## Practice: 533 - Pumping Plant

## Scenario: #1 - Irrigation, modify pump

### Scenario Description:

Description: This scenario includes the modification and/or replacement of vertical turbine pumps in new or existing active wells when done in conjunction with an irrigation conversion practice to ensure energy and water savings are realized. This includes an inventory of existing pump data and performing a pump test if sufficient performance data of the existing pump cannot be provided. This scenario includes all materials, equipment and labor to test and repair the inner column of the pump assembly and rebowling. Resource Concerns: Water Quality degradation - Excess nutrients in surface and ground waters; Insufficient water - Inefficient use of irrigation water. Associated Practices include: 374 - Farmstead Energy Improvement; 430 - Irrigation Pipeline; 441 - Irrigation System, Microirrigation; 449 - Irrigation Water Management; 313 - Waste Storage Facility; 634 - Waste Transfer; 436 - Irrigation Reservoir; and 447 - Irrigation System, Tailwater Recovery; and 614 - Watering Facility.

### Before Situation:

160 acres of cropland that is being irrigated under a less efficient system than a center pivot or linear move system with low pressure nozzles which is being serviced by a pump set up for the existing system.

### After Situation:

160 acres of cropland that has undergone an irrigation conversion practice to use a more efficient method of irrigation, which has had the pump modified to realize maximum water and energy savings.

**Scenario Feature Measure:** Number of pumps

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $14,189.78 **Scenario Cost/Unit:** $14,189.78

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Equipment/Installation*** | | | | | | |
| Truck, Pickup | 939 | Equipment and power unit costs. Labor not included. | Hour | $38.70 | 16 | $619.20 |
| Aerial lift, telescoping bucket | 1893 | Aerial lift, bucket truck or cherry picker, typical 40' boom. Equipment only. | Hour | $48.37 | 16 | $773.92 |
| ***Labor*** | | | | | | |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $18.71 | 32 | $598.72 |
| Supervisor or Manager | 234 | Labor involving supervision or management activities. Includes crew supervisors, foremen and farm/ranch managers time required for adopting new technology, etc. | Hour | $37.49 | 16 | $599.84 |
| ***Materials*** | | | | | | |
| Pump, Bowl replacement, 30 to 100 HP | 1984 | Includes all material and shop labor to replace/service the entire set of bowls for a vertical turbine pump, install new bowls as necessary, and all appurtenances and materials to connect to the existing well column. Typical of 100 to 300 feet of column depth, 400 to 800 gpm discharge at 30 to 50 psi. Does not include labor and equipment to remove and install the assembled pump from the well. | Horsepower | $93.72 | 100 | $9,372.00 |
| Swing Check Valve, metal, 8" | 2080 | 8" swing check valve for back flow prevention, ductile iron metal body with flange mount and lever shaft. Materials only. | Each | $1,693.74 | 1 | $1,693.74 |
| ***Mobilization*** | | | | | | |
| Mobilization, medium equipment | 1139 | Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds. | Each | $266.18 | 2 | $532.36 |

## Practice: 533 - Pumping Plant

## Scenario: #3 - Irrigation, variable frequency drive

### Scenario Description:

Description: This is an installation of electrical and electronic components designed to vary the frequency of the voltage to vary the speed of an electric motor in an irrigation system. This directly affects pressure and flowrate. This would give the operator the flexibility to operate several systems separately or at the same time. Resource concerns: Insufficient water - Inefficient use of irrigation water; Inefficient energy use - Equipment and facilities and Farming/ranching practices and field operations.
Associated Practices: 374 - Farmstead Energy Improvement; 430 - Irrigation Pipeline; 441 - Irrigation System, Microirrigation; 449 - Irrigation Water Management.

### Before Situation:

Standard electrical connection from electrical utility to pump motor. No capability to match pump output pressure and/or flowrate to field(s) need(s). Result is over/under pressure(s) and/or flow rate(s), possible hydraulic anomalies, energy loss, and or inefficient water application in the irrigation system.

### After Situation:

VFD Modifications are implemented at the pump site to allow for varying the speed of a 50 Hp electric motor to match the pressure and flow requirements for a center pivot irrigation system.

