Projects Committee Meeting
Thursday, February 2, 2023 8:00 AM
Lower Platte North NRD Office
P.O. Box 126
Wahoo, NE 68066

1. COMMITTEE CHAIR & VICE CHAIR ELECTIONS
   Director Sabatka nominated Director Olson for Projects Committee Chair appointment. Appointment passed with all in favor.
   Director Sabatka nominated Director Yosten for Projects Committee Vice Chair appointment. Appointment passed with all in favor.
2. SWCP

   2.A. SWCP Tree Planting Applications
   Attached are three applications for tree planting cost-share.

   Derek Simonds - 230 trees - $431.25
   Jordan Larsen - 200 trees - $375.00
   Seth McGinn - 800 trees - $1,500.00

   2.B. SWCP Policy
   Attached is the NRD's current SWCP Policy and DNR's updated practice payment cost-list. Historically the NRD has utilized the cost-list for our SWCP payment calculations. Please review and be ready to approve at March 13 Board meeting.

   2.C. SWCP Cancellations

   2.D. Wahoo Creek Cost Share Approvals

3. WATERSHEDS

   3.A. Shell Creek Watershed

   3.A.1. Shell Creek Implementation - 319/NET
   The SCWIG group met on January 17th in Columbus with lots of discussion focused on guiding the urban portions of project over the next 3 years.
   Our next meeting is scheduled for February 21st, 9:00 am, at the Columbus NRCS office.
   Attached is a publication correlating BMPs installed in Shell Creek Watershed with peak stream flows.
   The group is requesting to send up to 6 students to the National Soil and Water Conservation Society (SWCS) meeting in Des Moines, August 6-9 to present their volunteer monitoring work. SWCS has agreed to comp conference registration costs for 2 students. Grant funds can be used to defray travel costs.

   3.A.2. Shell Creek Student Testing Supplies
   Director Saier submitted a materials order (attached) for the upcoming summer

testing. All costs are reimbursable through upcoming 319 grant. Total cost for supplies:

$1,609.75

3.B. Wahoo Creek Watershed

3.B.1. Wahoo Creek Dam Site Planning Update

The RFP for Real Estate Services is available on our website and advertised in the January 19th, 26th, and February 2nd Wahoo paper. Proposals are due February 7th, 2023 at 12:00 noon. Proposals will be digitally delivered to the projects committee on the afternoon of the 7th. Should the committee wish to conduct interviews, firms are on notice to be available on the 8th, 9th, or 10th. The projects committee will need to meet before the board meeting on Monday, February 13 in order to make a recommendation to the board. Attached from Olsson are the current Progress Report and Invoices. Of note: first three (26AB and 27) have passed the 90% design milestone and will be submitted to NRCS 2/3. We have a sharedrive set up for all pertinent design/documents.

A motion will be needed at Board Meeting to approve hiring Great Plains Appraisal, Inc. of Lincoln and have staff negotiate a contract for General Manager signature.

3.B.1.a. Olsson Design Update and Invoice

Olsson progress report and invoices are attached.

3.B.1.b. NeDNR Agreement JEDI Funds

Staff have a meeting with NeDNR and NRCS on February 23rd to discuss federal and nonfederal funding sources.

Easement issue is still being discussed.

3.B.2. Wahoo Creek Watershed Water Quality Plan - 319

3.C. Skull/Bone Creek

Stakeholder meeting scheduled for January 18th in Abby was postponed due to phony blizzard. A new date has not been set at this time.

4. JOINT WATER MANAGEMENT ADVISORY BOARD (JWMAB)

4.A. East Fremont/Elkhorn Township Drainage - FEMA HMPG

4.B. West Fremont - FEMA BRIC

4.C. Rawhide Creek Watershed - NRCS WFPO

On January 30 representatives from NRD, Dodge County, City of Fremont, and JEO met for an update on the planning for the Rawhide WFPO plan. JEO presented an updated economic assessment (costs estimate attached) and advised that the planned alternative for County Rd S ditch improvements should be removed from plan due to lower than expected BCA. The flood damage reductions tied to this alternative only positively impacted ~85 acres of ag land, and a planned total cost of over $5 million.

JEO plans to proceed with geotechnical surveys (e.g. soil borings) once field conditions allow. A landowner list has been developed for all potentially impacted parcels and plans are for notification letters to be sent out mid-February.
JEO plans to have DRAFT plan submitted to national (NRCS) for review in September. After plan is approved the JWMAB will need to apply for design/construction funding. The JWMAB will be responsible for all land rights and permitting costs associated with the project. Currently there is no interlocal agreement to spell out how those costs would be divided.

5. HAZARD MITIGATION PLAN UPDATE
   We will be discussing funding opportunities for water sources for rural fire protection on February 3rd with the Nebraska Forest Service and JEO. It will be a hybrid inperson/zoom meeting. If you are interested in attending, please let staff know.
6. MORSE BLUFF LEVEE

7. WOLFE JETTY

8. LESHARA DRAINAGE IMPROVEMENT
   The Village of Leshara submitted a request #2 (attached) for $428.17 leaving a balance of $60,680.66 of the $62,000 approved at the July 2021 board meeting.
9. VILLAGE OF LINDSAY POND REQUEST
   The Village of Lindsay has formally requested cost-share assistance, up to $50,000, for the village pond rehabilitation project. See attachment for letter, plan drawing and engineers estimate.
   Representatives from JEO (Village consultant) and Lindsay will be present.
10. EROSION AND SEDIMENT RULES AND REGULATIONS

11. OTHER

12. ADJOURNMENT

Cost Share Assistance
2023 Tree Plantings

Name	County	# Trees	Landowner Total Cost w/out Tax	Cost Share CRP 50%	NRD Cost Share Program75%/25% CRP
Derek Simonds	Saunders	230 trees	$ 575.00		$ 431.25
Jordan Larsen	Saunders	200 trees	$ 500.00		$ 375.00
Seth McGinn	Dodge	800 trees	$ 2,000.00		$ 1,500.00
Totals		**1,230 trees**	**$3,075.00**		**$2,306.25**

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313	Waste Storage Facility
314	Brush Management
314	Brush Management
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314	Brush Management
314	Brush Management
314	Brush Management
315	Herbaceous Weed Treatment
315	Herbaceous Weed Treatment
315	Herbaceous Weed Treatment
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315	Herbaceous Weed Treatment
315	Herbaceous Weed Treatment
315	Herbaceous Weed Treatment
316	Animal Mortality Facility
316	Animal Mortality Facility
316	Animal Mortality Facility
317	Composting Facility
320	Irrigation Canal or Lateral
325	High Tunnel System
325	High Tunnel System
325	High Tunnel System
325	High Tunnel System
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327	Conservation Cover
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328 Conservation Crop Rotation
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329 Residue and Tillage Management, No Till
329 Residue and Tillage Management, No Till
329 Residue and Tillage Management, No Till
330 Contour Farming
332 Contour Buffer Strips
332 Contour Buffer Strips
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338 Prescribed Burning
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340 Cover Crop
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342 Critical Area Planting
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348 Dam, Diversion
350 Sediment Basin
350 Sediment Basin

351 Well Decommissioning
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356 Dike and Levee
356 Dike and Levee
356 Dike and Levee
359 Waste Treatment Lagoon
359 Waste Treatment Lagoon
360 Waste Facility Closure
360 Waste Facility Closure
360 Waste Facility Closure
362 Diversion
366 Anaerobic Digester
367 Roofs and Covers
367 Roofs and Covers
367 Roofs and Covers
367 Roofs and Covers
368 Emergency Animal Mortality Management
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371 Air Filtration and Scrubbing
372 Combustion System Improvement
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374 Energy Efficient Agricultural Operation
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386 Field Border

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390	Riparian Herbaceous Cover
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391	Riparian Forest Buffer
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393	Filter Strip
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394	Firebreak
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395	Stream Habitat Improvement and Management
395	Stream Habitat Improvement and Management
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395	Stream Habitat Improvement and Management
396	Aquatic Organism Passage
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399	Fishpond Management
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410	Grade Stabilization Structure
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436 Irrigation Reservoir
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441 Irrigation System, Microirrigation
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460 Land Clearing
462 Precision Land Forming and Smoothing
468 Lined Waterway or Outlet
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472 Access Control
484 Mulching
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490 Tree/Shrub Site Preparation
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511 Forage Harvest Management
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512 Pasture and Hay Planting
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520 Pond Sealing or Lining, Compacted Soil Treatment
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521 Pond Sealing or Lining, Geomembrane or Geosynthetic Clay Liner
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554 Drainage Water Management
558 Roof Runoff Structure
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560 Access Road
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561 Heavy Use Area Protection
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570 Stormwater Runoff Control
574 Spring Development
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575 Trails and Walkways
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576 Livestock Shelter Structure
578 Stream Crossing
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580 Streambank and Shoreline Protection
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582 Open Channel
584 Channel Bed Stabilization
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585 Stripcropping
587 Structure for Water Control
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601	Vegetative Barrier
603	Herbaceous Wind Barriers
604	Saturated Buffer
605	Denitrifying Bioreactor
606	Subsurface Drain
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612	Tree/Shrub Establishment
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629	Waste Treatment
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636 Water Harvesting Catchment
638 Water and Sediment Control Basin
638 Water and Sediment Control Basin
640 Waterspreading
642 Water Well
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644 Wetland Wildlife Habitat Management
645 Upland Wildlife Habitat Management
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645 Upland Wildlife Habitat Management
646 Shallow Water Development and Management
646 Shallow Water Development and Management
647 Early Successional Habitat Development-Mgt
647 Early Successional Habitat Development-Mgt
647 Early Successional Habitat Development-Mgt
649 Structures for Wildlife
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650 Windbreak/Shelterbelt Renovation

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656 Constructed Wetland
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660 Tree-Shrub Pruning
666 Forest Stand Improvement
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670 Energy Efficient Lighting System
670 Energy Efficient Lighting System
672 Energy Efficient Building Envelope
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808 Soil Carbon Amendment
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810	Annual Forages for Grazing Systems
812	Raised Beds
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821	Low Tunnel Systems
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5
1
2
3
5
58
72
73
74
75
76
86
129
130

24
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21

Scenario
Embankment Storage Pond
Excavated Storage Pond
Buried Concrete Tank, Less than 14,999 c.f. of storage
Buried Concrete Tank, Between 15,000 to 110,000 c.f. of storage
Buried Concrete Tank, Greater than 110,000 c.f. of storage
Steel or Concrete Above Ground Storage Structure
Bedded Pack - Concrete Floor and Concrete Walls
Bedded Pack - Earth Floor and Wood Walls
Bedded Pack - Earth Floor and Concrete Walls
Bedded Pack - Earth Floor with Concrete Walls and Concrete Apron
Dry Stack - Concrete floor and no walls
Dry Stack - Concrete floor and concrete walls
Mechanical and Chemical, Low Infestation
Mechanical and Chemical, Heavy Infestation
Chemical, Uplands
Chemical - Riparian
Chemical, Foliar Spot Treatment
Mechanical and Chemical, Medium Infestation
Mechanical and Chemical, Severe Infestation
Mechanical, Hand tools
Brush Management for 1 Ac. or less
Chemical, Ground or Aerial Treatment
Chemical, Wetland
Mechanical
Mechanical, Tree Establishment
Chemical, Tree Establishment - Banding
Chemical, Tree Establishment - Post-emergent Herbicide
Herbaceous Weed Treatment for One Acre Small Farm
Extra Large Animal - Daily Death Loss
Small Animal - Daily Death Loss
Medium to Large Animal - Daily Death Loss
Small Farm Pad + Bins
Irrigation Canal
High Tunnel, Low Snow and Wind Load
Contiguous US Snow
High Tunnel Gothic with Gutters
Small Gothic HT with Gutter
Small High Tunnel, Snow and Wind
Small High Tunnel, Intensive Sun
Introduced with Forgone Income
Wp_Introduced with Forgone Income
Native Species with Forgone Income
Wp_Native Species with Forgone Income
Pollinator Species with Forgone Income
Wp_Pollinator Species with Forgone Income
Introduced Species

