

**Practice:** 428 - Irrigation Ditch Lining

**Scenario:** #1 - Concrete Lining, 1 ft bottom

**Scenario Description:** Construct quarter mile of concrete (2.5 inch in thickness) lining in an existing ditch alignment to convey water from the source of supply to a field or fields in a farm distribution system. Typical scenario includes filling the old ditch with on-site fill material, compacting, and constructing an 8 ft pad with on site fill material. This scenario does not include any check or outlets gates. A trapezoidal trencher forms the ditch (typical cross-section: 1 ft bottom, 2.5 feet depth including freeboard, and 1:1 side slope) and lining with concrete slip forms (total width = 8.07 ft). Resource Concerns: Insufficient water - Inefficient use of irrigation water; Soil erosion - Excessive bank erosion from streams shorelines or channels. Associated Practices: 320-Irrigation Canal or Lateral; 388-Irrigation Field Ditch; 443-Irrigation System, Surface or Subsurface Water; 533-Pumping Plant; 430-Irrigation Pipeline; 587-Structure for Water Control.

**Before Situation:** Leaky and erosive earthen irrigation ditch.

**After Situation:** Impervious lining prevents seepage, reduces energy use and improves water quality and irrigation efficiency.

**Scenario Feature Measure:** Surface Area of Lining

**Scenario Unit:** Square Yard

**Scenario Typical Size:** 1184

**Total Scenario Cost:** \$17,989.49

**Scenario Cost/Unit:** \$15.19

**Cost Details**

Component Name	Id	Description	Unit	Cost	Qty	Total
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**Equipment Installation**

Concrete, CIP, formless, non reinforced	36	Non reinforced concrete cast-in-placed without forms by chute placement. Typical strength is 3000 to 4000 psi. Includes materials, labor and equipment to transport, place and finish.	Cubic Yard	\$142.77	82.2	\$11,735.85
Earthfill, Roller Compacted	49	Earthfill, roller or machine compacted, includes equipment and labor	Cubic Yard	\$4.22	978	\$4,126.39
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic Yard	\$2.23	510	\$1,138.60

**Mobilization**

Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$247.16	4	\$988.65
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**Practice:** 428 - Irrigation Ditch Lining

**Scenario:** #2 - Concrete lined ditch-thick, 1.5 ft bottom

**Scenario Description:** Construct quarter mile (1320') of concrete (3.0 inch in thickness) lining in an existing ditch alignment to convey water from the source of supply to a field or fields in a farm distribution system. Typical scenario includes filling the old ditch with on-site fill material, compacting, and constructing an 8 ft pad with on site fill material. This scenario does not include any check or outlets gates. A trapezoidal trencher forms the ditch (typical cross-section: 1.5 ft bottom, 2.5 ft depth including freeboard, and 1:1 side slope) and lining with concrete slip forms (total width = 8.57 ft). 1 foot bottom ditch is needed deliver expected water flows on realitively flat grades. Resource Concerns: Insufficient water - Inefficient use of irrigation water; Soil erosion - Excessive bank erosion from streams shorelines or channels. Associated Practices: 320-Irrigation Canal or Lateral; 388-Irrigation Field Ditch; 443-Irrigation System, Surface or Subsurface Water; 533-Pumping Plant; 430-Irrigation Pipeline; 587-Structure for Water Control.

**Before Situation:** Leaky and erosive earthen irrigation ditch.

**After Situation:** Impervious lining prevents seepage, reduces energy use and improves water quality and irrigation efficiency.

