

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

**STRUCTURE FOR WATER CONTROL**

(No.)

**CODE 587**

**DEFINITION**

A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation or measures water.

**PURPOSE**

The practice may be applied as a management component of a water management system to control the stage, discharge, distribution, delivery or direction of water flow.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies wherever a permanent structure is needed as an integral part of a water-control system to serve one or more of the following functions:

- Convey water from one elevation to a lower elevation within, to or from a water conveyance system such as a ditch, channel, canal or pipeline designed to operate under open channel conditions. Typical structures: drops, chutes, turnouts, surface water inlets, head gates, pump boxes and stilling basins.
- Control the elevation of water in drainage or irrigation ditches. Typical structures: checks, flashboard risers and check dams.
- Control the division or measurement of irrigation water. Typical structures: division boxes and water measurement devices.
- Keep trash, debris or weed seeds from entering pipelines. Typical structure: debris screen.
- Control the direction of channel flow resulting from tides and high water or back-flow from flooding. Typical structures: tide and water management gates.

- Control the water table level, remove surface or subsurface water from adjoining land, flood land for frost protection or manage water levels for wildlife or recreation. Typical structures: water level control structures, flashboard risers, pipe drop inlets and box inlets.
- Convey water over, under or along a ditch, canal, road, railroad or other barriers. Typical structures: bridges, culverts, flumes, inverted siphons and long span pipes.
- Modify water flow to provide habitat for fish, wildlife and other aquatic animals. Typical structures: chutes, cold water release structures and flashboard risers.
- Provide silt management in ditches or canals. Typical structure: sluice.
- Supplement a resource management system on land where organic waste or commercial fertilizer is applied.
- Create, restore or enhance wetland hydrology.

**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.*

*All pertinent safety codes (OSHA, ADOSH) and manufacturer's recommendations shall be followed in the installation and operation of the equipment.*

**Laws and Regulations.** *Design, installation, and operation of all structures for water control shall 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.*

#### **Cultural Resources and Wildlife**

**Habitat.** *Impact to cultural resources, wetlands and Federal and state protected species shall be evaluated and avoided or minimized to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National policy, General Manual (GM) Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH), National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).*

#### **General Criteria Applicable to All Purposes**

*Vegetation complying with Arizona Conservation Practice, Critical Area Planting, standard (code 342) shall be established on all disturbed earth surfaces. In some places, temporary vegetation may be used until permanent vegetation can be established. Where soil, climate or site specific conditions preclude establishing permanent vegetation, other protective means such as mulches or gravels, shall be used.*

*The structure shall be fenced, if necessary, to protect the vegetation. If the area is used for livestock, the structures, earthfill, and other areas should be fenced as necessary to protect the structure. Near urban areas, fencing may be necessary to control access and exclude traffic that may damage the structure or to prevent serious injury or death to trespassers.*

*Structures shall not be installed that have an adverse effect on septic filter fields.*

*The water level upstream of water control structures shall not be raised on adjacent landowners without their permission.*

*Structures shall be placed on firm foundations to the limits and grades (elevations) shown on the drawings or as staked in the field.*

*Excavation for structures shall be accomplished to the line and grades as shown on the drawings and to sufficient lengths and widths to allow forming, bracing and tying of embedded items. Where practical, the cutoff trench and wingwall trench shall be carefully excavated to allow the excavated trench walls to be brought to grade by compacting fill material to the same density as the undisturbed earth. All water or mud shall be removed from the excavated area prior to placement of the structure.*

**Concrete Structures.** *Concrete shall be as designed for the anticipated loading and specified in the applicable Arizona construction and material specifications or under the General Construction Notes criteria.*

**Gates.** *All materials (gates, valves, fittings, appurtenances, etc.), labor, equipment and installation (anchor bolts, frames, etc.) shall be per manufacturer recommendations or applicable Arizona Construction and Material specifications*

**Metal Fabrication – Cleaning, Painting and Fabrication.** *All materials (metal work, fasteners, paint, etc.) labor, equipment, and installation (fabrication, cleaning, painting, etc.)*

shall be per manufacturer recommendations and applicable (NRCS, ASTM, etc.) specifications.