Wp_Introduced Species
Native Species
Wp_Native Species
Pollinator Species
Wp_Pollinator Species
Monarch Species Mix
Wp_Monarch Species Mix
Pollinator Mix-Small Footprint
Wp_Basic Rotation Organic and Non-Organic
Pr_Basic Rotation Organic and Non-Organic
Wp_Irrigated to Dryland Rotation Organic and Non-Organic
Pr_Irrigated to Dryland Rotation Organic and Non-Organic
Pr_Specialty Crop Rotations-Small Scale
No-Till/Strip-Till
Wp_No-Till/Strip-Till
Small Scale No Till
Contour Farming
Introduced Species, Foregone Income (Organic and Non-Organic)
Wp_Introduced Species, Foregone Income (Organic and Non-Organic)
Native Species, Foregone Income (Organic and Non-organic)
Wp_Native Species, Foregone Income (Organic and Non-organic)
Pr_Herbaceous Fuel, Small Acreage
Pr_Herbaceous Fuel - Standard
Pr_Site Preparation
Pr_Level terrain, volatile fuel (wood) <640 acres
Pr_Steep Terrain, Volatile or Woody fuels
Cover Crop - Basic (Organic and Non-organic)
Wp_Cover Crop - Basic (Organic and Non-organic)
Cover Crop - Adaptive Management
Wp_Cover Crop - Adaptive Management
Cover Crop - Multiple Species (Organic and Non-organic)
Wp_Cover Crop - Multiple Species (Organic and Non-organic)
Cover Crop Multiple Species Frost Terminated Organic and Non-Organic
Wp_Cover Crop Multiple Species Frost Terminated Organic and Non-Organic
Cover Crop - 1 acre or less
Multi-species Cover Crop per 1000 square feet
Mechanical Termination of Cover Crop per 1000 square feet
Native or Introduced Vegetation - Normal Tillage (Organic and Non-Organic)
Wp_Native or Introduced Vegetation - Normal Tillage (Organic and Non-Organic)
Permanent Cover
Native Vegetation - Moderate Grading
Wp_Native Vegetation - Moderate Grading
Native Vegetation - Heavy Grading
Wp_Native Vegetation - Heavy Grading
Earthfill
Excavated Basin
Embankment Basin

Shallow, Greater than 15 in. dia.
Wp_Shallow, Greater than 15 in. dia.
Shallow, less than 15 in. dia.
Wp_Shallow, less than 15 in. dia.
Drilled, less than 300 feet
Wp_Drilled, less than 300 feet
Drilled, between 300 and 1,000 feet
Wp_Drilled, between 300 and 1,000 feet
Drilled, greater than 1,000 feet
Wp_Drilled, greater than 1,000 feet
Basic Water Test
Wp_Basic Water Test
Specialty Water Test
Wp_Specialty Water Test
Full Spectrum Test
Wp_Full Spectrum Test
Wetland Dike
Protective dike 6 feet high or less
Protective Dike >6 feet high
Embankment Lagoon
Excavated Lagoon
Decommissioning of Concrete Waste Storage Structure
Earthen Waste Impoundment Closure
Liquid Waste Impoundment Conversion to Fresh Water Storage
Diversion
Covered Lagoon/Holding Pond
Hoop Structure Roof
Timber or Steel Sheet Roof
Flexible Membrane Cover Only
Flex Membrane w/Flare
Burial
Cattle or Horse Disposal Other Than Burial
Swine Disposal Other Than Burial
Disposal of Goats or Sheep Other Than Burial
Forced Air Incineration
National Emergency Shallow Burial of Swine or Cattle
National Emergency Composting ??? purchase carbon material and mobilize equipment
National Emergency Carcass Disposal Other Than Burial, Incineration, Landfill or Render
National Emergency Disposal At Landfill or Render
National Emergency In-House Composting
National Emergency Forced Air Incineration
National Emergency Burial
Biofilter-Traditional Horizontal
IC Engine Repower, < 50 bhp
IC Engine Repower, 50-99 bhp
IC Engine Repower, 100-199 bhp
Electric Motor in-lieu of IC Engine, < 12 HP

Electric Motor in-lieu of IC Engine, 12-74 HP
Electric Motor in-lieu of IC Engine, 75-149 HP
Ventilation - Exhaust
Ventilation - HAF
Plate Cooler-Small
Plate Cooler
Scroll Compressor
Automatic Controller System
Motor Upgrade > 100 HP
Motor Upgrade 10 - 100 HP
Motor Upgrade > 1 and < 10 HP
Motor Upgrade <= 1 HP
Heating - Radiant Systems
Heating (Building)
Heating - Attic Heat Recovery vents
Grain Dryer
Excavated Pond
Excavated Pond with Embankment
Embankment Pond, No Principal Spillway
Embankment Pond with less than 24 inch Pipe
Embankment Pond with greater than or equal to 24 inch Pipe
Hand Planted, Bare Root
Trees, machine planted
Trees, machine planted, wildlife protection
Hand Planted, Bare Root, supplemental water for establishment
Trees, machine planted, wildlife protection, supplemental water for establishment
1 row windbreak - small acreage
Renovation-Supplemental hand planting with container or bare root stock
Barbed Wire, Multi-strand
Barbed Wire, Multi-strand with Fence Markers
Barbed Wire, Multi-strand, difficult terrain
Barbed Wire, Multi-strand with fence markers, difficult terrain
Woven Wire
Electric, high tensile with energizer
Electric, high tensile with energizer and fence markers
Protective Fence
Confinement
Portable Fence
Fence for 1 Acre or less
Fuel Break
Hand Fuel Break
Non Forested Fuel Break
Chipping and hauling off-site
Restoration/conservation treatment following catastrophic events
Forest Slash Treatment - Med/Heavy
Woody residue/silvicultural slash treatment- light
Wp_Field Border, Native Species, Forgone Income

Pr_Field Border, Native Species, Forgone Income
Wp_Field Border, Introduced Species, Forgone Income
Pr_Field Border, Introduced Species, Forgone Income
Wp_Field Border, Pollinator, Forgone Income
Pr_Field Border, Pollinator, Forgone Income
Pr_Small Scale Field Border
Native Species
Wp_Native Species
Native Species with foregone income
Wp_Native Species with foregone income
Wp_Direct Seeding (FI)
Pr_Direct Seeding (FI)
Wp_Bare-root, machine planted (FI)
Pr_Bare-root, machine planted (FI)
Wp_Small container, machine planted (FI)
Pr_Small container, machine planted (FI)
Wp_Filter Strip, Native species, Forgone Income
Pr_Filter Strip, Native species, Forgone Income
Wp_Filter Strip, Introduced species, Forgone Income
Pr_Filter Strip, Introduced species, Forgone Income
Vegetated, permanent, grass
Mowing
Constructed, Tillage
Constructed - Medium equipment, Dozer
Constructed - hand cleared
Constructed, tree clearing
Instream wood placement
Instream rock placement
Rock and wood structures
Fish Barrier
Blockage Removal
Nature-Like Fishway
CMP Culvert
Low Water Crossing
Habitat Structures
Planting Native Vegetation
Depth Management
Embankment, No PS
Embankment, Pipe <24 inch
Embankment, Pipe >=24 inch
Pipe Drop, Plastic - NP Reg 1
Pipe Drop, CMP
Concrete Box Drop
Sheet Pile Weir Drop
Gabion Rock Drop Structures
Concrete Block Chute
Modular Concrete Block Drop

Rock Chute
Tied Concrete Block Mat
Waterway, 25 to 50 ft2
Wp_Waterway, 25 to 50 ft2
Waterway with Side Dikes or Checks
Wp_Waterway with Side Dikes or Checks
Pr_High Species Diversity on Fallow or Non-Cropland, no Foregone Income
Pr_Specialized Habitat Requirements on Non-Cropland, no Foregone Income
Pr_High Species Diversity on Cropland with Foregone Income
Pr_Specialized Habitat Requirements on Cropland with Foregone Income
Pr_Very Small Acreage (<.5 ac) Planting with Seedlings
Pr_Low Species Diversity on Non-Cropland, no Foregone Income
Pr_Low Species Diversity on Cropland with Foregone Income
Bareroot, machine plant (FI)
Container, Machine Plant (FI)
PVC, 10-in by the foot
Wp_PVC, 10-in by the foot
PVC (Iron Pipe Size), less than or equal to 4 inch, Small Scale System
HDPE (Iron Pipe Size and Tubing), less than or equal to 2 inch, Small Scale
Surface HDPE (Iron Pipe Size and Tubing), less than or equal to 2 inch, Small Scale
Embankment Dam
Embankment Reservoir > 30 Acre-Feet
Excavated Tailwater Pit
Plastic tank, less than or equal to 1,000 gallons
Surface PE, with emitters, trees and shrubs
Wp_Surface PE, with emitters, trees and shrubs
Surface PE, with emitters, high tunnel
Surface Tape <5 acres
Small Microirrigation System
Small Surface Tape System
SDI (Subsurface Drip Irrigation)
Wp_SDI (Subsurface Drip Irrigation)
Gravity to Pivot Conversion
Wp_Gravity to Pivot Conversion
System Renovation, Renozzle with Drops
Wp_System Renovation, Renozzle with Drops
Gravity to Pivot Conversion with VRI
Wp_Gravity to Pivot Conversion with VRI
VRI System Retrofit Zone
Wp_VRI System Retrofit Zone
Linear Move System
Wp_Linear Move System
IWM, Advanced Technique
Wp_IWM, Advanced Technique
IWM, Advanced Technique Incorporating Precision Irrigation
Wp_IWM, Advanced Technique Incorporating Precision Irrigation
Consulatant Based IWM No Equipment