**Scenario Feature Measure:** Surface area of lining

**Scenario Unit:** Square Yard

**Scenario Typical Size:** 1257

**Total Scenario Cost:** \$22,252.14

**Scenario Cost/Unit:** \$17.70

**Cost Details**

Component Name	Id	Description	Unit	Cost	Qty	Total
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**Equipment Installation**

Concrete, CIP, formless, non reinforced	36	Non reinforced concrete cast-in-placed without forms by chute placement. Typical strength is 3000 to 4000 psi. Includes materials, labor and equipment to transport, place and finish.	Cubic Yard	\$142.77	105	\$14,991.05
Earthfill, Roller Compacted	49	Earthfill, roller or machine compacted, includes equipment and labor	Cubic Yard	\$4.22	1100	\$4,641.14
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic Yard	\$2.23	576	\$1,285.95

**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	\$43.17	8	\$345.36
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**Mobilization**

Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$247.16	4	\$988.65
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**Practice:** 428 - Irrigation Ditch Lining

**Scenario:** #3 - Concrete Lining, 2 ft bottom

**Scenario Description:** Construct quarter mile of concrete (2.5 inch in thickness) lining in an existing ditch alignment to convey water from the source of supply to a field or fields in a farm distribution system. Typical scenario includes filling the old ditch with on-site fill material, compacting, and constructing an 8 ft pad with on site fill material. This scenario does not include any check or outlets gates. A trapezoidal trencher forms the ditch (typical cross-section: 2 ft bottom, 2.5 ft depth including freeboard, and 1:1 side slope) and lining with concrete slip forms (total width = 9.07 ft). Two foot bottom ditch is needed for higher water flows (10+ cfs) on realitively flat grades. Resource Concerns: Insufficient water - Inefficient use of irrigation water; Soil erosion - Excessive bank erosion from streams shorelines or channels. Associated Practices: 320-Irrigation Canal or Lateral; 388-Irrigation Field Ditch; 443-Irrigation System, Surface or Subsurface Water; 533-Pumping Plant; 430-Irrigation Pipeline; 587-Structure for Water Control.

**Before Situation:** Leaky and erosive earthen irrigation ditch.

**After Situation:** Impervious lining prevents seepage, reduces energy use and improves water quality and irrigation efficiency.

**Scenario Feature Measure:** Surface area of lining

**Scenario Unit:** Square Yard

**Scenario Typical Size:** 1330

**Total Scenario Cost:** \$20,857.85

**Scenario Cost/Unit:** \$15.68

**Cost Details**

Component Name	Id	Description	Unit	Cost	Qty	Total
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**Equipment Installation**

Concrete, CIP, formless, non reinforced	36	Non reinforced concrete cast-in-placed without forms by chute placement. Typical strength is 3000 to 4000 psi. Includes materials, labor and equipment to transport, place and finish.	Cubic Yard	\$142.77	93	\$13,277.79
Earthfill, Roller Compacted	49	Earthfill, roller or machine compacted, includes equipment and labor	Cubic Yard	\$4.22	1222	\$5,155.88
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic Yard	\$2.23	643	\$1,435.53

**Mobilization**

Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$247.16	4	\$988.65
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**Practice:** 428 - Irrigation Ditch Lining

**Scenario:** #4 - Concrete Lining, > 2 ft bottom

**Scenario Description:** Construct quarter mile of concrete (2.5 inch in thickness) lining in an existing ditch alignment to convey water from the source of supply to a field or fields in a farm distribution system. Typical scenario includes filling the old ditch with on-site fill material, compacting, and constructing a 12 ft pad with on site fill material. This scenario does not include any check or outlets gates. A trapezoidal trencher forms the ditch (typical cross-section: 3 ft bottom, 2.5 ft depth including freeboard, and 1:1 side slope) and lining with concrete slip forms (total width = 10.07 ft). Three foot bottom ditch is needed for higher water flows (20+ cfs) on realitively flat grades. Resource Concerns: Insufficient water - Inefficient use of irrigation water; Soil erosion - Excessive bank erosion from streams shorelines or channels. Associated Practices: 320-Irrigation Canal or Lateral; 388-Irrigation Field Ditch; 443-Irrigation System, Surface or Subsurface Water; 533-Pumping Plant; 430-Irrigation Pipeline; 587-Structure for Water Control.