Metal structures and structural components shall consist of ASTM A36 steel or 6061-T6 aluminum alloy. Structural shapes shall conform to:

<u>Steel</u>	
Carbon steel bars	A575, Grade M 1015 to Grade M 1015
Carbon steel sheets	A569
Carbon steel strip	A569
Zinc-coated carbon	
Steel sheets	A526
<u>Aluminum</u>	
Standard structural shapes	B308
Extruded structural pipe and tube	B429
Extruded bars, rods, shapes and tube	B221
Drawn seamless tubes	B210
Rolled or cold-finished bars, rods and wire	B211
Sheet and plate	B209

Steel less than 1/8 inch thick (11 gauge) shall be hot dipped galvanized in accordance with ASTM A123.

Exposed steel surfaces shall be protected from corrosion by galvanizing, painting, or other approved coatings.

**Short Pipe Conduit.** New or high quality used corrugated steel, corrugated plastic, smooth plastic, steel or concrete pipe may be used. Used materials shall be free from defects, rust, corrosion, and shall be watertight. All materials (pipe, fittings, appurtenances, etc.), labor, equipment and installation shall be per manufacturer recommendations or applicable (NRCS, ASTM, etc.) specifications. Pipe connections must be watertight.

Short Pipe Conduits may be used in conjunction with irrigation culverts (i.e., under roadways), for sections less than 100-feet in length and as conveyance systems used with Arizona conservation practice 636, Water Harvesting Catchment, up to 300-feet in length.

Pipe conduits used in grade stabilization structures shall meet the requirements as stated in Arizona conservation practice standard 378, Pond.

Polyethylene, Type III, Class C, Category 4 or 5 conforming to ASTM D1248 and D3350 and AASHTO M252 or M294, Type S may be used for grade stabilization structures with a hydraulic head of 10 feet or less.

**Rubble Masonry.** All materials (rock, masonry units, concrete building blocks, mortar, etc.), labor, equipment, and installation (placement, finishing, curing, etc.) shall be per manufacturer recommendations and applicable (NRCS, ACI, ASTM, etc.) specifications.

Rock riprap shall consist of hard, durable, and well graded angular to sub-angular rock conforming to the gradation shown on the drawings or as specified on the Arizona Construction and/or Material specifications. Rock riprap and source shall be approved prior to commencement of work.

**Timber Structures.** All materials (timber, hardware, fasteners, etc.), labor, equipment and installation (framing, etc.) shall be per manufacturer recommendations or applicable Arizona Construction and Material specifications.

Wood structures or structural components shall consist of dense western fir, pine, cedar or redwood. Fir and pine in contact with the ground or subject to frequent wetting and drying shall be pressure treated.

Materials for pressure treated wood shall consist of water borne arsenical compounds such as ACA (ammoniac copper arsenate), ACZA (ammonia copper zinc arsenate), and CCA (chromate copper arsenate). These compounds are recommended because of their low leaching potential.

**Other materials.** *Fiberglass and plastic structures shall be installed according to manufacturer's recommendations.*

### **Investigations, Surveys and Design**

**Criteria.** *Documentation requirements will be as outlined below, in addition to the documentation requirements of the practice components used in the system.*

*Preliminary site assessment or investigation to determine the complexity of the problem, type and location(s) of proposed structures, availability of land and/or watershed and may include:*

1. *Review of soil borings or geological investigation, to determine soil conditions, depths, water table, restrictive layers, etc. Documentation shall include the following, at a minimum:*
  - a. *Classification by the Unified Soil Classification System (SM, CL, etc.), texture (silty sand, lean clay, etc.).*
  - b. *Soil physical (bearing capacity) and chemical properties or limitations.*
  - c. *Determination of foundation materials and borrow source or disposal area.*
  - d. *Corrosion potential (metal pipe), resistivity readings or published data.*
2. *Verify appropriate state or local laws for permitting and approval requirements and notify landowner of his/her responsibilities.*
3. *Verification or certification of used materials (if any).*

*To adequately plan and layout this practice, a detailed topographic survey is required, that adequately details:*

1. *Site topography, as needed to show the physical features of the site, including existing features/practices, field elevations, location of any utilities or markers, etc.*
2. *Centerline profiles and cross sections to establish the centerline or location of the structure, including the upstream and downstream profiles and the cross sections at maximum fill section(s).*
3. *If applicable, a permanent benchmark(s) shall be set and described. Preferably, the elevations and coordinates should be based*

