

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

PUMPING PLANT

(No.)

CODE 533

DEFINITION

A facility that delivers water at a designed pressure and flow rate. Includes the required pump(s), associated power unit(s), plumbing, appurtenances, and may include on-site fuel or energy source(s), and protective structures.

PURPOSE

This practice may be applied as a part of a resource management system to achieve one or more of the following:

- Delivery of water for irrigation, watering facilities, wetlands, or fire protection
- Removal of excessive subsurface or surface water
- Provide efficient use of water on irrigated land
- Transfer of animal waste as part of a manure transfer system
- Improvement of energy use efficiency
- Improvement of air quality

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where conservation objectives require the addition of energy to pressurize and transfer water to maintain critical water levels in soils, wetlands, or reservoirs; transfer wastewater; or remove surface runoff or groundwater.

CRITERIA

Legal Criteria

Design, installation, and operation of a pumping plant shall comply with all Federal, state, and local laws, rules and regulations. 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 and Georgia Policy.

General Criteria Applicable to All Purposes

The efficiency of units, type of power, quality of building, automation features, and other accessories installed shall be in keeping with the economic and environmental value of the system to accomplish the conservation objectives.

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

Pump requirements. Design flow rate, range of operating heads, and pump type shall meet the requirements of the application.

Selection of pump materials shall be based on the physical and chemical qualities of the material being pumped and manufacturer's recommendations. Size pumps utilized for the transfer of wastewater or manure to transfer material at the required system head and flow rate determined by the waste management plan. Base the pump type on the consistency of material being pumped and manufacturer's recommendations.

Power units. Pump power units shall be selected based on the availability and cost of power, operating conditions, need for automation, and other site specific objectives. Power units shall match the pump requirements and be capable of operating efficiently and effectively within the planned range of conditions. The power unit shall be sized to meet the horsepower requirements of the pump, including efficiency, service factor, and environmental conditions.

Electric power units may include line power, photovoltaic panels, and wind or water powered turbines.

Electrical wiring shall meet the requirements of the National Electrical Code.

Variable Frequency Drives. The owner shall inform the electric power provider that a Variable Frequency Drive will be installed prior to installation, and be responsible for following requirements of the electric power provider.

The Variable Frequency Drive shall be protected against overheating.

The Variable Frequency Drive control panel shall provide the read out display of flow rate or pressure.

Photovoltaic panels. The photovoltaic array shall be sized based on average data for the location and the time of year pumping occurs, according to manufacturer's recommendations. The photovoltaic array shall provide the power necessary to operate the pump at the design flow rate, with the appropriate service factor considering a minimum panel degradation of 10 years. Fixed arrays shall be oriented to receive maximum sunlight. Panel tilt angle shall be based on the location latitude and time of year for power requirements. Panels shall be mounted securely to resist movement by environmental factors.

Windmills. Pumping units shall be sized according to pumping lifts and capacities, as specified by the manufacturer. The diameter of the mill shall be based on the stroke length and the average wind speed. Towers shall be proportioned to the mill diameter, with adequate height for efficient and safe operation.

Water powered pumps (hydraulic rams).

Pumping units shall be sized according to flow rate, lift, fall, and efficiency. Bypass water shall be returned to the stream or storage facility, without erosion or impairment to water quality.

Suction and discharge pipes. To prevent cavitation, suction and discharge pipes shall be designed to account for suction lift, net positive suction head, pipe diameter and length, minor losses, temperature, and altitude. The size of suction and discharge pipes shall be based on hydraulic analysis, operating costs, and compatibility with other system components.

Appurtenances such as gate valves, check valves, pressure reducing valves, pressure gages, pipe connections, and other protective devices, shall be included to meet the requirements of the application.

Screens, filters, trash racks, or other devices shall be installed as needed to prevent the intake of sand, gravel, debris, or other objectionable material into the pump. Intake screens shall be designed according to applicable Federal and State guidelines, to avoid entrainment or trapping of aquatic organisms.

Backflow prevention devices shall be included according to Federal, State, and Local laws, to prevent contamination of water sources connected to the pumping plant. Backflow prevention check valves are required in all pumping plant installations by Georgia NRCS.

Buildings and accessories. Pumps shall be securely mounted on a solid foundation such as pilings or concrete. Foundations shall be designed to safely support the loads imposed by the pumping plant and appurtenances. Sheet piling or other measures shall be used, as required, to prevent piping beneath the foundation.

Where buildings are necessary to protect the pumping plant, provisions shall be included for adequate ventilation and accessibility for equipment maintenance, repairs, or removal.

Suction bays or sumps shall be designed to prevent the introduction of air at the intake.

The discharge bay or the connection to the distribution system shall meet all hydraulic and structural requirements.

Structures and equipment shall be designed to provide adequate safety features to protect operators, workers, and the public from potential injury. Drive shaft covers shall be required on all exposed rotating shafts.

Additional Criteria Applicable to Providing the Efficient Use of Water on Irrigated Land

Provisions for the connection of flow and pressure measurement devices shall be included in power plant system design.