**Scenario Feature Measure:** Number of Pumps

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $11,634.26 **Scenario Cost/Unit:** $11,634.26

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $29.26 | 8 | $234.08 |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $18.71 | 8 | $149.68 |
| ***Materials*** | | | | | | |
| Variable Speed Drive, 50 HP | 1288 | Variable speed drive for 50 Horsepower electric motor. Does not include motor. Materials only. | Horsepower | $225.01 | 50 | $11,250.50 |

## Practice: 533 - Pumping Plant

## Scenario: #5 - Livestock, manure transfer

### Scenario Description:

Description: Pump and accessories to move manure from storage location to manure distribution site/equipment. Part of a animal waste management system. Resource Concerns: Water Quality degradation - Excess nutrients in surface and ground waters.
Associated Practices include: 313 - Waste Storage Facility; 634 - Waste Transfer

### Before Situation:

Livestock facility that is not in compliance with federal and/or state regulations for animal feeding operations for handling livestock manure.

### After Situation:

A manure transfer pump is installed as part of animal manure handling system. The typical installation includes a 15 hp chopper/screw pump installed at the facility with all necessary appurtenances and controls. Other pump types may be substituted as needed to transfer manure. Waste is properly managed in accordance federal and/or state regulations for animal feeding operations to address water quality concerns.

**Scenario Feature Measure:** Number of Pumps

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $15,950.28 **Scenario Cost/Unit:** $15,950.28

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Equipment/Installation*** | | | | | | |
| Hydraulic Excavator, 1 CY | 931 | Track mounted hydraulic excavator with bucket capacity range of 0.8 to 1.5 CY. Equipment and power unit costs. Labor not included. | Hour | $118.74 | 16 | $1,899.84 |
| Concrete, CIP, slab on grade, reinforced | 37 | Steel reinforced concrete formed and cast-in-placed as a slab on grade by chute placement. Typical strength is 3000 to 4000 psi. Includes materials, labor and equipment to transport, place and finish. | Cubic yard | $173.70 | 5 | $868.50 |
| ***Labor*** | | | | | | |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $18.71 | 48 | $898.08 |
| Equipment Operators, Heavy | 233 | Includes: Cranes, Hydraulic Excavators >=50 HP, Dozers, Paving Machines, Rock Trenchers, Trenchers >=12", Dump Trucks, Ag Equipment >=150 HP, Scrapers, Water Wagons. | Hour | $25.79 | 16 | $412.64 |
| Supervisor or Manager | 234 | Labor involving supervision or management activities. Includes crew supervisors, foremen and farm/ranch managers time required for adopting new technology, etc. | Hour | $37.49 | 24 | $899.76 |
| ***Materials*** | | | | | | |
| Pump, > 5 HP to 30 HP, pump and motor, fixed cost portion | 1011 | Fixed cost portion of a pump between 5 and 30 HP, including the pump and motor. This portion is a base cost for the pump and is not dependant on horsepower. The total cost will include this fixed cost plus a variable cost portion. Includes material and shipping only. | Each | $1,900.46 | 1 | $1,900.46 |
| Pump, > 5 HP to 30 HP, pump and motor, variable cost portion | 1012 | Variable cost portion of a pump between 5 and 30 HP, including the pump and motor. This portion is dependent on the total horsepower for the pump. The total cost will include this variable cost plus a fixed cost portion. Includes material and shipping only. | Horsepower | $120.97 | 15 | $1,814.55 |
| Manhole, 6' x 10' | 2107 | Precast Manhole with base and top delivered. 6' diameter x 10' depth. Materials only. | Each | $6,990.27 | 1 | $6,990.27 |
| ***Mobilization*** | | | | | | |
| Mobilization, medium equipment | 1139 | Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds. | Each | $266.18 | 1 | $266.18 |

**Practice: 533 - Pumping Plant**

**Scenario: #6 - Livestock, with pressure tank, <= 0.5 HP**

**Scenario Description:**

Descriptions: A submersible electric-powered pump, equal to or less than 0.5 HP is installed in a well or structure. It is used to provide water for livestock as part of a prescribed grazing system. Submersible pump installed to deliver stockwater from a well or waterbody to a watering facility. Installation includes drop pipe, pump, and all necessary appurtenances and includes a pressure tank. Resource Concerns: Livestock Production Limitation - Inadequate livestock water.

Associated Practices include: 374 - Farmstead Energy Improvement; 516 - Livestock Pipeline.

**Before Situation:**

Grazing system that has an inadequate water supply for livestock.

