NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

PIPELINE

(Feet)

CODE 516

DEFINITION

Pipeline having an inside diameter of 8 inches or less.

PURPOSE

To convey water from a source of supply to points of use for livestock, wildlife, or recreation.

CONDITIONS WHERE PRACTICE APPLIES

Where it is desirable or necessary to convey water in a closed conduit from one point to another.

CRITERIA

Capacity. For pipelines, which are supplying water to a watering facility for grazing livestock, the following must be considered in determining the capacity required. The watering facility will be in demand approximately two hours in the morning and two hours in the afternoon by the grazing livestock. One half of the total daily requirement will need to be supplied during the morning and one half during the afternoon peak usage periods. The minimum capacity of the pipeline (design flow rate), *at the delivery point*, for this purpose in gallons per minute (gpm) shall be determined as follows:

$$\text{Gpm} = \frac{\text{no.of head} \times \frac{1}{2} \text{ daily water requirement}}{2 \text{ hr.} \times 60 \text{ min./hr.}}$$

Table 1 will be used to determine the minimum daily water requirements for various kinds of livestock.

Table 1 – Minimum Daily Water Requirements For Livestock

Kind of Livestock	Daily Water Requirements gallons per head per day
Beef Cattle & Horses	12
Dairy Cattle (drinking only)	
Lactating	25
Non-lactating	15
Swine	4
Sheep and Goats	2

For recreation areas, provide an adequate water capacity for all planned uses. Typical examples are drinking water, fire protection, showers, flush toilets, and irrigation of landscaped areas.

Additional water capacity will be provided for wildlife when applicable.

The minimum size pipe installed under this practice shall be ¾ inch nominal diameter.

The source pressure less head losses shall result in a residual pressure that is ≥5 psi at the design flow rate. The source pressure is defined as the pressure at the beginning of the pipeline where the pipeline connects to the water source. The residual pressure is the pressure at the end of the pipeline at the final delivery point.

Head losses including static and friction losses shall be computed. Friction head losses shall be no less than those computed by the Hazen-Williams equation, using a roughness coefficient, C, equal to 150 for plastic pipe and 100 for steel pipe.

Sanitary protection. If water from the pipeline is to be used for human consumption, applicable state and local regulations shall be met. Water used for this purpose must also meet the requirements of the Louisiana Department of Health and Hospitals for materials and installation.

Any pipeline, which has a municipal water supply line or ground water (i.e. well) as its source shall have a back flow prevention valve, installed in accordance with all federal, state, and local laws and requirements.

Pipe. All pipe must withstand the pressure it will be subjected to, including hydraulic transients, internal pressures and external pressures. As a safety factor against surge or water hammer, the working pressure should not exceed 72% of the pressure rating of the pipe and the design flow velocity at system capacity should not exceed 5 ft/sec. If either of these limits is exceeded, special consideration must be given to flow conditions and measures must be taken to adequately protect the pipeline against surge.

Steel pipe shall meet the requirements of AWWA Specification C-200.

Plastic pipe shall conform to the requirements of the following ASTM specifications, as applicable:

D 1527 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80

D 1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

D 2104 Polyethylene (PE) Plastic Pipe, Schedule 40

D 2239 Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

D 2241 Polyvinyl Chloride (PVC), Pressure-Rated Pipe (SDR)

D 2282 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)

D 2447 Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter

D 2513 Thermoplastic Gas Pressure Pipe, Tubing and Fittings

D 2737 Polyethylene (PE) Plastic Tubing

D 2672 Joints for IPS PVC Using Solvent Cement

D 3035 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter

AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches through 12 inches

AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, ½ inch through 3 inches

Plastic pressure pipe fittings shall conform to the following ASTM specifications, as applicable:

D 2464 Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

D 2466 Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

D 2467 Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

D 2468 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40

D 2609 Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe

D 2683 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

D 3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

D 3261 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

Solvents for solvent-welded plastic pipe joints shall conform to the following ASTM specifications, as applicable:

D 2235 Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings

D 2564 Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings

D 2855 Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings

Rubber gaskets for pipe joints shall conform to the requirements of ASTM F477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

Drainage. Valves or unions shall be installed at low points in the pipeline so that the line can be drained as needed. Check valves shall be installed as needed to protect groundwater quality or maintain a full pipeline.

Vents. Design shall provide for entry and removal of air along the pipeline, as needed, to prevent air locking or pipe collapse. If parts of the line are above the hydraulic gradient, periodic use of an air pump may be required. Provisions shall be made for pressure relief, air relief and vacuum relief as needed to protect the pipeline.