**Before Situation:** Leaky and erosive earthen irrigation ditch.

**After Situation:** Impervious lining prevents seepage, reduces energy use and improves water quality and irrigation efficiency.

**Scenario Feature Measure:** Surface area of lining

**Scenario Unit:** Square Yard

**Scenario Typical Size:** 1477

**Total Scenario Cost:** \$23,538.31

**Scenario Cost/Unit:** \$15.94

**Cost Details**

Component Name	Id	Description	Unit	Cost	Qty	Total
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**Equipment Installation**

Concrete, CIP, formless, non reinforced	36	Non reinforced concrete cast-in-placed without forms by chute placement. Typical strength is 3000 to 4000 psi. Includes materials, labor and equipment to transport, place and finish.	Cubic Yard	\$142.77	103	\$14,705.51
Earthfill, Roller Compacted	49	Earthfill, roller or machine compacted, includes equipment and labor	Cubic Yard	\$4.22	1466	\$6,185.37
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic Yard	\$2.23	743	\$1,658.78

**Mobilization**

Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$247.16	4	\$988.65
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**Practice:** 428 - Irrigation Ditch Lining

**Scenario:** #5 - Notched Ditch, 1.5 ft bottom

**Scenario Description:** Construct quarter mile (1320') of concrete (3.0 inch in thickness) lining in an existing ditch alignment with hand formed notches, located at the top of the ditch on field side, to convey water from the source of supply to a field or fields in a farm distribution system. Notches are typically spaced to match field crop row spacing and are wedge shaped with typical dimensions of 2" bottom width, 6" top width and 6" deep. Typical scenario includes filling the old ditch with on-site fill material, compacting, and constructing an 8 ft pad with on site fill material. This scenario does not include any check or outlets gates. A trapezoidal trencher forms the ditch (typical cross-section: 1.5 ft bottom, 2.5 ft depth including freeboard, and 1:1 side slope) and lining with concrete slip forms (total width = 8.57 ft). 1.5 foot bottom ditch is needed deliver expected water flows on realitively flat grades. Resource Concerns: Insufficient water - Inefficient use of irrigation water; Soil erosion - Excessive bank erosion from streams shorelines or channels. Associated Practices: 320-Irrigation Canal or Lateral; 388-Irrigation Field Ditch; 443-Irrigation System, Surface or Subsurface Water; 533-Pumping Plant; 430-Irrigation Pipeline; 587-Structure for Water Control.

**Before Situation:** Leaky and erosive earthen irrigation ditch.

**After Situation:** Impervious lining prevents seepage, reduces energy use and improves water quality and irrigation efficiency.

**Scenario Feature Measure:** Surface area of lining

**Scenario Unit:** Square Yard

**Scenario Typical Size:** 1257

**Total Scenario Cost:** \$33,571.97

**Scenario Cost/Unit:** \$26.71

**Cost Details**

Component Name	Id	Description	Unit	Cost	Qty	Total
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**Equipment Installation**

Concrete, CIP, formless, non reinforced	36	Non reinforced concrete cast-in-placed without forms by chute placement. Typical strength is 3000 to 4000 psi. Includes materials, labor and equipment to transport, place and finish.	Cubic Yard	\$142.77	115	\$16,418.77
Earthfill, Roller Compacted	49	Earthfill, roller or machine compacted, includes equipment and labor	Cubic Yard	\$4.22	1100	\$4,641.14
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic Yard	\$2.23	576	\$1,285.95

**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	\$24.26	397	\$9,633.09
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	\$43.17	14	\$604.37

**Mobilization**

Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$247.16	4	\$988.65
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**Practice:** 428 - Irrigation Ditch Lining

