Pipeline (Feet) 516

DEFINITION

Pipeline having an inside diameter of 8 inches (203mm) or less.

PURPOSES

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.
- Where additional water is required to provide erosion control and/or to maintain or improve water quality.
- To conserve the water supply, or for reasons of sanitation.

CRITERIA

General. When used for conveyance of livestock water, this practice shall facilitate proper pasture use by improving distribution of grazing over all parts of the pasture, meeting the water requirements of livestock with adequately distributed water supplies.

Capacity. For supplying livestock water, the installation shall have a capacity to provide at least the gallons per head per day listed in Table 1.

For recreation areas, the water capacity shall be adequate 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.

Sanitary Protection. If water from the pipeline is likely to be used for human consumption, the requirements of the state health department for materials and installation must be met.

When a pipeline serving livestock is supplied from a utility that provides water for human consumption, an approved method for eliminating backflow will be installed.

Pipe. All pipe must be designed to withstand the pressure it will be subjected to, including hydraulic transients, internal pressures, and external pressures. Where pipeline velocities exceed 1.5 feet per second and valve closure or frequent on/off cycling is possible, maximum system pressure shall not exceed 90 percent of the pipe's pressure rating or the design shall be based on a surge analysis. If either of these limits are 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 specified in ASTM-A-120 or in AWWA Specification C-200. Galvanized steel pipe shall meet the requirements specified in ASTM A 53 or in AWWA Specification C202.

Plastic pressure pipe shall be suitable for underground use.

The 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 2740 Polyvinyl Chloride (PVC) Plastic Tubing
- D 2662 Polybutylene Water Service Pipe
- D 2666 Polybutylene Water Service Pipe (Copper pipe size)
- D 2672 Joints for IPS PVC Using Solvent Cement

TABLE 1 - Minimum Daily Livestock Water Requirements

Livestock	Drinking Water Quantity * gals/day (liters/day)		**Maximum** Water Spacing miles (kilometers)	
	Conventional Grazing System	Prescribed Grazing System	Rough Relief ** (strongly sloping, rolling, moderately steep, and hilly; generally > 15% slope)	Gentle Relief ** (nearly level, gently sloping, and undulating)
Beef Cow	20 (76)	15 (57)	0.5 (0.8)	1 (1.6)
Cow & Small Calf	20 (76)	15 (57)	0.5 (0.8)	1 (1.6)
Horses & Mules	20 (76)	15 (57)	0.5 (0.8)	1 (1.6)
Sheep & Goats	4 (15)	2 (8)	0.5 (0.8)	1 (1.6)
Dairy Cow	25 (95)	20 (76)	0.5 (0.8)	1 (1.6)
Hog	2 (8)			

* Daily water consumption for livestock classes not listed may be calculated at one gallon per day per 100 lbs. of body weight.

** In a prescribed grazing system, less distance should be used.

- D 3035 Polyethylene (PE) Plastic Pipe (SDR-PR), Based on Controlled Outside Diameter
- AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches (102mm) through 12 inches (305mm)
- AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch (12.7mm) through 3 inches (76mm)

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 2465 Threaded Acrylonitrile-Butadiene-Styrene (ABS) 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 2469 Socket-Type Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 80
- D 2609 Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
- D 2610 Butt Fusion Polyethylene (PE) Plastic Pipe Fittings, Schedule 40 (for IPS Pipe)
- D 2611 Butt Fusion Polyethylene (PE) Plastic Pipe Fittings, Schedule 80 (for IPS Pipe)
- D 2683 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- D 3036 Socket-type Polyvinyl Chloride (PVC) Plastic Line Couplings
- 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.

Pipe Protection. 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.

Water shall not be allowed to freeze in pipelines or appurtenances. Protection from freezing may be achieved by draining pipe and fittings during freezing

conditions, insulating, burying below frost depth, or heating.

If cold weather operation is planned, bury the pipe below frost depth (4 foot minimum (1.2m)) or make provisions to drain the pipe. Freeze-resistant pipe is manufactured to allow expansion of the pipe during periods of cold weather. However, parts of the pipeline, such as float valves, connectors, etc., may not be freeze-proof. Install shutoff valves in various locations along the pipeline to allow easy repair of broken appurtenances and damaged pipe.

Pipelines shall have at least 1 1/2 feet (0.5m) of cover unless shallower cover is specified. If shallower covering is specified, there shall be provisions to protect the line from damage by livestock, vehicle traffic, excessive pipe movement, and other hazards.

PE pipe used in above ground systems will be made of materials with 2 percent carbon black to provide ultraviolet resistance. Pipe of this type is suitable for seasonal use. Protect pipe designed for above ground use (freeze-resistant pipe) by placement outside perimeter fences and under cross fences, by shallow burying, or rolling up for the winter months. Winterizing of these pipeline systems shall be done prior to freezing temperatures. This can be done by blowing out the system to remove any water within the pipeline or equivalent method.

When steel pipe is used, interior protective coatings shall be provided in accordance with NRCS Conservation Practice Standard 430FF, Steel Pipe. 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.