Wp_Consulatant Based IWM No Equipment
Intermediate IWM < 1 acre
Heavy Equipment
Terrace Removal
Turf Reinforced Matting, Moderate Stress
Turf Reinforced Matting, High Stress
Rock Lined, 12 in
Rock Lined, 24 in
Concrete - NP Reg 1
Articulated Concrete Block
Splash Pad
Pr_Animal exclusion from sensitive areas (FI)
Natural Material - Straw
Erosion Control Blanket
Tree and Shrub - Squares
Tree and Shrub - Rolls
Hydro-mulching
Natural Materials - Large Area
Mechanical, Heavy
Mechanical, Medium
Windbreak, mechanical only
Windbreak, chemical and mechanical
Windbreak, chemical only
Tree-Shrub Site Prep - small acreage
Removal and Disposal of Fence, Feedlot
Removal and Disposal of Fence, landscape
Removal and Disposal of Power Lines and Poles
Removal and Disposal of Steel and or Concrete Structures
Removal and Disposal of Wood Structures
Removal and disposal of individual landscape structures
Removal and Disposal of Brush and Trees <= 6 inch Diameter
Removal and Disposal of Brush and Trees > 6 inch Diameter
Removal and Disposal of Concrete Slab
Organic Preemptive Harvest
Per-Ann Crops - Delayed Mowing
Native Perennial Grasses, multi species
Wp_Native Perennial Grasses, multi species
Native Perennial Grasses, multi species, forgone income
Wp_Native Perennial Grasses, multi species, forgone income
Introduced Perennial Grasses-Legume
Wp_Introduced Perennial Grasses-Legume
Introduced Perennial Grasses-Legume, foregone income
Wp_Introduced Perennial Grasses-Legume, foregone income
Introduced Perennial & Native Grass Mix
Wp_Introduced Perennial & Native Grass Mix
Introduced Perennial & Native Grass Mix, foregone income
Wp_Introduced Perennial & Native Grass Mix, foregone income

Introduced Perennial Grasses with lime application
Wp_Introduced Perennial Grasses with lime application
Introduced Perennial Grasses-Legumes on irrigated cropland
Wp_Introduced Perennial Grasses-Legumes on irrigated cropland
Organic
Wp_Organic
Organic, forgone income
Wp_Organic, forgone income
Small farm, Pasture and Hay planting for 1 ac.
Shallow or Above Ground Pipeline, any diameter
Standard Installation, 2 inch dia. or less (KS/NE)
Standard Installation, greater than 2 inch dia.
Backhoe, 2 inch dia. or less
Backhoe, greater than 2 inch dia.
Boring, any diameter
Rural Water Connection Equipment
HDPE (Iron Pipe Size and Tubing), Small Scale
Surface HDPE (Iron Pipe Size and Tubing), Small Scale
Soil Dispersant - Covered
Use On-Site Material with Soil Cover
Flexible Membrane - Uncovered with liner drainage or venting
Flexible Membrane - Covered without liner drainage or venting
Flexible Membrane - Covered with liner drainage or venting
Small Ranch Unit
Range, 3-6 Pastures
Range, 7 or More Pastures
Grazing Lands, 30-73% Rest
Grazing Lands, Greater than 73% Rest
Habitat Mgt
Livestock Deferment (FI)
Cover Crop/Aftermath
Range Long Term Monitoring
Habitat Mgt. Long Term Monitoring
Livestock Deferment (FI) High Production Sites
Prescribed Grazing Management for 5 Acres or less
Irrigation, Modify Pump
Wp_Irrigation, Modify Pump
Irrigation, Submersible or Booster
Wp_Irrigation, Submersible or Booster
Irrigation, Variable Frequency Drive
Wp_Irrigation, Variable Frequency Drive
irrigation, Surface Water
Wp_irrigation, Surface Water
Livestock, Manure Transfer
Livestock, w/ Pressure Tank, Low HP
Livestock, without Pressure Tank (HP)
Windmill-Powered Pump - NP Region

Solar-Powered Pump 1hp
Livestock, Variable Frequency Drive
Native, Standard Prep
Wp_Native, Standard Prep
Native, Standard Prep (FI)
Wp_Native, Standard Prep (FI)
Native, Heavy Prep
Wp_Native, Heavy Prep
Native, Wildlife, or Pollinator (FI)
Wp_Native, Wildlife, or Pollinator (FI)
Drainage Water Management (DWM)
Roof Gutter
High Tunnel Roof Runoff Trench Drain and Storage
Roof Gutter, 6 inches wide with runoff Storage Tank
New 6 inch gravel road without Geotextile, Less than 2.5 Ft.
New 6 inch gravel road with Geotextile, less than 2.5 Ft.
New 6 inch gravel road without Geotextile, 2.5 ft. or higher
New 6 inch gravel road with Geotextile, 2.5 ft. or higher
Reinforced Concrete with sand or gravel foundation - cubic yard - NP Region
Rock/Gravel on Geotextile - cubic yard - NP Region
Rock/Gravel
Rock/Gravel-GeoCell-Geotextile
Rain Garden, small scale
Spring, up to 50 ft Collection
Spring, > 50 ft Collection
Earthfill Walkway, 4 Ft high or less
Earthfill Walkway, Higher than 4 Ft.
Wood Chips, Walkway small scale
Permanent Metal Wind Shelter
Bridge
Culvert installation
Low water crossing, rock armor
Low water crossing, concrete slab
Low water crossing, concrete block
Low water crossing, geocell
Shaping
Bioengineered
Rock Riprap
Gabion
Excavate & Fill
Bio-engineering
Wood structures
Stripcropping - wind and water erosion
Inline Flashboard Riser, Metal - Reg 1
Wp_Inline Flashboard Riser, Metal - Reg 1
Culvert <30 inches HDPE - NP Reg 1
Wp_Culvert <30 inches HDPE - NP Reg 1

Slide Gate - Flood Dike
Wp_Slide Gate - Flood Dike
Rock Check
Wp_Rock Check
Earth Check
Wp_Earth Check
Buried Automatic Valve
Wp_Buried Automatic Valve
Commercial Inline Flashboard Riser
Wp_Commercial Inline Flashboard Riser
Inlet Flashboard Riser, Metal
Wp_Inlet Flashboard Riser, Metal
Culvert <30 inches CMP
Wp_Culvert <30 inches CMP
Flow Meter with Mechanical Index
Wp_Flow Meter with Mechanical Index
Flow Meter with Electronic Index & Telemetry
Wp_Flow Meter with Electronic Index & Telemetry
Wp_Basic NM (Non-Organic/Organic)
Pr_Basic NM (Non-Organic/Organic)
Wp_Basic NM (Organic/NonOrganic) greater than or equal to 0.5-10 acres
Pr_Basic NM (Organic/NonOrganic) greater than or equal to 0.5-10 acres
Wp_Basic NM with Manure and/or Compost (Non-Organic/Organic)
Pr_Basic NM with Manure and/or Compost (Non-Organic/Organic)
Wp_Adaptive NM
Pr_Adaptive NM
Pr_Small Scale Basic Nutrient Management
Wp_Prescription Nutrient Efficiency and Precision Application
Pr_Prescription Nutrient Efficiency and Precision Application
Wp_Prescription Nutrient Efficiency
Pr_Prescription Nutrient Efficiency
Wp_Basic IPM Field Crops ??? Herbicide Substitution
Pr_Basic IPM Field Crops ??? Herbicide Substitution
Pr_Plant Health PAMS (acs) Low labor only
Wp_Pest Management Precision Ag
Pr_Pest Management Precision Ag
Wp_Water Quality Pesticide Mitigation > 30 Point AND/OR Beneficial Insect Pesticide Mitigation - Small Farm
Pr_Water Quality Pesticide Mitigation > 30 Point AND/OR Beneficial Insect Pesticide Mitigation - Small Farm
Wp_Water Quality Pesticide Mitigation = 30 Point AND/OR Beneficial Insect Pesticide Mitigation - Small Farm
Pr_Water Quality Pesticide Mitigation = 30 Point AND/OR Beneficial Insect Pesticide Mitigation - Small Farm
Wp_Water Quality Pesticide Mitigation > 30 Point AND/OR Beneficial Insect Pesticide Mitigation
Pr_Water Quality Pesticide Mitigation > 30 Point AND/OR Beneficial Insect Pesticide Mitigation
Wp_Water Quality Pesticide Mitigation = 30 Point AND/OR Beneficial Insect Pesticide Mitigation
Pr_Water Quality Pesticide Mitigation = 30 Point AND/OR Beneficial Insect Pesticide Mitigation
Pr_Plant health PAMS (Small Farm - each) labor only
Storage - Level or Flat Channel
Non-Storage - Broadbase

Storage - Broadbase
Broad Base, Rebuild
Non-Storage - Grass Back
Storage - Grass Back
Non-Storage - Narrow Base
Storage - Narrow Base
Narrow Base, Rebuild
Vegetative Planting
Cool Season Annual/Perennial Species
Saturated Buffer
Denitrifying Bioreactor
Corrugated Plastic Pipe (CPP), Single-Wall, <= 6 inch
Enveloped Corrugated Plastic Pipe (CPP), Single-Wall, <= 6 inch
Corrugated Plastic Pipe (CPP), Single-Wall, >= 8 inch
Corrugated Plastic Pipe (CPP), Twin-Wall, >= 8 inch
Secondary Main Retrofit for DWM
Individual tree - hand planting w/browse protection
Trees, Machine planted with tubes for animal protection
Trees, Machine planted - no tubes
Trees, Machine planted, no tubes, supplemental water for establishment
Hardwood Planting 1 gal pots
Tree-Shrub Establishment - Small Acreage
Steel Tank
Rubber Tire Tank on Earth
Fiberglass Tank on Earth
Rubber Tire Tank on Concrete
Fiberglass Tank on Concrete
Steel Rim Tank - Bottomless
Steel Rim Tank - Concrete Base
Enclosed Storage Tank
4 inch - 6 inch PVC or DW Pipe, Multi-Inlet System
6 inch or smaller Single Wall PE Pipe(non-perf or perf), Multi-Inlet System
8 inch - 10 inch PVC or DW Pipe, Multi-Inlet System
12 inch - 18 inch PVC or DW Pipe, Multi-Inlet System
12 inch - 18 inch PVC or DW Pipe, Single-Inlet System
Over 18 inch PVC or DW Pipe, Single- or Multi-Inlet System
6 inch - 10 inch PVC or DW Pipe, Single-Inlet System
8 inch Single Wall PE Pipe (non-perf or perf), Multi-Inlet System
10 inch Single Wall PE Pipe (non-perf or perf), Multi-Inlet System
>=12 inch Single Wall PE Pipe (non-perf or perf), Multi-Inlet System
Milking Parlor Waste Dosing System and Organic Bed
Aerobic Circulator
Mechanical Separator
Earthen Settling Structure with picket screen outlet
Earthen settling structure with pipe outlet
Concrete Settling Structure with picket screen outlet
Concrete Sand Settling Lane

Concrete Channel
Gravity flow, less than or equal to 18 inch diameter conduit
Pressure flow, less than or equal to 6 inch diameter conduit
Pressure flow, 8 inch diameter conduit
Pressure flow, 10 inch diameter conduit
Pressure flow, 12 inch or greater diameter conduit
Agitator, Slurry Transfer
Concrete Curb, with or without flow spreaders
Wp_Concrete Curb, with or without flow spreaders
Concrete Curb with major shaping
Wp_Concrete Curb with major shaping
Gated Pipe, with or without flow spreaders
Wp_Gated Pipe, with or without flow spreaders
Gated Pipe with major shaping
Wp_Gated Pipe with major shaping
Sprinkler, Solid Set Distribution
Wp_Sprinkler, Solid Set Distribution
Sprinkler, Mobile Pods
Wp_Sprinkler, Mobile Pods
Sprinkler, Center Pivot
Wp_Sprinkler, Center Pivot
Minor Shaping
Wp_Minor Shaping
Plastic tank, less than or equal to 1,000 gallons
WASCOB base
WASCOB topsoil
Dikes
Well Point
Dug (Excavated) Well
Single PVC Casing, greater than 100 ft. deep
Single PVC Casing with pitless unit, greater than 100 ft. deep
Dual Casing PVC
Steel or Copper, 100 ft. or deeper
Management and monitoring only, foregone income (FI)
Greater Prairie Chicken Habitat Development
Wildlife Habitat Enhancement - Former Cropland (FI)
Habitat Monitoring and Management, Medium Intensity and Complexity
Shallow Water Management-Low Level
Shallow Water Management, High Level
Mowing
Disking
Chemical
Escape Ramp
Fence Markers, Vinyl Undersill
Brush Pile - Small
Brush Pile - Large
Sod Release

