

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

PIPELINE

(Ft.)

CODE 516

DEFINITION

Pipeline having an inside diameter of eight 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

Laws and Regulations. This practice must conform to all federal, state, and local laws and regulations. Laws and regulations of particular concern include those involving water rights, land use, land disturbed by construction, pollution control, property easements, wetlands, preservation of culture resources, and endangered species.

Livestock Water Distribution. Stock watering facilities should be located so the travel distance between forage and dependable water is not more than one mile in gentle relief or one-half mile in rough relief. Location of the facilities shall be planned in conjunction with the prescribed grazing plan.

Capacity - Livestock Water. For livestock water, the installation shall provide the minimum capacity shown in Table 1. Higher flow rates may be needed to meet grazing plan goals.

On large extensive systems, peak use based on maximum flow from all outlets may not be needed. In these systems, capacity may be based on the maximum number of outlets used and livestock served at any one time.

Table 1. - Minimum Water Supply Per Animal

Animal	Water, Gal./Day
Beef Cattle:	
Cows lactating with calves	18
Bred, Dry Cows and Heifers	15
400 lb. Growing Cattle	10
600 lb. Growing Cattle	13
800 lb. Growing Cattle	15
Bulls	19
600 lb. Finishing Cattle	15
800 lb. Finishing Cattle	18
1000 lb. Finishing Cattle	21
1200 lb. Finishing Cattle	23
Dairy Cattle:	
1400 lb. Dry Cow	16
1700 lb. Dry Cow	17
Lactating, 20 lb. Milk	18
Lactating, 60 lb. Milk	25
Lactating, 80 lb. Milk	28
Lactating, 100 lb. Milk	33
200 lb. Heifer	3
400 lb. Heifer	6
800 lb. Heifer	11
1200 lb. Heifer	15
Swine:	
Boars & Gestating Sows	3
Lactating Sows	5
15 – 50 lb. Feeder	0.75
50 – 120 lb. Feeder	1
120 lb. to Market	2
Horses:	
Mature	18
Weanling	8
Sheep & Goats:	
Rams & Dry Ewes	2
Ewes with lambs	3
Feeder Lambs	1.5
Suckling Lambs	0.3
Birds:	
100 Chickens	9
100 Turkeys	15

Capacity – Domestic Use. System capacity must be adequate for all planned uses. Normal minimum design capacity shall be 10 gallons per

minute (gpm) and 360 gallons per day per headquarters or dwelling unit. For larger headquarters and/or multiple users, minimums are given in Tables 2 and 3.

Number of Dwellings	Minimum Gallons per Minute (gpm)
1	10
2	18
3	24
4	30
5	35
10	65
14	84

Equipment	Minimum Gallons per Minute (gpm)
Automatic waterers Cattle, hogs, sheep (20-40 head/bowl)	2
Poultry (100-150 layers)	1
Cleaning hose	10
Outdoor hydrant for uses other than firefighting	5
Fire fighting hydrant	20

(Suggested reference: Midwest Plan Service Structures, Environment Handbook (MWPS-1).

Capacity – Recreation. System capacity shall be adequate for all planned uses. Typical examples are drinking water, fire protection, showers, flush toilets, and irrigation of landscaped areas.

Capacity – Wildlife. Additional capacity will be provided for planned purposes. Daily water consumption may be calculated at one gallon per day per 100 pounds of body weight, or specific amounts based on species.

Sanitation Protection. If water from the pipeline is to be used for human consumption, applicable state and local regulations shall be met. Pipe conveying water for human consumption shall bear the National Sanitary Foundation Seal.

To prevent contamination or flow reversal on systems used for human consumption, double (or two single) spring-loaded check valves shall be used on all outlets or branch lines.

Pipe Size. Minimum nominal pipe diameter shall be three-quarter inch. Where deposits in pipelines occur, minimum pipe diameter shall be one and a half inch.

For design purposes, friction head losses shall be no less than those computed by using the roughness coefficients in Table 4:

Pipe Type:	Steel/Iron	Thermoplastic
Manning's N	0.012	0.009
Hazen Williams C	110	150

Pipe. All pipe must withstand the pressure it will be subjected to, including hydraulic transients, internal pressures, and external pressures.

Plastic pipe pressure rating normally is based on a water temperature of 73.4°F. Factors for adjusting allowable working pressure for higher water temperature are given in Table 5.

