauge	12 gauge	12 gauge
31-39	3/16 inch	10 gauge	10 gauge

Minimum reinforcing steel requirements are as follows:

Diameter (ft)	Floor Area (sq. ft.)	Minimum Steel Requirements
< 20	0 to 320	No. 4 on 10 ½" centers
20 - 30	320 to 710	No. 4 on 8" centers
31 - 39	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 40 feet or greater.

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 (Galvanized, or Corrugated Sheet) tanks or troughs shall be as follows:

Tank Height Less than 4 feet

Tank Diameter (ft)	Galvanized Sheet	Corrugated Sheet
< 8	20 gauge	20 gauge
8 – 30	14 gauge	16 gauge
31-39	12 gauge	14 gauge

Tank Height (4 feet – 8 feet)

Tank Diameter (ft)	Galvanized Sheet	Corrugated Sheet
< 30	12 gauge	12 gauge
30-39	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 40 feet or greater.

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 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: Circular reinforced concrete water storage tanks shall be designed in accordance

with the Portland Cement Association (PCA) publication "Circular Concrete Tanks without Pre-stressing", 1993.

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

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.

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.

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

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

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.

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 livestock

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>.

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 that are guided by the *National Engineering Handbook, Part 650, are in accordance with the National Engineering Manual, Parts 541 and 542, and are in keeping with and according to this standard. As a minimum the plans and specifications shall be prepared for each specific site and include the requirements for applying the practice to achieve its intended purpose. As a minimum, include:*

- *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);*
- *If applicable, a map showing the location of the practice(s) 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 (backfill material);*
- A plan map or aerial photograph showing the location of the facility and any associated pipeline; also all system components, construction and installation criteria, including State and Federal [OSHA] safety requirements;
- 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;
- *Site specific construction notes, details or specifications describing the installation of the facility and components; and*
- *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 to the specifications to make them fit the job as needed.*
- 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.
- *If fences are installed, they shall be maintained to provide warning and/or prevent unauthorized human or livestock entry.*
- *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.*

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.

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:

REFERENCES

Brigham, William and Stevenson, Craig, 1997, Wildlife Water Catchment Construction in Nevada, Technical Note 397.

National Engineering Handbook, Part 650 Engineering Field Handbook, Chapters 5, 11 & 12, USDA Natural Resources Conservation Service.

National Range and Pasture Handbook, Chapter 6, Page 6-12, Table 6-7 & 6-8, USDA-Natural Resources Conservation Service.

National Research Council, 1996 Nutrient Requirements of Domestic Animals, National Academy Press.

Prescribed Grazing and Feeding Management for Lactating Dairy Cows”, New York State Grazing lands and USDA NRCS, January 2000).

Taylor, Daniel A. R. and Merlin D. Tuttle. Water for Wildlife, A Handbook for Ranchers and Range Managers. Bat Conservation International. 2012.

Tsukamoto, George and Stiver, San Juan, 1990. Wildlife Water Development, Proceedings of the Wildlife Water Development Symposium, Las Vegas, NV, USDI Bureau of Land Management.

Yoakum, J. and W.P. Dasmann. 1971. Habitat manipulation practices. Ch. 14 in Wildlife Management Techniques, Third Edition. Ed. Robert H. Giles, Jr. Pub. The Wildlife Society. 633 pp.