Joints. Watertight joints that have strength equal to that of the pipe shall be used. Couplings must be of material compatible with that of the pipe. If they are made of material susceptible to corrosion, provisions must be made to protect them.

Physical Protection. Steel pipe installed above ground shall be galvanized or shall be protected with a suitable protective paint coating, including a primer coat and two or more final coats.

Plastic pipe installed above ground shall be resistant to ultraviolet light throughout the intended life of the pipe.

All pipes shall be protected from hazards presented by traffic, farm operations, freezing temperatures, fire, thermal expansion and contraction. Reasonable measures should be taken to protect the pipe from potential vandalism.

Pipelines will be buried below normal cultivation depth or at least 12 inches below normal ground, whichever is greater. The excavated trench will be uniform in depth with no abrupt changes in elevation. The fill over the pipe shall be friable soil that is free of roots, gravel, or other objects that could damaged the pipe. The fill shall be uniformly compacted over the entire length of the pipe to eliminate voids and excessive settlement.

When a pipeline crosses a stream or channel, it will be protected by either burying the line a minimum of 18 inches below the bottom of the stream or channel, or supporting it throughout its entire exposed length. When possible, keep an exposed pipeline above the flowline of the stream or channel. When the pipeline will cross within the flow of the stream or channel it will be protected from damage from floating debris or excessive stream or channel velocities by the use of a casing or other approved method.

Corrosion Protection. Provide protection for metal pipelines as described in NRCS Conservation Practice Standard 430 Irrigation Pipeline.

Vegetation. Disturbed areas shall be established with vegetation or otherwise stabilized as soon as practical after construction. Seedbed preparation, seeding, fertilizing, and mulching shall conform to NRCS Conservation Practice Standard 342, Critical Area Planting.

Visual resources. The visual design of pipelines and appurtenances in areas of high public visibility shall be carefully considered.

CONSIDERATIONS

Safety. Pipelines present a threat to the safety of people both during installation and during operation.

- Address trench safety in design and construction
- Provide protection for people from valve blows
- Require pressure ratings of valves and appurtenances to match pipeline ratings

Economic. Economics can be a major factor in designing a pipeline as follows:

- Pipe sizing considerations based upon type of pipe,
- Pipe material based upon expected life of practice,

Effects of water quality and quantity. The quantity and quality of water is a prime consideration when designing a pipeline as shown below:

- On the water budget, especially on infiltration and evaporation,

- On downstream flows or aquifers that would affect other water uses or users,
- Of controlled water delivery on the temperatures of water resources that could cause undesirable effects on aquatic and wildlife communities,
- On wetlands or water-related wildlife habitats, and
- On the visual quality of water resources.

Base the pipe material selection on exposure considerations (such as soil resistivity, pH, sunlight, and traffic).

The Langelier Saturation Index and related indices may be a factor in determining type of material to use for a pipeline.

Consider installing pressure relief valves upstream of all valves and ends of lines.

In-line valves should be equipped with geared operators. When lever operated valves are used, perform an analysis for potential surge/water hammer assuming an instantaneous valve closure.

Design pipelines to facilitate the conservation, use, and management of soil and water resources.

Pipelines installed below the ground surface should have a soil plan describing soil reconstruction of disturbed soil during and after pipeline installation so origin soil productivity is restored after pipeline installation

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

The source and use of the water must be considered in the design of the pipeline. For pipelines, which supply water for livestock, the layout of the system should be planned to provide water in a manner, which facilitates good grazing distribution.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for pipeline that describe the requirements for applying the practice according to this standard. As a minimum the plans and specifications shall include:

- A plan view of the layout of the pipeline
- Typical cross sections of the pipeline installation.
- Profile of the pipeline.

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

OPERATION AND MAINTENANCE

An O&M plan specific to the type of installed pipeline shall be provided to the landowner. The plan shall include, but not be limited to, the following provisions:

- Opening/closing valves to prevent excessive water hammer;
- Filling at the specified rate requirements;
- Inspecting and testing valves, pressure regulators, pumps, switches and other appurtenances;
- Maintaining erosion protection at outlets;
- Checking for debris, minerals, algae and other materials which may restrict system flow; and
- Draining and/or providing for cold weather operation of the system.

REFERENCES

Engineering Field Handbook
210-VI-NEH-650.03
No.PB85-175164/AS
EFM-1D
EFH Chapter 3, Hydraulics
07/01/1984

Structural Design of Flexible Conduits
210-VI-NEH-636.52
NEH Part 636 Chapter 52