**Scenario:** #6 - Flexible Lining

**Scenario Description:** Construct quarter mile of uncovered flexible membrane (30mil HDPE) lining in an existing ditch alignment to convey water from the source of supply to a field or fields in a farm distribution system. Typical scenario includes subgrade preparation via clearing & grubbing, shaping old channel with no bedding or geotextile cushion to place, and placing membrane with 8 inch tuck/anchor on each side (total liner width = 8 ft). Scenario assumes typical trapezoidal ditch (1 ft bottom, 2 ft depth including freeboard, and 1:1 side slope). Resource Concerns: Insufficient water - Inefficient use of irrigation water; Soil erosion - Excessive bank erosion from streams shorelines or channels. Associated Practices: 320-Irrigation Canal or Lateral; 388-Irrigation Field Ditch; 443-Irrigation System, Surface or Subsurface Water; 533-Pumping Plant; 430-Irrigation Pipeline; 587-Structure for Water Control.

**Before Situation:** Leaky and erosive earthen irrigation ditch.

**After Situation:** Impervious lining prevents seepage, reduces energy use and improves water quality and irrigation efficiency.

**Scenario Feature Measure:** Surface Area of Lining

**Scenario Unit:** Square Yard

**Scenario Typical Size:** 1173

**Total Scenario Cost:** \$11,245.38

**Scenario Cost/Unit:** \$9.59

**Cost Details**

Component Name	Id	Description	Unit	Cost	Qty	Total
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**Labor**

Equipment Operators, Light	232	Includes: Skid Steer Loaders, Hydraulic Excavators <50 HP, Trenchers <12", Ag Equipment <150 HP, Pickup Trucks, Forklifts, Mulchers	Hour	\$25.30	16	\$404.80
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	\$24.26	48	\$1,164.71
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	\$43.17	48	\$2,072.14

**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	\$54.15	16	\$866.47
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**Mobilization**

Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$247.16	2	\$494.33
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**Materials**

Synthetic Liner, 30 mil	1238	Synthetic 30 mil HDPE, LLDPE, EPDM, etc. membrane liner material. Includes materials and shipping only.	Square Foot	\$0.59	10560	\$6,242.93
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**Practice:** 428 - Irrigation Ditch Lining

**Scenario:** #7 - Transitions

**Scenario Description:** Construct short transition of concrete lining in an existing ditch alignment to convey water from one section of a ditch to another. Typical scenario includes hand placing concrete in the transition section where equipment cannot reach.

**Before Situation:** need to connect one end of a ditch with a specific cross section to another ditch with the same or different cross section that may include placing a transition in a curve which requires hand placement.

**After Situation:** Transitions prevents seepage and erosion at ditch joints, reduces energy use and improves water quality and irrigation efficiency.

**Scenario Feature Measure:** Surface area of lining

**Scenario Unit:** Square Foot

**Scenario Typical Size:** 120

**Total Scenario Cost:** \$509.57

**Scenario Cost/Unit:** \$4.25

**Cost Details**

Component Name	Id	Description	Unit	Cost	Qty	Total
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**Equipment Installation**

Concrete, CIP, formless, non reinforced	36	Non reinforced concrete cast-in-placed without forms by chute placement. Typical strength is 3000 to 4000 psi. Includes materials, labor and equipment to transport, place and finish.	Cubic Yard	\$142.77	1	\$142.77
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**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	\$24.26	8	\$194.12
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	\$43.17	4	\$172.68

**Practice:** 428 - Irrigation Ditch Lining

**Scenario:** #8 - Semi Rigid HDPE Prefab Liner

**Scenario Description:** Construct 1000 feet of uncovered semi-rigid HDPE liner in an existing ditch alignment to convey water from the source of supply to a field or fields in a farm distribution system. Typical scenario includes subgrade preparation via clearing & grubbing, shaping old channel to place, and placing edge anchors as required for installation. Scenario assumes typical trapezoidal ditch (1 ft bottom, 2 ft depth including freeboard, and 1:1 side slope). Total width is 8 ft. Resource Concerns: Insufficient water - Inefficient use of irrigation water; Soil erosion - Excessive bank erosion from streams shorelines or channels. Associated Practices: 320-Irrigation Canal or Lateral; 388-Irrigation Field Ditch; 443-Irrigation System, Surface or Subsurface Water; 533-Pumping Plant; 430-Irrigation Pipeline; 587-Structure for Water Control.