Additional Criteria Applicable to the Improvement of Energy Use Efficiency

For fossil fuel or electrical grid power sources, pumping plant installations shall meet or exceed the Nebraska Pumping Plant Performance Criteria. Refer to the NRCS National Engineering Handbook, Part 652, National Irrigation Guide, Table 12-2.

Additional Criteria Applicable to the Improvement of Air Quality

Replacement pumping plants shall have lower total emissions of oxides of nitrogen and fine particulate matter, compared to the unit being replaced.

New, replacement, or retrofitted pumping equipment shall utilize a non-combustion power source, or cleaner-burning technologies or fuels.

CONSIDERATIONS

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

- The removal of surface water by a pumping plant can affect downstream flows or aquifer recharge volumes. Consider the potential long term impacts downstream of the pumping plant.
- If using a pumping plant to remove surface water or ground water flowing into a wetland, consider the potential impacts on existing wetland hydrology.
- The operation and maintenance of a pumping plant can involve the use of fuels and lubricants that when spilled may adversely affect surface or ground water quality. Consider measures to protect the environment from potential spills. In some cases, secondary containment of spilled fuel may be required by Federal and State laws or regulations.
- Pumping plants are often constructed in flood-prone areas or can be subject to other unexpected natural events. Consider how the pumping plant may be protected from extreme natural events and the consequences of damage or failure.
- Include protective sensors to detect low or stopped flow, or pressures that are too high or too low.
- The visual appearance of buildings or structures associated with the pumping plant should be compatible with the surrounding environment.

- When installing new or replacing existing combustion equipment, non-combustion and renewable energy sources, such as solar, wind, and water, should be considered.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing pumping plants shall be in accordance with this standard and describe the requirements for properly installing the practice to achieve its intended purpose. As a minimum, the plans and specifications shall include the following:

- A plan view showing the location of the pumping plant in relationship to other structures or natural features.
- Detail drawings of the pumping plant and appurtenances, such as piping, inlet and outlet connections, mounting, foundations, and other structural components.
- Written specifications that describe the site specific details of installation.

OPERATION AND MAINTENANCE

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

- Inspection or testing of all pumping plant components and appurtenances.
- Proper start-up and shut-down procedures for the operation of the pumping plant.
- The rpm range for normal operation and associated operating pressures.
- Routine maintenance of all mechanical components (power unit, pump, drive train, etc.) in accordance with the manufacturer's recommendations.
- Procedures to protect the system from damage due to freezing temperatures.
- When applicable, procedures to frequently check the power unit, fuel storage facilities, and fuel lines, for leaks and repair as needed.
- Periodic checks and removal of debris as necessary from trash racks and structures, to assure adequate flow capacity reaching the pumping plant intake.
- Periodic removal of sediment in suction bays, to maintain design capacity and efficiency.
- Inspection and maintenance of anti-siphon devices, if applicable.
- Routine test and inspection of all automated components of the pumping plant, to assure the proper functioning as designed.
- Inspection and maintenance of secondary containment facilities, if applicable.
- Periodic inspection of all safety features, to ensure proper placement and function.
- Prior to retrofitting any electrically powered equipment, electrical service must be disconnected and the absence of stray electrical current verified.

COMMON ASSOCIATED PRACTICES

GA NRCS Conservation Practice Standard, Water Well (642)
GA NRCS Conservation Practice Standard, Waste Transfer (634)
GA NRCS Conservation Practice Standard, Drainage Water Management (554)

REFERENCES

NRCS National Engineering Handbook, Part 652, National Irrigation Guide

NATURAL RESOURCES CONSERVATION SERVICE
GEORGIA
OPERATION AND MAINTENANCE REQUIREMENTS
PUMPING PLANT
CODE 533

Land Owner/Operator _____

County _____ SWCD _____ Farm/Tract No. _____

Prepared By _____ Date _____

OPERATION AND MAINTENANCE ITEMS

A properly operated and maintained pumping plant is an asset to the farm. This practice was installed to transfer water for a conservation need. Estimated life span of this installation is at least _____ years. The life of this system can be assured and usually increased by developing and carrying out a systematic operation and maintenance program.

This practice will require periodic maintenance and may also require operational items to maintain satisfactory performance. Your operation and maintenance program includes:

- Inspect or test all pumping plant components and appurtenances routinely following manufacturer's recommendations to ensure proper function. Routinely test and inspect all automated components. The power unit, fuel storage facilities and fuel lines should be frequently checked for fuel or lubricant leaks. Remove debris as necessary from trash racks and other structures to assure adequate capacity reaches the pumping plant. Periodic removal of sediment in suction bays may be required to maintain design capacity and efficiency. Inspect and maintain anti-siphon devices. Inspect and maintain any secondary containment facilities. Repairs must be made promptly.
- Maintain all grounding rods and wiring of electrical equipment in good working condition.
- Proper start-up procedures for the operation of the pumping plant shall be followed. Refer to manufacturer's recommendations as needed.
- Routine maintenance of all mechanical components (power unit, pump, drive train, etc.) shall be in accordance with the manufacturer's recommendations. Prior to retrofitting any electrically powered equipment, electrical service must be disconnected and the absence of stray electrical current verified.
- Conduct a periodic inspection of all safety features to ensure they are in place and functional. All fences, railings, and/or warning signs shall be maintained to provide warning and/or prevent unauthorized human or livestock entry. Protect the area from being damaged by agriculture machinery, vehicles, or livestock. Locks on well covers and any fencing around the pumping plant are strongly recommended.
- Check all pump bases and mountings for durability and ability to hold the pump in place without vibration. Repair when necessary.