**After Situation:**

Water is transferred at a sufficient rate and pressure to meet the herd requirements of a prescribed grazing system.
Irrigation: A properly designed pump is installed to improve irrigation efficiency and reduce energy usage.

**Scenario Feature Measure:** No. of Pumps Installed

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $3,189.82 **Scenario Cost/Unit:** $3,189.82

**Cost Details (by category):**

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Equipment/Installation*** | | | | | | |
| Backhoe, 80 HP | 926 | Wheel mounted backhoe excavator with horsepower range of 60 to 90. Equipment and power unit costs. Labor not included. | Hour | $58.30 | 8 | $466.40 |
| ***Labor*** | | | | | | |
| Supervisor or Manager | 234 | Labor involving supervision or management activities. Includes crew supervisors, foremen and farm/ranch managers time required for adopting new technology, etc. | Hour | $37.49 | 8 | $299.92 |
| Equipment Operators, Light | 232 | Includes: Skid Steer Loaders, Hydraulic Excavators <50 HP, Trenchers <12”, Ag Equipment <150 HP, Pickup Trucks, Forklifts, Mulchers | Hour | $22.38 | 8 | $179.04 |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $18.71 | 8 | $149.68 |
| ***Materials*** | | | | | | |
| Pressure Tank, 40 gallon | 1038 | Pressure Tank, 40 gallon. Includes materials and shipping only. | Each | $447.54 | 1 | $447.54 |
| Pump, ≤ 5 HP, pump and motor, variable cost portion | 1010 | Variable cost portion of a pump less than or equal to 5 HP pump and motor. This portion IS dependent on the total horsepower for the pump. The total cost of any pump will include this variable cost plus the fixed cost portion. The completed pump and motor will include the motor and controls. Includes material and shipping only. | Horsepower | $399.47 | 0.5 | $199.74 |
| Pump, ≤ 5 HP, pump and motor, fixed cost portion | 1009 | Fixed cost portion of a pump less than or equal to 5 HP pump and motor. This portion is a base cost and is not dependant on horsepower. The total cost of any pump will include this fixed cost plus a variable cost portion. The completed pump and motor will include the motor and controls. Includes Includes material and shipping only. | Each | $530.75 | 1 | $530.75 |
| Pipe, PE, 1 ¼", DR 9 | 998 | Materials: - 1 1/4" - PE - 160 psi - ASTM D3035 DR 9 | Foot | $1.05 | 150 | $157.50 |
| Pumping Plant Pit, Concrete, 1200 Gallon | 1922 | Precast concrete septic tank structure, 1200 gal capacity, with access port and ladder. Materials only. | Each | $1,972.30 | 0.25 | $493.08 |
| ***Mobilization*** | | | | | | |

***Mobilization***

| | | | | | | |
|---|---|---|---|---|---|---|
| Mobilization, medium equipment | 1139 | Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds. | Each | $266.18 | 1 | $266.18 |

**Practice: 533 - Pumping Plant**

**Scenario: #7 - Livestock, with pressure tank, > 0.5 HP and < 2 HP**

**Scenario Description:**

Descriptions: A submersible electric-powered pump, greater than 0.5 HP and less than 2 HP is installed in a well or structure. It is used to provide water for livestock as part of a prescribed grazing system. Submersible pump installed to deliver stockwater from a well or waterbody to a watering facility. Installation includes drop pipe, pump, and all necessary appurtenances and includes a pressure tank. Resource Concerns: Livestock Production Limitation - Inadequate livestock water.

Associated Practices include: 374 - Farmstead Energy Improvement; 516 - Livestock Pipeline.

**Before Situation:**

Grazing system that has an inadequate water supply for livestock.

**After Situation:**

Water is transferred at a sufficient rate and pressure to meet the requirements of a prescribed grazing system.
Irrigation: A properly designed pump is installed to improve irrigation efficiency and reduce energy usage.