*on a local (assumed) or coordinate system (State or grid) and clearly stated on the plan. Datum may be in the form of Northing and Easting coordinates, or Longitude and Latitude.*

*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. Design computations, calculations or analysis shall meet the following criteria:*

1. *Record drainage areas, grades, dimensions, site conditions and related hydraulic design data.*
2. *Hydraulic analysis and determinations (capacity of ditch, channel or structure), for pipe structures, check hydraulics for all flow conditions (pipe, weir, and orifice).*
3. *Structural analysis (concrete and steel reinforcement requirements), stability, buoyancy, etc.*
4. *For conduits or culverts, perform hydraulic data computations/analysis to determine system performance (friction/head loss; maximum, minimum and actual operating pressures; hydraulic and static grade lines; flow ranges; hydraulic transients, etc.). Record all pipe sizing (material, number, diameter, pressure rating or wall thickness, location and quantities, depth of cover, markings), and supporting calculations with applicable references.*
5. *Construction material estimates (material volume computations), including estimates of earthwork, pipe, concrete, rock, vegetative components, geotextile and erosion control fabrics, or other appurtenances.*
6. *Subsidiary and applicable components shall be designed in accordance with applicable conservation practice standards (i.e., pipelines shall meet the requirements of Conservation Practice 614, Watering Facilities, etc.).*

**Installation and Basis of Acceptance.** *For construction that does not meet State, OSHA, 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. 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.*

*Contractors performing work under this practice shall abide by all Federal, State or Tribal laws or criteria, and must be licensed by the state board of technical registers where the work is being implemented.*

## CONSIDERATIONS

When planning, designing, and installing this practice, the following items should be considered:

- Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation and ground water recharge.
- Potential for a change in the rate of plant growth and transpiration because of changes in the volume of soil water.
- Effects on downstream flows or aquifers that would affect other water uses or users.
- Effects on the field water table to ensure that it will provide a suitable rooting depth for the anticipated crop.
- Potential use for irrigation management to conserve water.
- Effect of construction on aquatic life.
- Effects on stream system channel morphology and stability as it relates to erosion and the movement of sediment, solutes and sediment-attached substances carried by runoff.
- Effects on the movement of dissolved substances below the root zone and to ground water.
- Effects of field water table on salt content in the root zone.
- Short term and construction-related effects of this practice on the quality of downstream water.

- Effects of water level control on the temperatures of downstream waters and their effects on aquatic and wildlife communities.
- Effects on wetlands or water-related wildlife habitats.
- Effects on the turbidity of downstream water resources.
- Existence of cultural resources in the project area and any project impacts on such resources.
- Conservation and stabilization of archeological, historic, structural and traditional cultural properties when appropriate.

*In highly visible public areas and those associated with recreation, careful considerations should be given to landscape resources. Landforms, structural materials, water elements, and plant materials should visually and functionally complement their surroundings. Excavated material and cut slopes should be shaped to blend with the natural topography. Exposed concrete surfaces may be formed to add texture or finished to reduce reflection and to alter color contrast.*

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

**Flow Measurement.** *A water measurement device or structure (flow meter, ramp flume, weir, etc.) may be installed to manage water applications and for on-going evaluation of system performance. Manufacturer's recommendations or sound engineering guidance must be followed regarding size, placement, orientation, etc.*

## PLANS AND SPECIFICATIONS

*Use Arizona standard drawings 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 installing structures for water control will be guided by the *National Engineering Handbook, Part 650, the Engineering Field Handbook, Chapter 5*, and shall be in accordance with the *National Engineering Manual, Parts 541 and 542*, and shall be in keeping with this standard, prepared for each specific site and shall describe the requirements for properly applying the practice to achieve its intended purpose.