Removal <8 inches DBH with Skidsteer
Removal > 8 inches DBH with Dozer
Medium, 0.5 ac or less
Wp_Medium, 0.5 ac or less
Large, 0.5 to 1.0 ac.
Wp_Large, 0.5 to 1.0 ac.
Large, more than 1.0 ac.
Wp_Large, more than 1.0 ac.
Wp_Fill in dugout
Pr_Fill in dugout
Wp_Depression Sediment Removal
Pr_Depression Sediment Removal
Wp_Sediment Removal - Saturated Site
Pr_Sediment Removal - Saturated Site
Wp_Ditch plug - Lateral Restoration
Pr_Ditch plug - Lateral Restoration
Wp_Embankment - Fill Height <= 4 feet
Pr_Embankment - Fill Height <= 4 feet
Wetland Creation, Excavation
Excavation at Saturated Site
Excavation and Embankment
Excavation
Wp_Excavation
Excavation on Saturated Site
Wp_Excavation on Saturated Site
Depression Sediment Removal and Ditch Plug
Wp_Depression Sediment Removal and Ditch Plug
Pruning Individual Agroforestry tree - small acreage
Pre-commercial Thinning , Hand tools
Timber Stand Improvement, Single Stem Treatment
Timber Stand Improvement, Chemical, Ground
Thinning for Wildlife and Forest Health
Lighting - LED
Automatic Controller System
Building Envelope - Attic Insulation
Building Envelope - Wall Insulation
Building Envelope - Sealant
Greenhouse - Insulate Unglazed Walls
Building Envelope - Greenhouse Screens
100% Biochar
80% Biochar-20% Compost
60% Biochar-40% Compost
40% Biochar-60% Compost
20% Biochar-80% Compost
Compost - On Site
Compost + Biochar - Small Areas
Other Carbon Amendment

Annual forages mix
Unframed Raised Bed field size < 0.10 acres Contamination or Debris Sites only
Unframed Raised Bedfield size < 0.5 acres Contamination or Debris Sites only
Framed Raised Bed Small Lot Contamination or Debris Sites only
Framed Raised Bed < 500 sq ft Contamination or Debris Sites only
Framed Raised Bed greater than or equal to 500 sq ft Contamination or Debris Sites only
Low tunnel < 1000 square feet- Year 1
Low tunnel management- Year 2-3
Low tunnel 1000-5000 square feet, Year 1

Scenario Unit	Total Cost per Unit	EQIP Payment Per Unit	EQIP Share Rate
Cubic Feet	$0.08	$0.04	50%
Cubic Feet	$0.14	$0.07	50%
Cubic Feet	$4.26	$2.13	50%
Cubic Feet	$2.78	$1.39	50%
Cubic Feet	$2.69	$1.35	50%
Cubic Feet	$4.13	$2.06	50%
Square Feet	$13.53	$6.77	50%
Square Feet	$4.06	$2.03	50%
Square Feet	$6.14	$3.07	50%
Square Feet	$8.47	$4.24	50%
Square Feet	$8.41	$4.20	50%
Square Feet	$11.48	$5.74	50%
Acres	$61.58	$46.19	75%
Acres	$411.13	$308.35	75%
Acres	$31.99	$19.19	60%
Acres	$158.23	$87.03	55%
Acres	$42.01	$25.21	60%
Acres	$157.24	$117.93	75%
Acres	$624.60	$468.45	75%
Acres	$69.84	$10.48	15%
Acres	$378.29	$283.71	75%
Acres	$28.79	$21.59	75%
Acres	$28.61	$21.46	75%
Acres	$13.17	$9.88	75%
Acres	$209.55	$157.16	75%
Acres	$47.92	$35.94	75%
Acres	$44.10	$33.08	75%
Acres	$226.09	$169.57	75%
Pounds per Day	$364.24	$182.12	50%
Pounds per Day	$214.60	$107.30	50%
Pounds per Day	$181.82	$90.91	50%
Square Feet	$70.63	$52.98	75%
Cubic Yards	$2.46	$1.23	50%
Square Feet	$5.44	$4.08	75%
Square Feet	$8.12	$6.09	75%
Square Feet	$7.44	$5.58	75%
Square Feet	$12.92	$9.69	75%
Square Feet	$14.10	$10.58	75%
Square Feet	$10.14	$7.60	75%
Acres	$420.34	$382.35	91%
Acres	$420.34	$382.35	91%
Acres	$501.94	$376.46	75%
Acres	$501.94	$376.46	75%
Acres	$817.91	$680.53	83%
Acres	$817.91	$680.53	83%
Acres	$212.91	$117.10	55%

Acres	$212.91	$117.10	55%
Acres	$233.56	$151.81	65%
Acres	$233.56	$151.81	65%
Acres	$717.82	$287.13	40%
Acres	$717.82	$287.13	40%
Acres	$894.97	$402.74	45%
Acres	$894.97	$402.74	45%
1,000 Square Foot	$133.94	$100.46	75%
Acres	$13.63	$12.27	90%
Acres	$13.63	$12.27	90%
Acres	$270.96	$203.22	75%
Acres	$270.96	$203.22	75%
1,000 Square Foot	$35.57	$32.02	90%
Acres	$21.98	$10.99	50%
Acres	$21.98	$10.99	50%
1,000 Square Foot	$40.43	$30.32	75%
Acres	$10.19	$5.10	50%
Acres	$408.92	$307.58	75%
Acres	$408.92	$307.58	75%
Acres	$436.02	$315.71	72%
Acres	$436.02	$315.71	72%
Acres	$25.90	$23.31	90%
Acres	$9.53	$8.57	90%
Acres	$55.66	$50.09	90%
Acres	$9.14	$8.22	90%
Acres	$20.64	$18.58	90%
Acres	$81.65	$28.58	35%
Acres	$81.65	$28.58	35%
Each	$2,819.50	$1,973.65	70%
Each	$2,819.50	$1,973.65	70%
Acres	$102.21	$40.88	40%
Acres	$102.21	$40.88	40%
Acres	$79.22	$23.77	30%
Acres	$79.22	$23.77	30%
Acres	$538.82	$404.11	75%
1,000 Square Foot	$57.32	$42.99	75%
1,000 Square Foot	$27.26	$20.44	75%
Acres	$420.33	$315.24	75%
Acres	$420.33	$315.24	75%
1,000 Square Foot	$20.51	$15.38	75%
Acres	$990.89	$743.17	75%
Acres	$990.89	$743.17	75%
Acres	$1,428.21	$1,071.15	75%
Acres	$1,428.21	$1,071.15	75%
Cubic Yards	$3.51	$1.76	50%
Cubic Yards	$4.26	$2.13	50%
Cubic Yards	$3.34	$1.67	50%

Feet	$41.34	$31.00	75%
Feet	$41.34	$31.00	75%
Feet	$9.31	$4.66	50%
Feet	$9.31	$4.66	50%
Feet	$23.52	$11.76	50%
Feet	$23.52	$11.76	50%
Feet	$21.53	$10.77	50%
Feet	$21.53	$10.77	50%
Feet	$12.12	$6.06	50%
Feet	$12.12	$6.06	50%
Each	$67.27	$33.63	50%
Each	$67.27	$33.63	50%
Each	$258.72	$129.36	50%
Each	$258.72	$129.36	50%
Each	$363.69	$181.84	50%
Each	$363.69	$181.84	50%
Cubic Yards	$4.58	$3.43	75%
Feet	$28.39	$14.19	50%
Feet	$41.93	$20.96	50%
Cubic Feet	$0.09	$0.05	56%
Cubic Feet	$0.12	$0.06	50%
Cubic Feet	$0.19	$0.09	47%
Cubic Feet	$0.10	$0.05	50%
Cubic Feet	$0.05	$0.02	40%
Cubic Yards	$3.78	$2.45	65%
Animal Unit	$474.19	$118.55	25%
Square Feet	$11.94	$5.97	50%
Square Feet	$16.27	$8.14	50%
Square Feet	$1.19	$0.59	50%
Square Feet	$10.41	$5.21	50%
Animal Unit	$107.05	$80.28	75%
Each	$411.21	$308.41	75%
Each	$158.54	$118.91	75%
Each	$128.26	$96.20	75%
Animal Unit	$316.78	$237.58	75%
Animal Unit	$184.14	$138.10	75%
Animal Unit	$504.44	$378.33	75%
Animal Unit	$352.83	$264.62	75%
Pound	$0.06	$0.05	83%
Animal Unit	$110.13	$82.60	75%
Animal Unit	$316.78	$237.58	75%
Animal Unit	$107.05	$80.28	75%
Cubic Yards	$65.04	$32.52	50%
Each	$3,013.16	$1,506.58	50%
Each	$14,355.08	$7,177.54	50%
Each	$24,144.08	$12,072.04	50%
Each	$1,709.07	$925.79	54%

Each	$6,404.43	$3,202.21	50%
Each	$11,956.86	$5,978.43	50%
Each	$2,259.85	$1,129.93	50%
Each	$277.24	$138.62	50%
Each	$5,196.10	$2,598.05	50%
Each	$36,279.86	$9,069.97	25%
Horsepower	$757.74	$378.87	50%
Each	$2,340.49	$1,170.24	50%
Horsepower	$151.76	$75.88	50%
Horsepower	$125.24	$62.62	50%
Horsepower	$224.11	$112.05	50%
Horsepower	$751.73	$375.87	50%
Each	$1,834.88	$917.44	50%
1,000 BTU/Hour	$25.00	$12.50	50%
Each	$230.97	$173.23	75%
Bushel per Hour	$223.62	$111.81	50%
Cubic Yards	$2.79	$1.39	50%
Cubic Yards	$3.45	$1.72	50%
Cubic Yards	$5.09	$2.54	50%
Cubic Yards	$6.86	$4.46	65%
Cubic Yards	$5.51	$3.58	65%
Each	$2.66	$1.99	75%
Feet	$0.36	$0.27	75%
Feet	$1.02	$0.77	75%
Each	$9.22	$5.53	60%
Feet	$1.58	$1.19	75%
Feet	$3.99	$2.99	75%
Feet	$3.22	$0.64	20%
Feet	$2.81	$2.11	75%
Feet	$2.97	$2.23	75%
Feet	$3.33	$2.50	75%
Feet	$3.44	$2.58	75%
Feet	$2.70	$2.03	75%
Feet	$1.32	$0.99	75%
Feet	$1.50	$1.12	75%
Feet	$2.54	$1.91	75%
Feet	$6.36	$4.77	75%
Feet	$0.28	$0.21	75%
Feet	$4.48	$3.36	75%
Acres	$1,772.04	$886.02	50%
Acres	$2,366.91	$1,183.46	50%
Acres	$309.25	$154.62	50%
Acres	$288.72	$216.54	75%
Acres	$704.11	$528.08	75%
Acres	$264.68	$198.51	75%
Acres	$208.48	$156.36	75%
Acres	$456.91	$438.06	96%