**Scenario Feature Measure:** No. of Pumps Installed

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $3,508.63 **Scenario Cost/Unit:** $3,508.63

**Cost Details (by category):**

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Equipment/Installation*** | | | | | | |
| Backhoe, 80 HP | 926 | Wheel mounted backhoe excavator with horsepower range of 60 to 90. Equipment and power unit costs. Labor not included. | Hour | $58.30 | 8 | $466.40 |
| ***Labor*** | | | | | | |
| Supervisor or Manager | 234 | Labor involving supervision or management activities. Includes crew supervisors, foremen and farm/ranch managers time required for adopting new technology, etc. | Hour | $37.49 | 8 | $299.92 |
| Equipment Operators, Light | 232 | Includes: Skid Steer Loaders, Hydraulic Excavators <50 HP, Trenchers <12", Ag Equipment <150 HP, Pickup Trucks, Forklifts, Mulchers | Hour | $22.38 | 8 | $179.04 |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $18.71 | 8 | $149.68 |
| ***Materials*** | | | | | | |
| Pressure Tank, 40 gallon | 1038 | Pressure Tank, 40 gallon. Includes materials and shipping only. | Each | $447.54 | 0.5 | $223.77 |
| Pipe, PE, 1 ¼", DR 9 | 998 | Materials: - 1 1/4" - PE - 160 psi - ASTM D3035 DR 9 | Foot | $1.05 | 175 | $183.75 |
| Pump, ≤ 5 HP, pump and motor, variable cost portion | 1010 | Variable cost portion of a pump less than or equal to 5 HP pump and motor. This portion IS dependent on the total horsepower for the pump. The total cost of any pump will include this variable cost plus the fixed cost portion. The completed pump and motor will include the motor and controls. Includes material and shipping only. | Horsepower | $399.47 | 1 | $399.47 |
| Pressure Tank, 80 gallon | 1039 | Pressure Tank, 80 gallon. Includes materials and shipping only. | Each | $633.19 | 0.5 | $316.60 |
| Pumping Plant Pit, Concrete, 1200 Gallon | 1922 | Precast concrete septic tank structure, 1200 gal capacity, with access port and ladder. Materials only. | Each | $1,972.30 | 0.25 | $493.08 |
| Pump, ≤ 5 HP, pump and motor, fixed cost portion | 1009 | Fixed cost portion of a pump less than or equal to 5 HP pump and motor. This portion is a base cost and is not dependant on horsepower. The total cost of any pump will include this fixed cost plus a variable cost portion. The completed pump and motor will include the motor and controls. Includes Includes material and shipping only. | Each | $530.75 | 1 | $530.75 |

***Mobilization***

| | | | | | | |
|---|---|---|---|---|---|---|
| Mobilization, medium equipment | 1139 | Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds. | Each | $266.18 | 1 | $266.18 |

## Practice: 533 - Pumping Plant

## Scenario: #9 - Livestock, without pressure tank (HP)

### Scenario Description:

Description: A 1 Hp submersible electric-powered pump is installed in a well or structure. It is used for watering livestock as part of a prescribed grazing system. Submersible pump installed to deliver stockwater from a well or waterbody to a watering facility. Installation includes drop pipe, pump, and all necessary appurtenances. Installation without pressure tank is typically used during warm seasons. Resource Concerns: Livestock Production Limitation - Inadequate livestock water; Insufficient water - Inefficient use of irrigation water. Associated Practices include: 374 - Farmstead Energy Improvement; 516 - Livestock Pipeline.

### Before Situation:

Grazing system that has an inadequate water supply for livestock.

### After Situation:

Water is transferred at a sufficient rate and pressure to meet the requirements of a prescribed grazing system.
Irrigation: A properly designed pump is installed to improve irrigation efficiency and reduce energy usage.

**Scenario Feature Measure:** Pump Power Required

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 1

**Scenario Cost:** $1,387.36 **Scenario Cost/Unit:** $1,387.36

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Supervisor or Manager | 234 | Labor involving supervision or management activities. Includes crew supervisors, foremen and farm/ranch managers time required for adopting new technology, etc. | Hour | $37.49 | 4 | $149.96 |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $18.71 | 8 | $149.68 |
| ***Materials*** | | | | | | |
| Pump, ≤ 5 HP, pump and motor, variable cost portion | 1010 | Variable cost portion of a pump less than or equal to 5 HP pump and motor. This portion IS dependent on the total horsepower for the pump. The total cost of any pump will include this variable cost plus the fixed cost portion. The completed pump and motor will include the motor and controls. Includes material and shipping only. | Horsepower | $399.47 | 1 | $399.47 |
| Pump, ≤ 5 HP, pump and motor, fixed cost portion | 1009 | Fixed cost portion of a pump less than or equal to 5 HP pump and motor. This portion is a base cost and is not dependant on horsepower. The total cost of any pump will include this fixed cost plus a variable cost portion. The completed pump and motor will include the motor and controls. Includes Includes material and shipping only. | Each | $530.75 | 1 | $530.75 |
| Pipe, PE, 1 ¼", DR 9 | 998 | Materials: - 1 1/4" - PE - 160 psi - ASTM D3035 DR 9 | Foot | $1.05 | 150 | $157.50 |