Quality Assurance Plan (QAP)

Landowner/Project: _____ Engineering Job Class^{1/}: _____
 Service Center: _____ County _____
 Conservation Practice(s) & Engineering Job Class Included in this Job: Pumping Plant, 533
 QAP Prepared By: _____ Job Approved By _____
 Est. Construction Start Date: _____ Est. # Site Visits: _____ Est. # QA Hours: _____

^{1/}The engineering job class for a given job will is based on the most restrictive element or conservation practice included in the job.

Certification Statements

I certify that the items, intensity, and inspection requirements listed in Table 1 is adequate quality assurance (QA) for this project.

Approver of Engineering Plans (Signature)

Date

I certify that _____ has the experience necessary to perform the construction inspection for the items shown in Table 1 and has the qualifications as shown in Table 2 for this project. I support this individual as the construction inspector and will allow the individual adequate staff time to perform the QA inspection for this project.

Line Supervisor (Signature)

Date

I certify that I have reviewed the engineering plans and specifications and fully understand the QA requirements of the subject project. I will contact the Project Approver if I have any questions or concerns regarding the QA activities and will notify and obtain approval from the Project Approver if there is need to make any changes to the plans and/or specification during construction.

QA Inspector (Signature)

Date

Quality Assurance Plan (QAP)

Table 1 - Items to be Inspected and Verified

Items ^{2/}	Intensity ^{3/}	Inspection Requirements ^{4/}
Preconstruction Meeting	B	Meet with landowner and contractor, discuss project, sign and date documents; provide all applicable documents including drawings and specifications.
Permits	B	Verify that the landowner has obtained all required permits prior to construction.
Utility Notification	B	Verify that landowner has contacted utility companies prior to construction for underground utility location.
Manufacturers Data	B	Verify pump purchased meets design criteria.
Pollution Control	P/F	Inspect to verify that any construction debris has been disposed of properly.
Quantity Computation	P/F	Perform quantity computations for payment purposes as per the payment schedule and specifications. Quantity computations shall be recorded on standard NRCS forms or NRCS-ENG-523A and <u>checked</u> and <u>initialed</u> by a second person.
Photographs	P	Take photographs of the site, before, during and after construction.
As-built Drawings	P	Keep drawings current during construction and prepare as-built drawings within 14 days of final construction.
Survey Notes	P	All construction checks taken during pumping plant installation shall be recorded on loose leaf survey notes (form ENG 28, 29) or in a bound survey field book.

^{2/} Include items that require quality assurance.

^{3/} Intensity of inspection: B – Before Construction, NA – Not Applicable, C – Continuous, P – Periodic, F– Final. The inspector shall immediately notify the approver of the job if continuous inspection is required and cannot be performed with available staff.

^{4/} Inspection requirements shall be to the degree necessary to certify that the project is installed in accordance with the plans and specifications.

Table 2 – Required QA Qualifications for Construction Inspector

QA Qualifications
1. Appropriate EJAA for the engineering job class for construction of the conservation practices to be installed.
2. Knowledgeable of the following references: <ul style="list-style-type: none"> a) National Engineering Manual (NEM) Part 512 – Construction b) National Engineering Handbook, Part 645, Construction Inspection

STATEMENT OF WORK Pumping Plant (533) Georgia

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

Licensure

Georgia Code Title 43, Professions and Businesses, Chapter 15, Professional Engineers and Land Surveyors, regulates the practice of engineering in Georgia and provides the definition of engineering in Chapter 15 §2(11). Technical assistance for this engineering conservation practice may be considered the practice of engineering and subject to licensure requirements of Georgia Code Chapter 15. It is the responsibility of the individual providing technical assistance to determine and verify whether this practice is subject to Georgia Code Chapter 15.

DESIGN

Deliverables:

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
 - a. Practice purpose(s) as identified in the conservation plan.
 - b. List of required permits to be obtained by the client.
 - c. Impacts on adjacent properties and structures.
 - d. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06).
 - e. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
 - i. Mechanical
 - ii. Structural
 - iii. Appurtenances
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certifications that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03(b)(2)).
6. Design modifications during installation as required.

INSTALLATION

Deliverables

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
 - a. Actual materials used.
 - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

**STATEMENT OF WORK
Pumping Plant (533)
Georgia**

CHECK OUT

Deliverables

1. As-Built documentation.
 - a. Extent of practice units applied
 - b. Drawings
 - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03(c)(1)).
3. Progress reporting.

REFERENCES

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Pumping Plant, 533.
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook