NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

PUMPING PLANT FOR WATER CONTROL

(No.)

CODE 533

DEFINITION

A pumping facility installed to transfer water for a conservation need.

PURPOSE

Provide a dependable water source or disposal facility for water management.

CONDITIONS WHERE PRACTICE APPLIES

Wherever water must be pumped to accomplish a conservation objective, which may include but is not limited to one of the following:

- To provide a water supply for such purposes as irrigation, recreation, livestock, or wildlife.
- To maintain critical water levels in swamps, marshes, open water, or for newly constructed wetlands and ponds.
- To transfer wastewater for utilization as part of a waste management system.
- To provide drainage by the removal of surface runoff water or groundwater.

CRITERIA (all purposes)

Design, installation, and operation of a pumping plant shall comply with all federal, state, and local laws, rules and regulations. All Ohio drainage and water laws shall be adhered to in the planning and construction of this practice

The efficiency of units, type of power, quality of building, automation and accessories installed, shall be in keeping with the value and importance of the system, needs and desires of the sponsoring group or individual, and shall accomplish the conservation and environmental objectives.

Criteria for the design of components not addressed in NRCS practice standards shall be consistent with sound engineering principles

Pump requirements. Capabilities, range of operating heads, and general class and efficiency of equipment shall be determined by appropriate technical means. Size and number of pumps and their performance shall be determined on the basis of system conservation requirements in order to meet the intended purpose. Total head shall be determined for critical operating conditions, taking into account all hydraulic losses. Automatic controls shall be included as required.

The pumping plant shall be designed as an integral part of the water or wastewater management system.

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Pump

Pump selection for the installation will be done by the pump manufacturer after the required pump capacity, static head, and length of discharge pipe have been determined.

Power units. Power units shall be selected on the basis of availability of fuel or power costs, operating conditions, conservation needs, and objectives, including the need for automation. The power unit shall be matched to the pump and be capable of operating the pump efficiently and effectively within the range of operating conditions. The horsepower requirements, pump efficiency and total head on the pump shall be computed.

Suction and discharge pipes. The size of suction and discharge pipes shall be based on a hydraulic analysis, operating cost, and compatibility with other system components. The arrangement and length of discharge pipe shall be based on the need for recovery of head through siphoning action, and for delivery of water in keeping with conservation and environmental objectives. Gates, valves, pipe connections, discharge bays, and other protective devices shall be installed, as needed, for satisfactory pumping plant operation.

Federal, State, and local laws and regulations concerning back flow prevention shall be followed when pumping from wells or when irrigation lines are used for chemigation. Similarly, backflow prevention requirements of public water systems must be followed when these water systems are used for water supply.

Building and accessories. The design of the pumping plant and associated housing, if required, shall consider accessibility for equipment maintenance and repairs, and the need for protecting equipment from the elements, vandalism, and fire. The appearance of the plant shall be compatible with the surrounding environment, as applicable.

Foundations shall be designed to safely support the loads imposed. Sheet piling or other measures shall be used, as required, to prevent piping beneath the foundation.

Pumps may be mounted in the open, on piling or concrete foundations, in a well or pit, or by other appropriate means.

Suction bays (or sumps) shall be designed to conform to the hydraulic characteristics established by the pump manufacturer.

The discharge bay or connection with the distribution system shall meet hydraulic and structural requirements. Provisions for repair or removal of pumps and engines shall be provided. Trash racks shall be provided, as needed, to exclude debris and trash from the pump.

All structural features and equipment shall provide adequate safety features to protect workers and the public from injury.

Additional criteria when the purpose is to provide drainage by the removal of surface runoff water or groundwater

Drainage Coefficient

The entire watershed draining to the pump, including seepage must be used in arriving at the amount of water to be pumped.

For subsurface drainage only, the minimum capacity shall equal the capacity of the drainage system as determined, using charts and tables from Chapter 14 of the Engineering Field Handbook for Conservation Practices, plus 20 percent.