## Practice: 533 - Pumping Plant

## Scenario: #10 - Windmill-Powered Pump

### Scenario Description:

Description: A windmill is installed in order to supply a reliable water source for livestock and/or wildlife. The windmill includes the tower, concrete footings, wheel blade unit, sucker rod, down pipe, gear box, pump, plumbing, and well head protection concrete pad. The typical scenario will be a windmill system with a 8 ft diameter mill and 27-foot tower which is pumping from a 100-foot well. As a result of installing this windmill, resource concerns of inadequate stock water, plant establishment, growth, productivity, health, and vigor, and water quantity can be addressed.
Resource Concerns: Insufficient stockwater. Associated Practices include: 374 - Farmstead Energy Improvement; 516 - Livestock Pipeline.

### Before Situation:

In a rangeland or pasture setting, a reliable source of water for livestock is not available, or the spacing between water sources is such that grazing distribution and plant health are adversely impacted.

### After Situation:

A windmill, will be installed over a well that is located to provide a reliable source of livestock water at the rate of at least 2 gpm, to facilitate proper grazing distribution and improved plant health. To increase reliability, water is pumped into a storage tank to provide a given number of days of supply. Installation includes the footings, wellhead protection concrete pad, tower, gear box, sail, sucker rod, down hole accessories, and a short outlet pipe to a storage tank.

**Scenario Feature Measure:** Windmill Units

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $6,847.08 **Scenario Cost/Unit:** $6,847.08

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Equipment/Installation*** | | | | | | |
| Concrete, CIP, slab on grade, reinforced | 37 | Steel reinforced concrete formed and cast-in-placed as a slab on grade by chute placement. Typical strength is 3000 to 4000 psi. Includes materials, labor and equipment to transport, place and finish. | Cubic yard | $173.70 | 2 | $347.40 |
| Truck, Pickup | 939 | Equipment and power unit costs. Labor not included. | Hour | $38.70 | 8 | $309.60 |
| ***Labor*** | | | | | | |
| Supervisor or Manager | 234 | Labor involving supervision or management activities. Includes crew supervisors, foremen and farm/ranch managers time required for adopting new technology, etc. | Hour | $37.49 | 8 | $299.92 |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $18.71 | 16 | $299.36 |
| ***Materials*** | | | | | | |
| Windmill, 6 or 8', fan diameter | 1035 | Includes materials costs for windmill head and 27’ tower | Each | $5,590.80 | 1 | $5,590.80 |

## Practice: 533 - Pumping Plant

## Scenario: #11 - Solar-Powered Pump, 0.5 HP

### Scenario Description:

Description: The typical scenario assumes installation of a submersible solar-powered pump in a well or a live stream. The installation includes the pump, wiring, drop pipe, solar panels, mounts, inverter, and all appurtenances. Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Irrigation - energy consumption will be reduced and the increased pressure and flow rates will improve irrigation efficiency.
Resource Concerns: Insufficient stockwater.
Associated Practices include: 374 - Farmstead Energy Improvement; 382 - Fence; 516 - Livestock Pipeline; 561 - Heavy Use Area Protection; and, 614 - Watering Facility.

### Before Situation:

Inadequate supply or location of water for a prescribed grazing system. Eroded stream banks and degraded water quality due to livestock access to stream. Cattle are not well-distributed because of remote water location.

### After Situation:

The typical scenario assumes installation of a 373-watt photovoltaic (PV) panel, capable of operating a 1/2 Hp (0.5 Hp) solar-powered submersible pump in a well or other water source (Notes: 1) A PV panel is rated under standard and ideal conditions which will most likely not be replicated in the field; 2) 1 Hp is defined as 746 watts; 3) It is reasonable to expect a 0.5 Hp solar-powered submersible pump to deliver about 3 gpm and develop a pressure at the pump outlet of about 20 psi.). The installation includes the pump, wiring, pipeline in the well, solar panels, frame mounts, inverter, and all appurtenances. Water will be pumped to pressurize the Livestock Pipeline (516). Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Grazing has potential to be well distributed.