Acres	$456.91	$438.06	96%
Acres	$390.54	$378.33	97%
Acres	$390.54	$378.33	97%
Acres	$772.88	$722.43	93%
Acres	$772.88	$722.43	93%
1,000 Square Foot	$78.98	$71.08	90%
Acres	$172.95	$129.71	75%
Acres	$172.95	$129.71	75%
Acres	$218.45	$175.21	80%
Acres	$218.45	$175.21	80%
Acres	$1,169.06	$1,085.27	93%
Acres	$1,169.06	$1,085.27	93%
Acres	$1,867.51	$1,714.15	92%
Acres	$1,867.51	$1,714.15	92%
Acres	$2,869.05	$2,615.53	91%
Acres	$2,869.05	$2,615.53	91%
Acres	$540.33	$513.14	95%
Acres	$540.33	$513.14	95%
Acres	$492.53	$470.11	95%
Acres	$492.53	$470.11	95%
Feet	$0.14	$0.07	50%
100 Foot	$3.36	$1.68	50%
Feet	$0.12	$0.07	58%
Feet	$0.73	$0.37	51%
Feet	$0.72	$0.36	50%
Feet	$0.89	$0.45	51%
Acres	$20,193.92	$10,096.96	50%
Acres	$16,510.97	$8,255.49	50%
Acres	$35,190.07	$17,595.04	50%
Cubic Yards	$8,306.33	$4,153.16	50%
Cubic Yards	$31.17	$15.59	50%
Acres	$39,735.16	$19,867.58	50%
Each	$9,330.62	$4,665.31	50%
Cubic Yards	$203.40	$101.70	50%
Acres	$1,069.39	$534.70	50%
Acres	$1,007.01	$503.50	50%
Acres	$6,966.56	$3,483.28	50%
Cubic Yards	$5.08	$2.54	50%
Cubic Yards	$6.86	$4.46	65%
Cubic Yards	$5.52	$3.59	65%
Square Feet	$69.32	$34.66	50%
Square Feet	$22.70	$11.35	50%
Cubic Yards	$1,083.94	$541.97	50%
Square Feet	$64.59	$41.99	65%
Cubic Yards	$195.12	$97.56	50%
Square Feet	$6.91	$3.45	50%
Cubic Yards	$225.34	$146.47	65%

Cubic Yards	$137.41	$89.32	65%
Square Feet	$11.54	$5.77	50%
Acres	$5,036.38	$2,518.19	50%
Acres	$5,036.38	$2,518.19	50%
Acres	$6,692.02	$3,346.01	50%
Acres	$6,692.02	$3,346.01	50%
Acres	$531.54	$478.38	90%
Acres	$981.82	$883.63	90%
Acres	$868.52	$808.08	93%
Acres	$1,284.44	$1,182.41	92%
Square Feet	$0.58	$0.53	91%
Acres	$265.29	$238.76	90%
Acres	$585.10	$553.00	95%
Feet	$1.02	$0.58	57%
Feet	$1.17	$0.65	56%
Feet	$16.60	$5.81	35%
Feet	$16.60	$5.81	35%
Linear Feet	$6.26	$4.70	75%
Pound	$40.70	$30.53	75%
Pound	$8.79	$6.60	75%
Cubic Yards	$5.29	$2.65	50%
Cubic Yards	$4.09	$2.05	50%
Cubic Yards	$2.40	$1.20	50%
Gallons	$4.10	$3.08	75%
Each	$3.92	$1.18	30%
Each	$3.92	$1.18	30%
Square Feet	$0.82	$0.25	30%
Acres	$4,224.28	$3,168.21	75%
Square Feet	$1.04	$0.78	75%
Square Feet	$0.81	$0.60	74%
Acres	$2,543.55	$890.24	35%
Acres	$2,543.55	$890.24	35%
Feet	$77.84	$23.35	30%
Feet	$77.84	$23.35	30%
Each	$37.25	$14.90	40%
Each	$37.25	$14.90	40%
Feet	$129.89	$38.97	30%
Feet	$129.89	$38.97	30%
Feet	$54.81	$21.92	40%
Feet	$54.81	$21.92	40%
Feet	$124.31	$37.29	30%
Feet	$124.31	$37.29	30%
Each	$3,048.96	$1,219.58	40%
Each	$3,048.96	$1,219.58	40%
Each	$5,062.08	$2,024.83	40%
Each	$5,062.08	$2,024.83	40%
Each	$727.04	$363.52	50%

Each	$727.04	$363.52	50%
Square Feet	$0.91	$0.68	75%
Acres	$1,061.29	$795.97	75%
Feet	$0.76	$0.23	30%
Square Feet	$2.47	$1.24	50%
Square Feet	$2.17	$1.09	50%
Square Feet	$6.10	$3.05	50%
Square Feet	$13.65	$6.82	50%
Square Feet	$7.67	$3.83	50%
Square Feet	$13.00	$6.50	50%
Square Feet	$9.70	$4.85	50%
Acres	$45.94	$45.67	99%
Acres	$462.96	$347.22	75%
Square Feet	$0.28	$0.21	75%
Each	$1.30	$0.97	75%
Feet	$0.79	$0.59	75%
Acres	$1,144.97	$572.48	50%
Acres	$392.16	$196.08	50%
Acres	$360.93	$198.51	55%
Acres	$336.64	$168.32	50%
Acres	$110.40	$55.20	50%
Acres	$314.83	$236.12	75%
Acres	$79.84	$39.92	50%
Square Feet	$3.61	$2.71	75%
Feet	$4.02	$2.01	50%
Feet	$1.26	$0.63	50%
Feet	$3.62	$1.81	50%
Square Feet	$13.59	$6.80	50%
Square Feet	$7.08	$3.54	50%
Square Feet	$6.38	$3.19	50%
Acres	$1,141.93	$570.96	50%
Acres	$2,184.40	$1,092.20	50%
Square Feet	$0.81	$0.40	49%
Acres	$4.82	$2.41	50%
Acres	$4.82	$2.41	50%
Acres	$162.10	$97.26	60%
Acres	$162.10	$97.26	60%
Acres	$319.19	$198.87	62%
Acres	$319.19	$198.87	62%
Acres	$80.64	$60.48	75%
Acres	$80.64	$60.48	75%
Acres	$237.74	$158.14	67%
Acres	$237.74	$158.14	67%
Acres	$76.85	$38.42	50%
Acres	$76.85	$38.42	50%
Acres	$275.60	$177.07	64%
Acres	$275.60	$177.07	64%

Acres	$177.30	$88.65	50%
Acres	$177.30	$88.65	50%
Acres	$126.10	$63.05	50%
Acres	$126.10	$63.05	50%
Acres	$131.54	$65.77	50%
Acres	$131.54	$65.77	50%
Acres	$288.64	$183.59	64%
Acres	$288.64	$183.59	64%
Acres	$705.80	$529.35	75%
Feet	$3.13	$1.57	50%
Feet	$3.16	$1.74	55%
Feet	$5.90	$2.95	50%
Feet	$6.21	$3.10	50%
Feet	$8.76	$4.38	50%
Feet	$77.52	$38.76	50%
Each	$4,395.67	$3,296.75	75%
Pound	$40.70	$30.53	75%
Pound	$15.26	$11.44	75%
Cubic Yards	$6.95	$3.82	55%
Cubic Yards	$5.94	$2.08	35%
Square Yard	$19.32	$9.66	50%
Square Yard	$10.53	$5.26	50%
Square Yard	$20.67	$10.34	50%
Acres	$31.27	$15.63	50%
Acres	$7.09	$3.54	50%
Acres	$9.50	$4.75	50%
Acres	$10.85	$5.42	50%
Acres	$14.91	$7.46	50%
Acres	$17.31	$8.66	50%
Acres	$45.94	$31.62	69%
Acres	$8.07	$4.04	50%
Acres	$22.58	$16.94	75%
Acres	$32.15	$24.12	75%
Acres	$59.59	$58.91	99%
Acres	$226.43	$169.82	75%
Each	$29,690.76	$7,422.69	25%
Each	$29,690.76	$7,422.69	25%
Each	$9,110.90	$4,555.45	50%
Each	$9,110.90	$4,555.45	50%
Each	$6,829.00	$5,121.75	75%
Each	$6,829.00	$5,121.75	75%
Each	$15,344.81	$7,672.40	50%
Each	$15,344.81	$7,672.40	50%
Each	$23,926.40	$11,963.20	50%
Each	$5,141.03	$3,084.62	60%
Horsepower	$2,353.52	$1,765.14	75%
Each	$8,404.68	$4,202.34	50%

Each	$8,373.79	$6,280.34	75%
Each	$6,797.75	$5,098.32	75%
Acres	$162.10	$97.26	60%
Acres	$162.10	$97.26	60%
Acres	$207.60	$167.08	80%
Acres	$207.60	$167.08	80%
Acres	$181.96	$109.18	60%
Acres	$181.96	$109.18	60%
Acres	$277.19	$219.27	79%
Acres	$277.19	$219.27	79%
Each	$118.81	$59.40	50%
Feet	$5.61	$2.81	50%
Linear Feet	$41.91	$31.43	75%
Feet	$20.71	$15.53	75%
Feet	$13.02	$6.51	50%
Feet	$15.90	$7.95	50%
Feet	$19.20	$9.60	50%
Feet	$22.47	$11.23	50%
Cubic Yards	$464.07	$232.04	50%
Cubic Yards	$47.04	$23.52	50%
Cubic Yards	$25.70	$12.85	50%
Square Feet	$3.61	$2.71	75%
Square Feet	$1.69	$1.27	75%
Each	$3,686.48	$1,843.24	50%
Each	$5,917.89	$2,958.95	50%
Feet	$11.30	$5.65	50%
Feet	$24.93	$12.46	50%
Square Feet	$1.98	$1.48	75%
Feet	$127.73	$95.79	75%
Square Feet	$68.42	$34.21	50%
Diameter Inch Foot	$3.49	$1.75	50%
Square Feet	$7.51	$3.75	50%
Square Feet	$11.06	$5.53	50%
Square Feet	$13.91	$6.96	50%
Square Feet	$5.76	$2.88	50%
Feet	$8.96	$4.48	50%
Feet	$30.30	$15.15	50%
Cubic Yards	$141.69	$70.85	50%
Feet	$571.73	$285.86	50%
Cubic Yards	$2.20	$1.10	50%
Square Feet	$4.28	$2.14	50%
Each	$4,472.99	$2,236.49	50%
Acres	$1.98	$0.99	50%
Diameter Inch Foot	$3.99	$1.99	50%
Diameter Inch Foot	$3.99	$1.99	50%
Diameter Inch Foot	$6.04	$3.02	50%
Diameter Inch Foot	$6.04	$3.02	50%