As a safety factor against surge or water hammer, the working pressure should not exceed 72 percent of the pressure rating of the pipe including any reductions for water temperature. Pipe pressure rating should be at least 100 pounds per square inch. Design flow velocity at system capacity should not exceed five ft./sec. If any of these limits are exceeded, an engineer must prepare a detailed hydraulic analysis.

Table 5. Pressure rating factors for PVC and PE pipe for water at elevated temperatures

Degrees F	PVC	PE
73.4	1.00	1.00
80	.88	.92
90	.75	.81
100	.62	.72
110	.50	.63
120	.40	.60
130	.30	.55
140	.22	.50

Note: To obtain reduced pipe pressure rating, multiply the normal pipe pressure rating by the appropriate factor from table.

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

Plastic pipe shall meet ASTM D1785 or D2241 for polyvinyl chloride (PVC).

HDPE pipe material used shall be PE 3408 as per ASTM D3350 and pipe shall be manufactured in accordance with ASTM D2239 Polyethylene (PE) Plastic Pipe (SIDR-PR) based on Controlled Inside Diameter or, ASTM D3035 Polyethylene (PE) Plastic Pipe (SDR-DR) based on Controlled Outside Diameter. The pipe shall be Class C Polyethylene pipe compound as described in ASTM D2239 or D3035.

Equivalent plastic pipe, solvents, rubber gaskets, and fittings conforming to other ASTM or AWWA specifications may also be used as appropriate.

Material used in plastic pipe installed above ground (or otherwise exposed) must meet HDPE material requirements, contain a minimum of two percent carbon black and have a pressure rating of at least 160 psi.

Drainage. Provisions shall be made to drain pipelines that are installed above the frost line. Check valves shall be installed as needed to protect water quality or maintain a full pipeline.

Vents. Designs shall provide for entry and removal of air along the pipeline as needed to prevent air locking or pipe collapse. Provisions

shall be made for pressure relief, air relief, and vacuum relief as needed to protect the pipeline.

An air release valve or manually operated valve or hydrant shall be located on the first summit from the water source. Additional air release valves should be considered at summits in the line where an accumulation of air could cause reduction in flow. Additional venting is normally needed for artesian systems which contain gas, summits with extremely low operating heads, and summits collecting air from multiple laterals or long reaches. Special care shall be taken in the pipeline layout to eliminate undulating grade changes.

Automatic vacuum relief valves may be needed at high points to prevent pipe collapse when drainage occurs in systems in steep terrain. These valves may also be needed to allow effective drainage of systems that will be drained to prevent freezing or for other purposes.

Periodic siphon priming by water or air vacuum may be required for pipeline sections installed above the hydraulic gradient.

Joints. Watertight joints that have a 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.

Use of gasketed joints is preferred over solvent weld joints on thermoplastic pipelines one and one-half inch diameter and larger for increased thermal expansion capabilities.

Other appurtenances. Check valves may be required in pipelines delivering water to points at higher elevations to prevent flow reversal.

Flow restrictor valves should be used on group pipelines to control flow to outlets and prevent periods of no flow on sections of the pipeline. They may also be used to maintain design flows.

Valves used to control flow may be smaller than the nominal size of the pipeline. Size shall be based on allowable velocity and headloss.

Suitable screens, strainers, or other protection should be considered to protect valves and other appurtenances that are prone to plugging.

Protection. When steel pipe is used, interior protective coatings shall be provided in accordance with NRCS Conservation Practice Standard Irrigation Water Conveyance Pipeline,