**Scenario Feature Measure:** Each Pumping Plant

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $5,731.12 **Scenario Cost/Unit:** $5,731.12

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $29.26 | 20 | $585.20 |
| ***Materials*** | | | | | | |
| Pump, ≤ 5 HP, pump and motor, variable cost portion | 1010 | Variable cost portion of a pump less than or equal to 5 HP pump and motor. This portion IS dependent on the total horsepower for the pump. The total cost of any pump will include this variable cost plus the fixed cost portion. The completed pump and motor will include the motor and controls. Includes material and shipping only. | Horsepower | $399.47 | 0.5 | $199.74 |
| Solar Panels, fixed cost portion | 1031 | Fixed cost portion of the Solar Panels. This portion is a base cost for all Solar Panels and is not dependant on KiloWatt. The total cost of any Solar Panels will include this fixed cost plus a variable cost portion. The completed Solar Panels will include all materials (electrical, controllers, service drops and etc). This cost will include material, labor and equipment. | Each | $432.48 | 1 | $432.48 |
| Pipe, PE, 1 ¼", DR 9 | 998 | Materials: - 1 1/4" - PE - 160 psi - ASTM D3035 DR 9 | Foot | $1.05 | 100 | $105.00 |
| Pump, ≤ 5 HP, pump and motor, fixed cost portion | 1009 | Fixed cost portion of a pump less than or equal to 5 HP pump and motor. This portion is a base cost and is not dependant on horsepower. The total cost of any pump will include this fixed cost plus a variable cost portion. The completed pump and motor will include the motor and controls. Includes Includes material and shipping only. | Each | $530.75 | 1 | $530.75 |

***Materials***

| | | | | | | |
|---|---|---|---|---|---|---|
| Solar Panels, variable cost portion | 1135 | Variable cost portion of the Solar Panels. This portion IS dependent on the total Kilowatt for the Solar Panels. The total cost of any Solar Panels will include this variable cost plus the fixed cost portion. The completed Solar Panels will include all materials (electrical, controllers, and service drop, etc). This cost will include material, labor and equipment. | Kilowatt | $7,755.90 | 0.5 | $3,877.95 |

## Practice: 533 - Pumping Plant

## Scenario: #12 - Solar-Powered Pump, 1 HP

### Scenario Description:

Description: The typical scenario assumes installation of a submersible solar-powered pump in a well or a live stream. The installation includes the pump, wiring, drop pipe, solar panels, mounts, inverter, and all appurtenances. Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Irrigation - energy consumption will be reduced and the increased pressure and flow rates will improve irrigation efficiency.
Resource Concerns: Insufficient stockwater.
Associated Practices include: 374 - Farmstead Energy Improvement; 382 - Fence; 516 - Livestock Pipeline; 561 - Heavy Use Area Protection; and, 614 - Watering Facility.

### Before Situation:

Inadequate supply or location of water for a prescribed grazing system. Eroded stream banks and degraded water quality due to livestock access to stream. Cattle are not well-distributed because of remote water location.

### After Situation:

The typical scenario assumes installation of a 746-watt photovoltaic (PV) panel, capable of operating a 1 Hp solar-powered submersible pump in a well or other water source (Notes: 1) A PV panel is rated under standard and ideal conditions which will most likely not be replicated in the field; 2) 1 Hp is defined as 746 watts; 3) It is reasonable to expect a 1 Hp solar-powered submersible pump to deliver about 3 gpm and develop a pressure at the pump outlet of about 20 psi.). The installation includes the pump, wiring, pipeline in the well, solar panels, frame mounts, inverter, and all appurtenances. Water will be pumped to pressurize the Livestock Pipeline (516). Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Grazing has potential to be well distributed.