Feet	$68.02	$34.01	50%
Feet	$68.02	$34.01	50%
Each	$1,520.01	$760.01	50%
Each	$1,520.01	$760.01	50%
Each	$823.78	$411.89	50%
Each	$823.78	$411.89	50%
Each	$901.57	$450.78	50%
Each	$901.57	$450.78	50%
Diameter Inch Foot	$5.29	$2.64	50%
Diameter Inch Foot	$5.29	$2.64	50%
Diameter Inch Foot	$5.89	$2.94	50%
Diameter Inch Foot	$5.89	$2.94	50%
Diameter Inch Foot	$2.95	$1.47	50%
Diameter Inch Foot	$2.95	$1.47	50%
Inch	$178.94	$134.20	75%
Inch	$178.94	$134.20	75%
Inch	$492.52	$369.39	75%
Inch	$492.52	$369.39	75%
Acres	$9.72	$8.75	90%
Acres	$9.72	$8.75	90%
Each	$327.95	$295.16	90%
Each	$327.95	$295.16	90%
Acres	$20.62	$18.56	90%
Acres	$20.62	$18.56	90%
Each	$2,876.33	$2,588.70	90%
Each	$2,876.33	$2,588.70	90%
1,000 Square Foot	$73.63	$66.27	90%
Acres	$63.34	$57.01	90%
Acres	$63.34	$57.01	90%
Acres	$47.08	$42.37	90%
Acres	$47.08	$42.37	90%
Acres	$36.22	$32.60	90%
Acres	$36.22	$32.60	90%
Acres	$15.51	$10.85	70%
Acres	$63.77	$57.39	90%
Acres	$63.77	$57.39	90%
Each	$1,942.84	$1,748.56	90%
Each	$1,942.84	$1,748.56	90%
Each	$1,169.86	$1,052.87	90%
Each	$1,169.86	$1,052.87	90%
Acres	$69.28	$62.35	90%
Acres	$69.28	$62.35	90%
Acres	$39.79	$35.81	90%
Acres	$39.79	$35.81	90%
Each	$584.60	$526.14	90%
Feet	$2.08	$1.35	65%
Feet	$1.89	$1.04	55%

Feet	$3.62	$1.99	55%
Feet	$1.82	$0.91	50%
Feet	$3.23	$1.45	45%
Feet	$4.39	$1.98	45%
Feet	$3.21	$1.77	55%
Feet	$3.46	$1.73	50%
Feet	$1.40	$0.70	50%
Feet	$1.26	$0.95	75%
Linear Feet	$0.10	$0.07	70%
Feet	$8.98	$6.74	75%
Cubic Yards	$82.99	$62.24	75%
Feet	$3.90	$1.95	50%
Feet	$4.92	$2.46	50%
Feet	$6.76	$3.38	50%
Feet	$14.84	$7.42	50%
Feet	$8.32	$4.16	50%
Each	$7.12	$5.34	75%
Each	$11.71	$8.78	75%
Each	$3.56	$2.67	75%
Each	$8.79	$6.59	75%
Acres	$1,464.66	$1,098.50	75%
Each	$18.47	$13.85	75%
Gallons	$2.35	$0.71	30%
Gallons	$1.95	$1.07	55%
Gallons	$2.36	$0.71	30%
Gallons	$2.44	$1.22	50%
Gallons	$2.85	$1.14	40%
Gallons	$0.51	$0.31	61%
Gallons	$2.08	$1.15	55%
Gallons	$1.83	$0.91	50%
Feet	$8.64	$4.32	50%
Feet	$5.06	$2.53	50%
Feet	$20.75	$8.30	40%
Feet	$29.44	$11.78	40%
Feet	$40.51	$20.26	50%
Feet	$50.83	$25.41	50%
Feet	$24.78	$12.39	50%
Linear Feet	$7.08	$3.54	50%
Linear Feet	$10.26	$5.13	50%
Linear Feet	$13.58	$6.79	50%
Gallons per Day	$67.69	$33.85	50%
Animal Unit	$130.08	$65.04	50%
Each	$56,300.84	$28,150.42	50%
Cubic Feet	$0.36	$0.18	50%
Cubic Feet	$0.22	$0.11	50%
Cubic Feet	$3.85	$1.92	50%
Square Feet	$10.38	$5.19	50%

Square Feet	$15.59	$7.80	50%
Feet	$33.68	$16.84	50%
Feet	$17.82	$8.91	50%
Feet	$26.26	$13.13	50%
Feet	$37.88	$18.94	50%
Feet	$55.30	$27.65	50%
Each	$33,633.19	$16,816.60	50%
Acres	$4,769.55	$2,384.78	50%
Acres	$4,769.55	$2,384.78	50%
Acres	$12,298.85	$6,149.43	50%
Acres	$12,298.85	$6,149.43	50%
Acres	$3,120.98	$1,560.49	50%
Acres	$3,120.98	$1,560.49	50%
Acres	$12,536.75	$6,268.38	50%
Acres	$12,536.75	$6,268.38	50%
Acres	$8,411.00	$4,205.50	50%
Acres	$8,411.00	$4,205.50	50%
Acres	$4,238.75	$2,119.37	50%
Acres	$4,238.75	$2,119.37	50%
Acres	$4,442.49	$2,221.24	50%
Acres	$4,442.49	$2,221.24	50%
Acres	$1,376.03	$688.02	50%
Acres	$1,376.03	$688.02	50%
Gallons	$2.15	$1.61	75%
Cubic Yards	$3.90	$1.95	50%
Cubic Yards	$4.20	$2.10	50%
Acres	$2,017.93	$1,008.97	50%
Feet	$136.85	$68.43	50%
Feet	$556.07	$278.03	50%
Feet	$54.02	$13.51	25%
Feet	$56.35	$22.54	40%
Feet	$63.24	$31.62	50%
Linear Feet	$81.91	$40.95	50%
Acres	$244.96	$239.99	98%
Acres	$11.17	$8.38	75%
Acres	$226.76	$226.54	100%
Acres	$13.73	$10.30	75%
Acres	$162.57	$81.28	50%
Acres	$364.78	$182.39	50%
Acres	$11.97	$5.99	50%
Acres	$29.80	$14.90	50%
Acres	$29.97	$14.98	50%
Each	$95.35	$47.67	50%
Feet	$0.18	$0.09	50%
Each	$44.54	$22.27	50%
Each	$177.39	$88.69	50%
Feet	$0.15	$0.11	73%

Feet	$1.18	$0.59	50%
Feet	$2.79	$1.40	50%
Acres	$14,829.59	$7,414.80	50%
Acres	$14,829.59	$7,414.80	50%
Acres	$10,436.80	$5,218.40	50%
Acres	$10,436.80	$5,218.40	50%
Acres	$7,920.13	$3,960.06	50%
Acres	$7,920.13	$3,960.06	50%
Cubic Yards	$3.80	$3.42	90%
Cubic Yards	$3.80	$3.42	90%
Cubic Yards	$3.68	$3.31	90%
Cubic Yards	$3.68	$3.31	90%
Cubic Yards	$4.67	$4.21	90%
Cubic Yards	$4.67	$4.21	90%
Cubic Yards	$8.35	$7.51	90%
Cubic Yards	$8.35	$7.51	90%
Cubic Yards	$6.21	$5.59	90%
Cubic Yards	$6.21	$5.59	90%
Cubic Yards	$2.65	$1.98	75%
Cubic Yards	$4.67	$3.50	75%
Cubic Yards	$4.17	$3.13	75%
Cubic Yards	$2.46	$1.84	75%
Cubic Yards	$2.46	$1.84	75%
Cubic Yards	$4.49	$3.36	75%
Cubic Yards	$4.49	$3.36	75%
Cubic Yards	$2.50	$1.88	75%
Cubic Yards	$2.50	$1.88	75%
Each	$12.42	$9.31	75%
Acres	$346.12	$173.06	50%
Acres	$385.84	$192.92	50%
Acres	$59.41	$29.70	50%
Acres	$1,169.37	$584.69	50%
Each	$12.06	$6.03	50%
Each	$498.69	$249.35	50%
Square Feet	$1.11	$0.56	50%
Square Feet	$2.47	$1.24	50%
Feet	$2.00	$1.00	50%
Square Feet	$0.39	$0.20	51%
Square Feet	$3.12	$1.56	50%
Cubic Yards	$213.19	$159.89	75%
Cubic Yards	$217.85	$163.39	75%
Cubic Yards	$158.25	$118.69	75%
Cubic Yards	$119.75	$89.81	75%
Cubic Yards	$95.67	$71.76	75%
Cubic Yards	$357.35	$71.47	20%
Cubic Feet	$11.56	$8.67	75%
Cubic Yards	$190.53	$142.90	75%

Acres	$92.78	$69.58	75%
Square Feet	$4.97	$3.73	75%
Square Feet	$4.02	$3.01	75%
Square Feet	$14.30	$10.73	75%
Square Feet	$7.73	$5.80	75%
Square Feet	$4.64	$3.48	75%
Square Feet	$5.82	$4.36	75%
Square Feet	$0.52	$0.39	75%
Square Feet	$1.57	$1.18	75%

Lower Platte North
Natural Resources District

Soil & Water Conservation Program
(SWCP)

LPNNRD Board Approval 4/11/22

Table of Contents

LOWER PLATTE NORTH NATURAL RESOURCES DISTRICT POLICY
2021 SOIL & WATER CONSERVATION PROGRAM (SWCP)

I. PURPOSE

The purpose of this program is to provide guidance for administering federal (EPA 319 grants), state (NSWCP, Environmental Trust grants) and local cost-share assistance as an incentive to landowners for the construction and application of soil and water conservation practices.

II. ELIGIBILITY, DISTRIBUTION OF FUNDS

A. Any landowner within the Lower Platte North NRD (LPNNRD), individual, partnership, corporation or other legal entity is eligible to apply for SWCP funds.
B. Cost-share program funds will be approved and distributed based on the number of high priority applications received each fiscal year (July 1 - June 30).
C. Funds may be reserved and targeted toward high priority watersheds and projects as determined and approved by the LPNNRD Projects Committee and Board.
D. Unobligated or unused SWCP funds in priority watersheds may be redistributed to other areas if not used in a timely manner.
E. The LPNNRD may supplement the Nebraska Soil and Water Conservation Program (NSWCP) state funds with available federal, other state & local funds. The amount of local funds budgeted and available will be decided each year.
F. Landowners will be expected to apply for available federal EQIP cost-share funding when applicable and available for eligible high priority practices A, C through M, before state and local cost share funding is approved. It is also generally expected to approve available state funding before local funds are considered.
G. Lands for Conservation (LFC) program is exempt from the payment cap stipulations of the SWCP policy.

III. APPLICATION REQUIREMENTS

A. Eligible SWCP applicants are to apply at their local NRCS Service Office (also the LPNNRD office if for tree planting or windbreak renovations). Applications with appropriate NRCS comments/recommendations are to be forwarded to the NRD for consideration.
B. Applications will contain sufficient information to include:
   1. Date construction (summer or fall) is expected to be completed.
   2. Type of Project to be installed.
   3. Whether the proposed project is located in a priority watershed area or if other special conditions exist.
   4. An aerial photograph showing the project location.
   5. Total estimated cost-share needed for the project.
   6. When applying for a small dam or grade stabilization structure, the estimated percent of land treatment draining to the proposed site (Attachment C).