The plan shall specify the location, grades, quantities, dimensions, materials, and hydraulic and structural requirements for the individual structure. The following minimum criteria shall also be addressed:

- 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 (special requirements for foundation preparation and treatment);
- System overview and layout (i.e., location and orientation of structure in relation to existing or planned facilities; requirements for diverting water, dewatering the site, and/or soil disposal; borrow source; vegetative requirements; construction/installation criteria,

State and Federal [OSHA] safety requirements, etc.), including size and types, necessary appurtenances and/or structures;

- If applicable, plan and profile views of the proposed conduit or culvert, including location, size, type and pressure class; original ground surface; invert elevations and grades [slope]; hydraulic grade lines; maximum static pressure/head; changes in pipe size and ratings; depth of cover for each pipe diameter; pipe trench/backfill requirements; pipe joint requirements; fittings and/or appurtenances (i.e., drains, vents, valves, outlets, pressure relief, thrust blocks outlet, turnouts, etc.);
- Sectional or detail views of all system components (i.e., dimensions and details; reinforcing steel schedules, etc.) and appurtenances, as required, for proper system functionality;
- Specifications for the construction of metal, wooden, or rock grade stabilization structures shall describe installation requirements on the drawings in sufficient detail to achieve the intended purpose;
- 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 or delete 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

An operation and management (O&M) plan shall be provided to and reviewed with the land manager. The plan shall be site specific, document needed actions, provide specific instructions for operating and maintaining the system, including reference to periodic inspections and the prompt repair or replacement of damaged component to ensure that practices perform adequately throughout their expected life and include, but not be limited to the following: Structures will be checked and necessary maintenance, including removal of debris, shall be performed after major storms and at least semi-annually. Water level management and timing shall be adequately described wherever applicable. The plan shall include provisions to address the following, as a minimum:

- Inspect the structure(s) periodically to ensure that the structure functions as planned.
- Inspect structures for deterioration and capacity. Remove any blockage of trash and debris that could affect flows through the structure. Repair or replace materials that have deteriorated, including rock used for outlet protection.
- Determine and eliminate causes of settlement or cracks in the earthen sections and repair damage.
- Periodically remove sediment if storage is less than the expected accumulation during the design life.
- Periodic cleaning and re-grading of collection facilities (ditches, pipes, structures) to maintain proper flow lines and functionality
- Prevent surface ponding by grading area adjacent to structures to remove depressions.
- Make sure that all structural drains are functional.
- Repair spalls, cracks and weathered areas in concrete surfaces.
- Repair or replace rusted or damaged metal and paint.
- Check all valves, gates, and other appurtenances for proper functioning. If worn or damaged, repair or replace following the manufacturer's recommendations.

- Replace weathered or displaced rock riprap to constructed grade.
- 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.
- Limit livestock usage to periods that permit use without damage to the structures and appurtenances.
- Inspect for safety of people or animals using the area near the structure.
- Inspect vegetation on all earthfills. Mow when vegetative growth becomes excessive. Repair and/or fertilize damaged vegetation as needed.
- 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, or livestock.
- Install and maintain fences to prevent livestock access where excessive trampling of banks or ditch may occur, and do not allow livestock near equipment during operation.

## REFERENCES

- USDA-NRCS, National Engineering Manual (NEM), 2<sup>nd</sup> Edition
- General Manual, Title 420-Part 401, Title 450-Part 401, Title 190-Parts 410.22 and 410.26
- National Engineering Handbook - Part 650, Engineering Field Handbook, Chapter 1 – Engineering Surveys; Chapter 2 – Hydrology; Chapter 3 – Hydraulics; Chapter 4 – Elementary Soils Engineering; Chapter 5 – Preparation of Engineering Plans; Chapter 6 – Structures; Chapter 11 – Ponds and Reservoirs; Chapter 13 – Wetland Restoration; and Chapter 17 – Construction & Construction Materials
- National Engineering Handbook (NEH), Part 630 – Hydrologic Engineering; Part 634 – Hydraulic Engineering; Part 636 – Structural Engineering; Part 639 – Erosion Control Engineering; Part 531 – Geology; Part 652 –

*Irrigation Guide; USDA, Natural Resources  
Conservation Service*

- *USDA-NRCS, TR-62 – Engineering Layout,  
Notes, Staking and Calculations; TR-77, Design  
& Installation of Flexible Conduits*
- *National Environmental Compliance  
Handbook*
- *National Planning Procedures Handbook*
- *National Cultural Resources Handbook*
- *USDA NRCS, Engineering Design Standards  
– Far West States*