**Scenario Feature Measure:** Each Pumping Plant

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $9,913.80 **Scenario Cost/Unit:** $9,913.80

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $29.26 | 20 | $585.20 |
| ***Materials*** | | | | | | |
| Pipe, PE, 1 ¼", DR 9 | 998 | Materials: - 1 1/4" - PE - 160 psi - ASTM D3035 DR 9 | Foot | $1.05 | 200 | $210.00 |
| Pump, ≤ 5 HP, pump and motor, fixed cost portion | 1009 | Fixed cost portion of a pump less than or equal to 5 HP pump and motor. This portion is a base cost and is not dependant on horsepower. The total cost of any pump will include this fixed cost plus a variable cost portion. The completed pump and motor will include the motor and controls. Includes Includes material and shipping only. | Each | $530.75 | 1 | $530.75 |
| Pump, ≤ 5 HP, pump and motor, variable cost portion | 1010 | Variable cost portion of a pump less than or equal to 5 HP pump and motor. This portion IS dependent on the total horsepower for the pump. The total cost of any pump will include this variable cost plus the fixed cost portion. The completed pump and motor will include the motor and controls. Includes material and shipping only. | Horsepower | $399.47 | 1 | $399.47 |
| Solar Panels, fixed cost portion | 1031 | Fixed cost portion of the Solar Panels. This portion is a base cost for all Solar Panels and is not dependant on KiloWatt. The total cost of any Solar Panels will include this fixed cost plus a variable cost portion. The completed Solar Panels will include all materials (electrical, controllers, service drops and etc). This cost will include material, labor and equipment. | Each | $432.48 | 1 | $432.48 |

***Materials***

| | | | | | | |
|---|---|---|---|---|---|---|
| Solar Panels, variable cost portion | 1135 | Variable cost portion of the Solar Panels. This portion IS dependent on the total Kilowatt for the Solar Panels. The total cost of any Solar Panels will include this variable cost plus the fixed cost portion. The completed Solar Panels will include all materials (electrical, controllers, and service drop, etc). This cost will include material, labor and equipment. | Kilowatt | $7,755.90 | 1 | $7,755.90 |

## Practice: 533 - Pumping Plant

## Scenario: #13 - Solar-Powered Pump, 2 HP

### Scenario Description:

Description: The typical scenario assumes installation of a submersible solar-powered pump in a well or a live stream. The installation includes the pump, wiring, drop pipe, solar panels, mounts, inverter, and all appurtenances. Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Irrigation - energy consumption will be reduced and the increased pressure and flow rates will improve irrigation efficiency.
Resource Concerns: Insufficient stockwater.
Associated Practices include: 374 - Farmstead Energy Improvement; 382 - Fence; 516 - Livestock Pipeline; 561 - Heavy Use Area Protection; and, 614 - Watering Facility.

### Before Situation:

Inadequate supply or location of water for a prescribed grazing system. Eroded stream banks and degraded water quality due to livestock access to stream. Cattle are not well-distributed because of remote water location.

### After Situation:

The typical scenario assumes installation of a 1.5-kW photovoltaic (PV) panel, capable of operating a 2 Hp solar-powered submersible pump in a well or other water source (Notes: 1) A PV panel is rated under standard and ideal conditions which will most likely not be replicated in the field; 2) 1 Hp is defined as 746 watts; 3) It is reasonable to expect a 2 Hp solar-powered submersible pump to deliver about 3 gpm and develop a pressure at the pump outlet of about 20 psi.). The installation includes the pump, wiring, pipeline in the well, solar panels, frame mounts, inverter, and all appurtenances. Water will be pumped to pressurize the Livestock Pipeline (516). Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Grazing has potential to be well distributed.

**Scenario Feature Measure:** Each Pumping Plant

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $18,174.17 **Scenario Cost/Unit:** $18,174.17

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $29.26 | 20 | $585.20 |
| ***Materials*** | | | | | | |
| Pipe, PE, 1 ¼", DR 9 | 998 | Materials: - 1 1/4" - PE - 160 psi - ASTM D3035 DR 9 | Foot | $1.05 | 300 | $315.00 |
| Solar Panels, variable cost portion | 1135 | Variable cost portion of the Solar Panels. This portion IS dependent on the total Kilowatt for the Solar Panels. The total cost of any Solar Panels will include this variable cost plus the fixed cost portion. The completed Solar Panels will include all materials (electrical, controllers, and service drop, etc). This cost will include material, labor and equipment. | Kilowatt | $7,755.90 | 2 | $15,511.80 |
| Solar Panels, fixed cost portion | 1031 | Fixed cost portion of the Solar Panels. This portion is a base cost for all Solar Panels and is not dependant on KiloWatt. The total cost of any Solar Panels will include this fixed cost plus a variable cost portion. The completed Solar Panels will include all materials (electrical, controllers, service drops and etc). This cost will include material, labor and equipment. | Each | $432.48 | 1 | $432.48 |
| Pump, ≤ 5 HP, pump and motor, fixed cost portion | 1009 | Fixed cost portion of a pump less than or equal to 5 HP pump and motor. This portion is a base cost and is not dependant on horsepower. The total cost of any pump will include this fixed cost plus a variable cost portion. The completed pump and motor will include the motor and controls. Includes Includes material and shipping only. | Each | $530.75 | 1 | $530.75 |