IV. ELIGIBLE HIGH PRIORITY PRACTICES

A. <u>Establishment of warm and cool season grass on crop land</u>
B. **<u>Small conservation project (terraces, basins, diversion, grass waterways and/or underground outlets) applications.</u>** This priority practice includes newly established

grass waterways and/or replacement grass waterways.

i. Small projects are only eligible on fields where a complete no-till cropping management system is currently being applied.
ii. Existing grassed waterway applications must be over 10-years old and part of an approved terrace system or on 100% no-tilled fields)
iii. Small Projects may involve the construction of a new terrace and/or sediment & water control basins systems or it may include the extension of an existing terrace system with the inclusion of sediment & water control basins (this priority does "NOT" include the replacement of functionally obsolete terrace systems, waterways and sediment & water control basins in excess of 10-years old).
iv. Small projects do not include practice of installing tile outlets into existing functional terrace outlet systems (refer to priority G).
v. Small projects will not exceed $5000.00 in cost incentive request.
   *For small projects, landowners will not be expected to apply for available federal EQIP cost-share funding for eligible high priority practice B. It will generally be expected to approve available state funding before local funds are considered.

C. **<u>*Construction of new terrace systems</u>** (includes replacement of functionally obsolete terrace systems in excess of 20-years old).

D. **<u>Construction of sediment & water control basins when part of a new terrace system where cost share incentives exceeds $5,000</u>** (Attachment A).

E. **<u>Construction of Diversions when part of a new terrace system or dam</u>** (Attachments A & C).

F. **<u>Planned Grazing Management Systems</u>** (Attachment B)

G. **<u>* Installation of Tiled Outlets into Existing Terraces</u>** (includes the storage portion of the terrace).

H. **<u>Water Impoundment and Grade Stabilization Structures</u>** (Attachment C)

I. **<u>Tree/Shrub Planting</u>** (Only when NRD stock is provided and planted by the District) For riparian buffer strips, field, acreage and farmstead windbreaks and for wildlife habitat 200- tree/shrub minimum is required for riparian buffer strips, and for field and farmstead windbreaks. A 300-tree/shrub minimum is required for wildlife habitat. An eligible high priority practice under our Soil and Water Conservation Program (SWCP), at 50% cost share assistance on handplanting of 600 or more trees, provided that the cooperator uses our tree planning machine. It is further recommended that final approved payments will be subject to LPNNRD inspection. (4/2022)

J. **<u>Windbreak Renovation</u>** (Attachment D)

K. **<u>Supplementing EQIP Contracts in Priority Areas</u>**
When federal EQIP funds are approved in LPNNRD priority areas, the District may approve additional local and/or state cost share not to exceed the established maximum cost share percentage approved for a practice or the specific area.

L. **<u>Emergency Repair of Conservation Practices</u>** (Attachment E)

M. **<u>Lands for Conservation (LFC) Program :</u>** **(Attachment F) Any approved EQIP contract that agrees to the terms of the LFC program; summer construction Jun 1 – September 30 of the calendar year.**

***<u>NOTE</u>**: Cost share only applies toward the tile outlet portion of approved terrace systems to establish a stable outlet. A stable outlet is considered to be on land that has a 2% grade or less. A landowner may choose to install a portion of the outlet without cost share assistance provided that it meets NRCS design standards and specifications.

V. INELIGIBLE PRACTICES

A. Any application that would allow the installation of terraces on land that has established grass will not be approved.

B. The LPNNRD will not approve any conservation practice that will encourage the conversion of grassland, including CRP land, to crop land. This includes CRP land in the last year of the contract.
C. Rebuilding grassed waterways or tile outlets if under 10-years old. Note: Cost share for replacing grass waterways will be considered on a case-by-case basis when over ten (10) years old and part of an approved terrace system or on 100% no-till fields (see IV. M.).
D. Work that is considered normal maintenance of existing conservation practices.
E. Rebuilding terraces on existing terrace lines.
F. Terraces systems on Class VI land or greater.
G. Sediment removal from small dams or other impoundments and/or from adjacent lands of said structures.
H. Work started or constructed prior to approval.
I. Livestock Waste Pits.
J. The District will not provide cost share for practices on farmland that does not have a certified Nitrogen operator or on irrigated land where the irrigated acres are not certified by LPNNRD.
K. Any practice on fields that are determined sod-busted by the NRCS.
L. Repair of damage to conservation practices that is determined to be landowner negligence in performing normal maintenance as outlined in NRCS specifications.

VI. APPLICATION SUBMITTAL, APPROVAL & PROJECT COMPLETION PERIODS

A. <u>Summer Construction Applications (For June through September 15):</u>

To insure LPNNRD consideration, **applications for summer construction must be submitted by February 1.** Most generally, the Projects Committee will review, rank and recommend summer application approvals prior to construction season. **.** However, consideration and approval of summer applicationsreceived after **February 1** may occur depending on available funds. All **summer construction projects are to be completed by September 15** and **final paperwork submitted to the LPNNRD office by October 15.** The Projects Committee will review all uncompleted or unpaid applications at the end of each period to determine **if** application extensions and/or cancellations are warranted. **The field must be available for construction by August 1. The area must be planted to a cover crop or a crop preceding or after construction. The crop or cover may be harvested or pastured during the contract period.** Work not **completed by September 15,** may be canceled or receive reduced cost share as determined by the **Projects** Committee/Board.

NOTE: Cooperators who are approved for incentive payments within special designated watersheds, must follow these same summer construction requirements (refer to the "Lands for Conservation Program" – Attachment F).

B. **<u>Fall Construction Applications (September through December project completion):</u>**

To insure LPNNRD consideration, applications for fall construction must be received **by July 1.** Most generally, the Projects Committee will review, rank and recommend fall construction application approvals prior to fall construction season. However, additional approvals for fall work may occur after July/August as funds are available.

Approved fall applications will be given until December 31 to complete the work. The Committee will review all unpaid applications at the end of each year to determine application extensions and cancellations.

C. **Grass, Tree Planting, Windbreak Renovation Applications:**
Application periods for grass establishment will be approved based on NRCS seed and seeding specifications. Applications for trees are generally considered for approval just before the spring planting season. For approved Windbreak Renovation applications, tree removal will normally be completed in the summer or fall so the site will be ready before spring tree planting.

D. **Small Dam Application (Attachment C):**
To ensure consideration for approval, the **District will need NRCS/NRD technician recommended applications by December 15.** The Projects Committee will review and prioritize and submit a recommendation for approval at the January Board Meeting.

E. **LPNNRD Signatures on Approved Applications & Related Documents:**
The Manager, Assistant Manager and Projects Coordinator are authorized to sign Board approved SWCP applications, Completion and Document Certifications and other related documents on behalf of the LPNNRD.

VII. 2022 PRIORITY AREAS & ELIGIBLE COST-SHARE PERCENTAGES

Priority areas for 2022 listed below are given first consideration for District cost share assistance. Each year, high priority practice applications located in priority areas are reviewed and approved by the Projects Committee and Board for the upcoming program year. The cost-share assistance payment may not exceed a total of the eligible percent for an area when combining all sources of federal, state and local assistance. If there is not enough funding for all applications for all listed priority areas, the Projects Committee may rank areas for approval or approve a lower maximum cost share percent.

LPNNRD Cost-Share Amounts	Average (%) and Actual
FALL Work (District Wide) max $ limit: $12,500.00	75
FALL Work (Targeted Areas) max $ limit: $12,500.00	75
SUMMER Work (District Wide) max $ limit: $10,000.00	75
SUMMER Work (Targeted Areas) max $ limit: $12,500.00	75

	Targeted Areas	Notes
A.	LPNNRD Lands North of the Platte River	Platte, Boone, Madison, Colfax & Dodge Counties. Shell Creek is also in ET & EPA 319 grant area - actual percent depends on priority area and practice as defined in approved grant application).
B.	Lake Wanahoo (Sand/Duck Creek) Watershed	
C.	Czechland Lake Recreation Area Watershed	
D.	Homestead Lake Recreation Area Watershed	
E	Wahoo Creek Sub-Basins	Dunlap Creek; North Fork Wahoo Creek; Miller Branch Creek. These Wahoo Creek Sub-Basins are designated EQIP NWQI, EPA 319 and Environmental Trust Priority Areas.
F.	Skull Creek Watershed	It is anticipated to alternate this watershed with the Bone Creek Watershed every two years
G.	Watersheds Above All Existing and Planned LPNNRD Flood Control Structures	Non-public structures that are or will be LPNNRD Flood Control Structures operated and maintained by the District
H.	Watersheds Above Proposed or Completed Landowner SWCP Cost Share Dams	That will or have received LPNNRD assistance
I.	Voluntary Compliance of Verified Erosion & Sediment Complaints	District-wide
J.	All High Priority Practice Summer Applications	District-wide (June 1 through September 15 completion)
K.	Tree/Shrub Planting	District-wide
L.	Voluntary Compliance of Verified Erosion & Sediment Complaints	District-wide
M.	All High Priority Practice Summer Applications	District-wide (June 1 through September 15 completion)
N.	Tree/Shrub Planting	District-wide

VIII. COST SHARE PERCENTAGE - PRACTICE EXCEPTIONS

The maximum cost share percentage for most high priority conservation practices will be 75%, depending on the where the practice is located **(Refer to VII. above).** The exception to this is for the following high priority practices:

- **A. Water Impoundment Dams and Grade Stabilization Structures: 65% - 75%** (Attachment C)
- B. **Windbreak Renovation Practice: 50%** (Attachment D)
- C. **Emergency Repair of Conservation Practices: 50%** (Attachment E)

IX. MAXIMUM COST SHARE LIMITS

A. General Maximum Limit:

A cooperator may receive up to $12,500 SWCP funds within any program year (July 1 - June 30) for most high priority practices unless otherwise specified below.

B. Priority Areas with Federal or State Grant Funding:

Within priority areas (Wahoo Creek and Shell Creek e.g.) that are receiving reimbursable federal or state grant funding, the maximum limits may be exceeded to expedite use of those special funds within the specified grant period time line.

C. Planned Grazing Systems – Livestock Well Pumping Plants:

The maximum limit for planned grazing systems is $12,500, however a maximum cost share limit of $5,000 will also apply toward the livestock well and well pumping plant components (combined) when part of the approved system (Attachment B).

D. Water Impoundment & Grade Stabilization Structures:

The maximum limit for water impoundment dams and grade stabilization structures is $15,000 upon NRCS recommendation and Projects Committee/Board approval on a case-by-case basis (Attachment C).

E. Windbreak Renovation:

The maximum limit for windbreak renovation is $1,000 per landowner per year (Attachment D).

F. Emergency Repair of Conservation Practices:

The maximum limit for emergency repair of conservation practices is $1,000 per landowner per year (Attachment E).

G. 2022 Summer Conservation Practices in Non-Priority Areas:

For 2022, the maximum limit for approved conservation practices in non-priority areas will be $10,000 per landowner per year.