Minimum Burial Depth for Pipelines

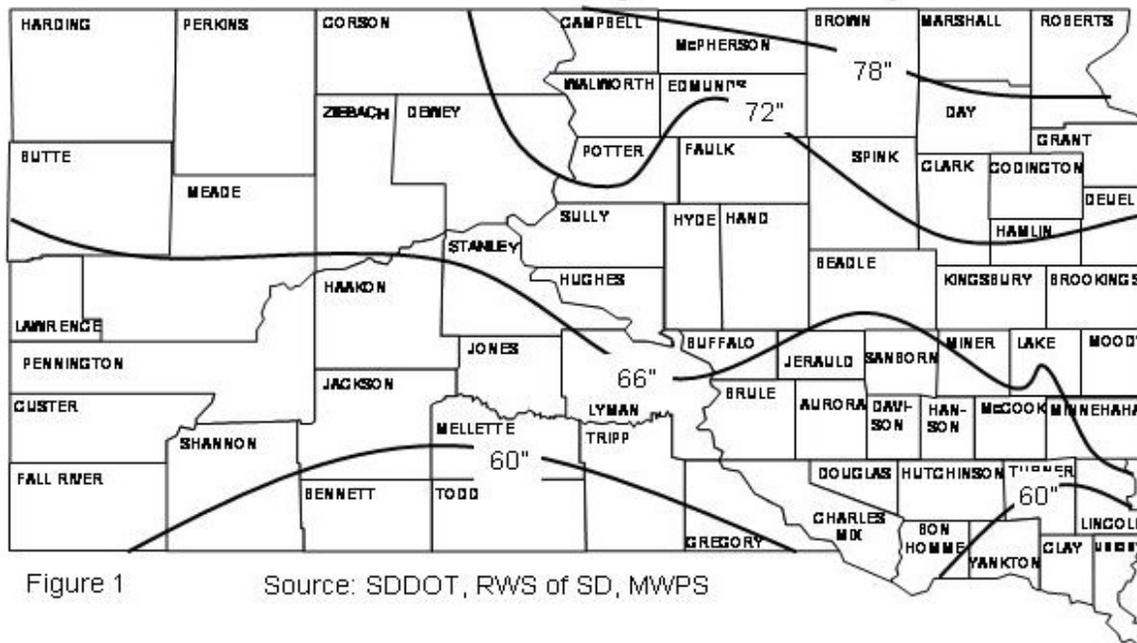


Figure 1

Source: SDDOT, RWS of SD, MWPS

Steel (430FF). If a coal-tar enamel protective coating is needed for corrosion protection, the coating shall meet the requirements of AWWA Specification C-203.

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.

All pipe shall be buried to protect it from hazards such as traffic, farm operations, freezing temperatures, thermal expansion, and contraction, ultra-violet degradation, and sharp rocks. Reasonable measures should be taken to protect

the pipe from vandalism. Shallow burying or covering the pipe with six inches of soil may be used for seasonal use pipelines.

Exception: Above ground pipe meeting HDPE material requirements may be used if one of the following conditions is met:

Pipeline is to be used in conjunction with the Practice Standard Prescribed Grazing (528) where each pasture will be grazed two or more times per year with the livestock in the each pasture no more than two consecutive weeks at a time. Pipe must be protected by placing under fence lines and shallow burying at gates, roads, or other crossings; or

Pipe length is less than 2,640 feet; or

Pipe length may be longer than 2,640 feet if required because of shallow soil, rock, cultural resource avoidance, slope stability, or other site specific reasons throughout the majority of the length of the pipeline.

Pipelines used for water supply during freezing weather must be installed below average frost line or be otherwise protected from freezing.

Seasonal use pipelines that will be subject to freezing shall be drained prior to winter.

Normal frost free pipeline burial depth is shown in Figure 1.

For pipelines that will flow constantly (from springs, artesian wells, etc.), minimum uninsulated burial depth for winter is one and one-half feet.

Plastic pipe may expand or contract 1.4 inches per 100 feet of pipe length for each 10°F change in temperature. Rigid pipes must include "slip" (rubber gaskets, etc.), joints, and flexible pipes must be "snaked" to accommodate these length changes.

Water Bars. Water bars (flow barriers) should be installed across the trench on long slopes or other locations where runoff water may cause erosion.

Vegetation. Disturbed areas not expected to naturally revegetate shall be vegetated or otherwise stabilized as soon as practical after construction. Vegetation establishment shall

conform to NRCS Practice Standard Critical Area Planting (342).

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

CONSIDERATIONS

Consider location of water supply outlets to avoid concentration of livestock near homes, recreation areas, streams, lakes, and other areas needing protection.

Above ground pipelines may be moved to a point where the original design may not be valid. The pipeline owner operator shall be instructed that moving the pipe may change the performance of the pipeline and lead to the failure of the pipe.

PLANS AND SPECIFICATIONS

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

The Engineering Field Handbook, Chapter 5, will guide the development of plans.

OPERATION AND MAINTENANCE

An Operation and Maintenance (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.

Changing the location of above ground pipe will change the performance of the pipe. A redesign of the pipeline at the new proposed location will be required.

REFERENCES

Engineering Field Handbook

Unibell "Handbook of PVC Pipe"