***Materials***

| | | | | | | |
|---|---|---|---|---|---|---|
| Pump, ≤ 5 HP, pump and motor, variable cost portion | 1010 | Variable cost portion of a pump less than or equal to 5 HP pump and motor. This portion IS dependent on the total horsepower for the pump. The total cost of any pump will include this variable cost plus the fixed cost portion. The completed pump and motor will include the motor and controls. Includes material and shipping only. | Horsepower | $399.47 | 2 | $798.94 |

## Practice: 533 - Pumping Plant

## Scenario: #15 - Wind Turbine-Powered Pump, 1.5 hp

### Scenario Description:

Description: The typical scenario assumes installation of a submersible pump powered by a wind turbine in a well or a live stream. The installation includes the pump, wiring, drop pipe, wind turbine, mounts, inverter, and all appurtenances. Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Irrigation - energy consumption will be reduced and the increased pressure and flow rates will improve irrigation efficiency.
Resource Concerns: Insufficient stockwater.
Associated Practices include: 374 - Farmstead Energy Improvement; 382 - Fence; 516 - Livestock Pipeline; 561 - Heavy Use Area Protection; and, 614 - Watering Facility.

### Before Situation:

Inadequate supply or location of water for a prescribed grazing system. Eroded stream banks and degraded water quality due to livestock access to stream. Cattle are not well-distributed because of remote water location.

### After Situation:

The typical scenario assumes installation of a 1.5 kW wind turbine, capable of operating a 1.5 Hp submersible pump in a well or other water source (Notes: 1) A wind turbine is rated under standard and ideal conditions which will most likely not be replicated in the field; 2) 1 Hp is defined as 746 watts; 3) It is reasonable to expect a 1.5 Hp submersible pump to deliver about 11 gpm and develop a pressure at the pump outlet of about 20 psi.). The installation includes the pump, wiring, pipeline in the well, wind turbine, frame mounts, inverter, and all appurtenances. Water will be pumped to pressurize the Livestock Pipeline (516). Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Grazing has potential to be well distributed.

**Scenario Feature Measure:** Each Pumping Plant

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $3,452.23 **Scenario Cost/Unit:** $3,452.23

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Supervisor or Manager | 234 | Labor involving supervision or management activities. Includes crew supervisors, foremen and farm/ranch managers time required for adopting new technology, etc. | Hour | $37.49 | 12 | $449.88 |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $18.71 | 16 | $299.36 |
| ***Materials*** | | | | | | |
| Pipe, PE, 1 ¼", DR 9 | 998 | Materials: - 1 1/4" - PE - 160 psi - ASTM D3035 DR 9 | Foot | $1.05 | 200 | $210.00 |
| Pump, ≤ 5 HP, pump and motor, fixed cost portion | 1009 | Fixed cost portion of a pump less than or equal to 5 HP pump and motor. This portion is a base cost and is not dependant on horsepower. The total cost of any pump will include this fixed cost plus a variable cost portion. The completed pump and motor will include the motor and controls. Includes Includes material and shipping only. | Each | $530.75 | 1 | $530.75 |
| Pump, ≤ 5 HP, pump and motor, variable cost portion | 1010 | Variable cost portion of a pump less than or equal to 5 HP pump and motor. This portion IS dependent on the total horsepower for the pump. The total cost of any pump will include this variable cost plus the fixed cost portion. The completed pump and motor will include the motor and controls. Includes material and shipping only. | Horsepower | $399.47 | 1.5 | $599.21 |
| Wind Turbine | 2596 | Wind generator, 1.5 kW maximum, 48 volt system. Includes materials and shipping only. | Each | $1,363.03 | 1 | $1,363.03 |