For surface and subsurface water, the minimum capacity shall be 1 inch in 24 hours.

Pump Capacity

The capacity of the pump shall be determined using the following formula:

Q = C x A x 0.042 x 450 x F
Q = Capacity in gallons per minute
C = Drainage coefficients in inches in 24 hours
A = Watershed area in acres
0.042 = Factor to change 1 inch in 24 hours to cubic feet per second per acre.
450 = Factor to change cubic feet per second to gallons per minute
F = 1.2 for subsurface drainage only
= 1.0 for surface drainage, or surface drainage plus subsurface drainage.

Pump Storage – Automatic Operations

Active water storage in the ditch, sump, or pump bay shall be provided to supply the pump. The number of cycles per hour used in designing the pump system shall be 12 cycles per hour or the manufacturer's recommendation, whichever is less. The active storage volume will be determined using the following formula:

$$\frac{S}{12} = \frac{Qp}{6} \qquad \frac{A}{12} = \frac{Qp}{6xd}$$

$$\frac{S}{10} = \frac{Qp}{5} \qquad \frac{A}{10} = \frac{Qp}{5xd}$$

$$\frac{S}{8} = \frac{Qp}{4} \qquad \frac{A}{8} = \frac{Qp}{4xd}$$

S = Active storage volume in cubic feet; formulas for 12, 10, and 8 cycles per hour.
Qp = Pump capacity in gallons per minute
A = Active storage area in square feet; formulas for 12, 10 and 8 cycles per hour.
d = Depth of storage in feet or the difference in water level elevations where the pump will start and stop operations

Pump Storage – Manual Operation

Active water storage for manual operation must be greater than for automatic operation. It depends on the number of times the operator desires to start the pump. When the number of starts is limited to two per day, the following formula may be used to estimate the active storage desirable.

Active Storage in cu. ft. = Pump Capacity in GPM x 24

Additional criteria when the purpose is to transfer wastewater:
Pumps utilized for the transfer of wastewater or manure shall be sized to transfer material at the required system head and flow rate determined by the waste management plan. The pump type shall be based on the consistency of material being pumped and manufacturer's recommendations.

CONSIDERATIONS

When planning this practice the following items should be considered, as applicable:

- Effects on downstream flows or aquifer recharge volumes.
- Effects on existing wetland hydrology.
- Effects on surface and ground water by leaked or spilled fuels and lubricants.
- Secondary containment of spilled fuel for water quality as may be required by federal and state laws or regulations.
- Protection of system components from “natural" events such as floods.
- Maintaining and improving visual resources and habitat for wildlife where applicable

PLANS AND SPECIFICATIONS

Plans and specifications for constructing pumping plants shall be in compliance with this standard and describe the requirements for properly installing the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An Operation and Maintenance plan specific to the facilities installed shall be prepared for use by the landowner or responsible operator. The plan shall provide specific instructions for operating and maintaining facilities to ensure the pumping plant functions properly. The plan shall include provisions to address the following, as a minimum:

- Inspection or testing of all pumping plant components and appurtenances, as applicable.
- Proper start-up procedures for the operation of the pumping plant.
- Routine maintenance of all mechanical components (power unit, pump, drive train, etc.) in accordance with the manufacturer's recommendations.
- When applicable, the power unit, fuel storage facilities and fuel lines should be frequently checked for fuel or lubricant leaks and repaired as needed.
- Periodic checks and removal of debris as necessary from trash racks and structures to assure adequate capacity reaches the pumping plant.
- Periodic removal of sediment in suction bays to maintain design capacity and efficiency.
- Inspect and maintain anti-siphon devices, if applicable.
- Routinely test and inspect all automation components of the pumping plant to assure they are functioning as designed.
- Inspect and maintain secondary containment facilities, if applicable.
- Periodic inspection of all safety features to ensure they are in place and functional.
- Prior to retrofitting any electrically powered equipment, electrical service must be disconnected and the absence of stray electrical current verified.