**Before Situation:** Leaky and erosive earthen irrigation ditch.

**After Situation:** Impervious lining prevents seepage, reduces energy use and improves water quality and irrigation efficiency.

**Scenario Feature Measure:** surface area of lining

**Scenario Unit:** Square Yard

**Scenario Typical Size:** 889

**Total Scenario Cost:** \$39,596.42

**Scenario Cost/Unit:** \$44.54

**Cost Details**

Component Name	Id	Description	Unit	Cost	Qty	Total
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**Equipment Installation**

Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic Yard	\$2.23	111	\$247.81
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**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	\$24.26	50	\$1,213.24
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	\$43.17	8	\$345.36

**Mobilization**

Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$247.16	1	\$247.16
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**Materials**

Ditch liner, HDPE, semi-rigid, 24" depth	2374	Semi-rigid, corrugated HDPE ditch liner, 24" depth. Materials only.	Foot	\$37.54	1000	\$37,542.86
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**Practice:** 428 - Irrigation Ditch Lining

**Scenario:** #9 - Concrete Lining, Hand Placed, Any Size

**Scenario Description:** Construct quarter mile of concrete (3 inch in thickness) lining in an existing ditch alignment to convey water from the source of supply to a field or fields in a farm distribution system. Typical scenario includes filling the old ditch with on-site fill material, compacting, and constructing an 8 ft pad with on site fill material. This scenario does not include any check or outlets gates. A grader cuts the ditch section (typical cross-section: 2 ft bottom, 2.5 feet depth including freeboard, and 1:1 side slope) and lining with concrete by forming and hand placing concrete sections. This ditch type may also be used in certain situations when the back and front of the ditch are at different design elevations. Typical cy/lf is 0.0874. Resource Concerns: Insufficient water - Inefficient use of irrigation water; Soil erosion - Excessive bank erosion from streams shorelines or channels. Associated Practices: 320-Irrigation Canal or Lateral; 388-Irrigation Field Ditch; 443-Irrigation System, Surface or Subsurface Water; 533-Pumping Plant; 430-Irrigation Pipeline; 587-Structure for Water Control.

**Before Situation:** Leaky and erosive earthen irrigation ditch.

**After Situation:** Impervious lining prevents seepage, reduces energy use and improves water quality and irrigation efficiency.

**Scenario Feature Measure:** Cubic Yard of Concrete Lining

**Scenario Unit:** Cubic Yard

**Scenario Typical Size:** 115.4

**Total Scenario Cost:** \$22,729.52

**Scenario Cost/Unit:** \$196.96

**Cost Details**

Component Name	Id	Description	Unit	Cost	Qty	Total
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**Equipment Installation**

Concrete, CIP, formless, non reinforced	36	Non reinforced concrete cast-in-placed without forms by chute placement. Typical strength is 3000 to 4000 psi. Includes materials, labor and equipment to transport, place and finish.	Cubic Yard	\$142.77	115.4	\$16,475.88
Earthfill, Roller Compacted	49	Earthfill, roller or machine compacted, includes equipment and labor	Cubic Yard	\$4.22	978	\$4,126.39
Excavation, Common Earth, side cast, small equipment	48	Bulk excavation and side casting of common earth with hydraulic excavator with less than 1 CY capacity. Includes equipment and labor.	Cubic Yard	\$2.23	510	\$1,138.60

**Mobilization**

Mobilization, medium equipment	1139	Equipment with 70-150 HP or typical weights between 14,000 and 30,000 pounds.	Each	\$247.16	4	\$988.65
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