Pipe Size. Stockwater mainline shall be sized to accommodate potential future expansion of the system. Minimum pipe size shall be 1 1/4 inch (32mm) nominal diameter, unless justification for a smaller diameter is documented by an engineering analysis or allowed under low pressurized systems.

Overflow pipes for watering facilities shall be a minimum diameter of 1/2 inch (12.7mm) larger than the delivery pipe or 2 inch (51mm) diameter, whichever is larger.

In areas where mineral or biological deposition in pipelines has proven to be a problem, the pipe shall be a minimum of 1/2 inch (12.7mm) larger than otherwise required.

Low Pressure Systems. These systems are gravity flow or pumping systems where operating pressure does not exceed 15 psi (103 kPa) and length of the pipe is less than 1,500-feet (458m). The minimum pipe size shall be 3/4 inch (19mm) diameter.

Flow from spring development may need a larger pipe size. See Chapter 12, Engineering Field Handbook (EFH). Pipe capacities for gravity systems are given in Chapter 12, EFH. Pipe capacity is based on Manning's equation. Low-pressure systems may also be designed based on Hazen-Williams equation. Low pressure pumping systems such as nose pumps, solar pumps, etc. shall be considered if operating pressure does not exceed 15 psi (103 kPa).

Pump Pressure System. Pump pressure system is any system that has working pressures greater than 15 psi (103 kPa). Pump pressure systems shall be designed by an engineer, or approved engineering procedure. The design shall meet site conditions. Pipe friction loss per lineal foot shall be based on Hazen-Williams equation.

Pipeline Appurtenances. Pipeline design shall include details for all needed air release valves, air-and-vacuum valves, pressure relief valves, pressure reducer valves, check valves, vents, drain valves, hydrants, surge chambers, pressure tanks, drains, access enclosures, water source hookups, and other appurtenances.

Maximum pressure shall not exceed the pressure rating of pipe and appurtenances at any point in the 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 pipeline 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.

Air Valves - Portions of Pipeline Operating Pressures Greater Than 10 psi (69 kPa). Pipelines where static or operating pressures exceed 10 psi (68 kPa) shall have continuous acting air-release valves,

or manually operating air vents at all significant high points in the line. A significant high point is defined as a high point in the pipeline more than 10-feet (3m) above an adjacent low point.

Automatic valves performing high volume air-and-vacuum release and continuous acting air-release functions shall be installed at the first summit of any height (greater than 5-feet (1.5m)) in the pipeline.

Except for the first air valve in the line, a manually operated air vent, such as a frost-free hydrant, may be used as an alternative to an automatic air valve. The operation and maintenance plan shall be specific concerning when and how to operate manual valves.

The need for vents or air-and-vacuum valves to exhaust large volumes to air during pipeline filling shall be evaluated on a case-by-case basis. This type of venting is usually needed at the end of pipelines and at major summits in the pipeline.

Air Valves and Vent - Portions of Pipeline Operating at 10 psi (69 kPa) or Less. Pipe shall be laid to grade such that all summits are well defined and can be vented. An open vent or continuous action air-release valve shall be installed at all summits (between 5 feet (1.5m) and 10 feet (3m) in elevation) in the pipeline.

Air valves shall only be used where pressures are high enough at summits to operate a valve properly.

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.

Drainage shall be provided on above ground installations.

Where the pipeline is buried below probable frost depth (4 feet minimum (1.2m)), drains may be omitted.

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.

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 Michigan NRCS Standard Critical Area Planting (342).

Use vegetation adapted to the site that will accomplish the desired purpose. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provide management of existing invasive species; and minimize the economic, ecological, and human health impacts that invasive species may cause. If native plant materials are not adaptable or proven effective for the planned use, then non-native species may be used. Refer to the Field Office Technical Guide, Section II, Invasive Plant Species for plant materials identified as invasive species.

CONSIDERATIONS

Potential effects of installation and operation of the pipeline on cultural, historical, archeological, or scientific resources at or near the site need to be considered in planning.

Vegetation should be allowed to grow over the pipe to shade it from the sun. Where fire is to be used as a management tool, specific provisions must be made to protect the pipe from fire.

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

The impact of water available at remote sites is a factor in keeping livestock out of streams and lakes, with the resulting reduction in bank erosion, sediment yield, and the direct deposit of manure in water courses.

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.

Support data documentation requirements are as follows:

- Inventory and evaluation records
  - CONS-6 notes or special report

- Survey notes, where applicable
  - Design survey
  - Construction layout survey
  - Construction check survey
- Design records
  - Physical data, functional requirements, and site constraints, where applicable
  - Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
  - Location map
  - "Designed by" and "Checked by" names or initials
  - Approval signature
  - Job class designation
  - Initials from pre-construction conference
  - As-built notes
- Construction inspection records
  - CONS-6 notes or separate inspection records
  - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

OPERATION AND MAINTENANCE

An Operation and Maintenance 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:

- The plan shall provide specific instructions for operating and maintaining the system to ensure that it functions properly.

- It shall also provide for periodic inspections and prompt repair or replacement of damaged components or erosion.

- 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

NRCS - Engineering Field Handbook.

NRCS - National Range and Pasture Handbook.