X. AMENDMENTS FOR ADDITIONAL COST SHARE

When applications are approved under the maximum limit, additional funds, up to the limit, may be approved if notified by the landowner or technician before construction. LPNNRD staff is authorized to approve an additional $1,000 above the original approval (up to the maximum limit) if the request is received from the landowner and/or technician prior to construction. Staff will notify the Projects Committee of any staff authorized changes.

XI. APPLICATION EXTENSIONS

Extensions may be granted for inclement weather or for other conditions beyond the landowner's control. All extension requests will be considered by the Projects Committee and Board on a case-by-case basis. No more than one 6-month extension can be approved for the same application.

XII. CONSERVATION PRACTICE DESIGN, STAKING & PERMITS

A. All conservation measures must be designed and staked by Natural Resources Conservation Service personnel (NRCS), NRD technicians or other NRCS approved technical service providers. All completed conservation work must be according to the NRCS design standards and specifications as outlined in the NRCS Procedures Handbook for LPNNRD.

B. The landowner is responsible for contacting the NRCS office to secure funds and schedule the layout (design and staking) of the approved work

C. The landowner is responsible for obtaining all required local, state and federal permits**.**

XIII. SUBMITTING BILLS & PAPERWORK ON COMPLETED WORK

A. The landowner is responsible for submitting all bills to the NRCS office. The NRCS will calculate the eligible cost share payment (on NSWCP form # 3) and submit completed and properly signed paperwork to the LPNNRD.

B. Drawings of the completed practices at to be provided by the NRCS/NRD technician on an aerial photo and submitted with the payment request.

XIV. COST SHARE PAYMENTS

A. LPNNRD has approved use of NeDNR's 2022 conservation practice payment rates for calculating SWCP contract cost-share payments. Payments will be based on NeDNR's conservation practice payment rates that were in force at the time the application was approved. The cost-share percent may be lowered if summer work is extended into fall.

B. The LPNNRD calculates and pays cost-share on terraces only by the linear foot, not by the cubic yard.

C. The cost-share percentages are calculated by multiplying the eligible cost share percentage by the approved cost share practice payment schedule rate or actual cost whichever is less. The cost-share assistance payment may not exceed a total of the eligible percent for an area when combining all sources of federal, state and local assistance.

D. **Splitting Cost-Share Percentages:** When a field splits two cost-share priority areas, the corresponding eligible cost share percentage will be applied to each portion of the field being treated. When a field splits into a non-priority area, that area will be allowed up to 50% cost share assistance, if the non-priority area is 50% or less of the entire field being treated.

E. When grant funds are available special conditions aligned with terms of grants will be implemented; in some cases a higher payment percentage rate, or payment cap may be allowed.

XV. PAYMENT OVERRUNS AND LANDOWNER REQUESTED REFUNDS

A. **Payment Overruns:**

Overruns of up to 10 % above the approved project amount may be approved by staff. Overruns above 10% will need Board approval. Payments are not to exceed the maximum cost share limits set for the various practices. Exception to this is when payments are combined with grant funds in priority areas.

B. **Landowner Refunds:**

If an SWCP practice is purposely damaged, removed or destroyed within ten years after completion (25 years for a small dam), the cooperator who received cost share, will be requested to reimburse the District, all or a portion of the SWCP cost share funds, as determined by the Projects Completion (25 years for a small dam), the cooperator who received cost share will be required to reimburse the District all or a prorated portion of the funding assistance, as determined by the Projects Committee and Board.

SWCP ATTACHMENT A
SEDIMENT & WATER CONTROL BASINS AND DIVERSIONS

This attachment is to help clarify the use of sediment & water control basins and diversions as an eligible cost-share practice. Basins and diversions are to be used as a part of an approved conservation system according to the NRCS technical guides and field manual.

A. Sediment & water control basins and diversions may be approved as a high priority practice when in conjunction with terraces or dams.

B. Basins and diversions will be considered a high priority practice when a part of a terrace system or in conjunction with a 100% no-till system. A 100% no-till system must have the goal of controlling soil erosion to soil replacement levels (“T”). A 100% no-till system is accepted land treatment when ephemeral and gully erosion is controlled, or “T” is met. Basins and/or diversions built separately on a terraced field are not considered a part of the terrace system.

C. Basins and diversions not part of a terrace system may be considered as a high priority practice on fields where the NRCS or NRD technician determines terraces are not feasible and/or they offer the most practical solution to a problem. This will be determined by the Projects Committee on a case-by-case basis.

LOWER PLATTE NORTH NRDSWCP ATTACHMENT B
PLANNED GRAZING SYSTEM PRACTICE

I. GENERAL REQUIREMENTS

A. An applicant must have at least 40 acres of connecting grassland to be developed into at least two grazing cells with planned rest periods in accordance with Natural Resources Conservation Service (NRCS) recommendations.

B. Applicants must complete a minimum 10-year planned grazing system developed by the NRCS prior to submitting an application.

C. Applicants are required to sign a 10-year cost-share agreement with the LPNNRD. (Form NSWCP-10)

D. All approved cost-share items must meet NRCS Standards and Specifications.

E. Funds for approved practices may be used on CRP lands if such lands are in the last year of the CRP contract.

F. The amount and type of eligible practices approved for each application will be determined by the overall grazing system plan and the most cost effective alternative available.

G. Cost-share on eligible practices will be based on the approved cost-share percentage times the approved practice payment schedule cost share rate or 75 percent of the actual cost, whichever is less.

II. ELIGIBLE PRACTICES

A. **Cross Fencing**: Only fencing designed to facilitate cell division is eligible for cost-share (Standard 382 specifications). Boundary fences are not eligible for cost-share.

B. **Livestock Water Dugouts**: Dugouts will be sized by daily animal needs and Nebraska Engineering Handbook Standards.

C. **Livestock Well Installation**: Livestock wells will be sized to provide a maximum of 15 gallons of water per animal-unit per day within each cell. No cost-share will be available for domestic or irrigation wells. Well test holes are not eligible for cost-share.

D. **Pumping Plants for Livestock Wells** (As outlined by State NSWCP Guidelines): While a cooperator may receive up to $12,500 SWCP funds toward completing a Planned Grazing System, a maximum cost share limit of $5,000 will apply toward the livestock well and well pumping plant component (combined) if part of the approved system.

E. **Livestock Water Tanks**: Tanks sized according to standard storage requirements in the NRCS Technical Guide, Standard 614, are eligible.

F. Livestock Water Pipeline Installation

LOWER PLATTE NORTH NRD
SWCP ATTACHMENT C
GUIDELINES FOR WATER IMPOUNDMENT (SMALL DAMS) &
GRADE STABILIZATION STRUCTURES

I. PURPOSE

The purpose of this program is to assist landowners with the construction of water impoundment and grade stabilization structures on their property.

II ELIGIBLE PROJECT ITEMS

A. Eligible Project Costs Include:

1. Construction (Not to include site preparation)
2. Seeding (Structure and emergency spillway)
3. Fencing when required by the NRCS

III. LAND TREATMENT REQUIREMENT

To be eligible for cost-share assistance, a minimum of 75% land treatment is required within the watershed above each proposed structure site. To calculate this percentage, non-highly erodible land is considered treated.

Land Treatment Definition:

Land treatment is defined as any practice or combination of practices (i.e. terraces, no-till etc.), that control soil erosion rates on highly erodible soils to soil replacement levels or less (Soil replacement level or “T” = 5 tons/acre in the LPNNRD). Any approved NRCS farm plan that treats land to “T” qualifies under this definition (8/2/00 Projects Committee).

IV. COST-SHARE PERCENTAGE AND MAXIMUM ASSISTANCE

The cost-share percent for approved applications outside selected priority areas is up to a maximum of 65%. For small dams approved within selected LPNNRD priority areas, the cost-share rate is up to a maximum of 75%. Eligible assistance will be based on the eligible cost-share percent times the county average costs or 75% of actual costs whichever is less. The maximum cost-share limit will be $15,000 upon NRCS recommendation and Projects Committee approval on a case-by-case basis (see Special conditions below).

Special conditions: The Board may approve a higher cost-share percentage and increase the maximum assistance if an application site is above an LPNNRD recreation area, within a targeted watershed or when other special conditions exist. The Board may also approve a lower cost-share percent and decrease the maximum assistance for structure sites of lower priority. **Special** conditions will be evaluated by the Board on a case-by-case basis.

V. PRIORITY AREAS

Priority-areas for small dams and grade stabilization structures include the following watersheds:

A. Sand & Duck Creek
B. Wahoo Creek*

C. Skull Creek
D. Shell Creek* (Additional grant funding available)
E. Bone Creek
F. Watersheds above Pubic Recreation Structures (e.g. Czechland Lake, Homestead Lake, Lake Wanahoo)
G. Above all existing LPNNRD Operated and Maintained Watershed Structures.

VI. APPLICATION ELIGIBILITY AND SIGN-UP

A. Any landowner within the Lower Platte North NRD who is an individual, a partnership, a corporation or other legal entity.
B. Applications may be submitted any time during the year; however, only NRCS inspected and recommended applications received by December 15, will ensure consideration for the following construction year. Unapproved applications will expire on May 1 of each year, requiring a new landowner application for future consideration. The Projects Committee will review, prioritize and submit a recommendation for approval at the January Board Meeting.
C. The applicant shall apply at the county NRCS office on forms provided by the LPNNRD. An aerial photo showing the proposed project location must accompany the application. The application must be signed by the applicant and sent to the LPNNRD before December 15 of each year to insure consideration for the immediate year's construction.
D. At the time of application, the NRCS will be requested to provide an estimate of drainage acres, percentage of land treatment present, quantities and costs for the project.

VII. APPLICATION EVALUATION AND TENTATIVE APPROVAL

A. Application sites will be inspected by LPNNRD and NRCS representatives to evaluate feasibility, benefits and cost. Benefits to be evaluated will include but not be limited to: flood control, grade control, erosion and sediment control, wildlife habitat enhancement, livestock water, and protection to public roads and property.
B. The Projects Committee will most generally review, prioritize, and make recommendations on applications at their January meeting.
C. The NRD Board of Directors will generally approve, reject, or table each request at the January Board Meeting.
D. After receiving LPNNRD approval, the applicant will be required to submit a $500 deposit to the NRD before a survey or design is started. The deposit will be returned to the applicant after project completion. If the deposit is not received by February 1, the application will be canceled. If the applicant withdraws from the project after the design has been complete, the deposit will be retained by the LPNNRD unless conditions in XII. B. apply.
E. In February of each year, the Natural Resources Conservation Service will be requested to proceed with survey and design of approved projects.
F. After receiving LPNNRD approval, the applicant will be given two years to obtain necessary permits, complete the structure and submit all required paperwork. If the project is delayed due to adverse weather conditions, or other conditions beyond the

applicant's control, an extension may be granted by the LPNNRD Board of Directors. Extensions will be considered by the LPNNRD Board on a case-by-case basis.

VIII. LAND RIGHTS, AGREEMENTS AND PERMITS

A. The applicant is responsible for obtaining any required easements and any required federal, state and local (i.e. NDNR, Army COE, and County Zoning) permits.

B. The applicant is responsible for the relocation or modification of water lines, power lines and telephone lines and pay the costs involved.

C. The applicant will be required to enter into a 25-year cost-share agreement with the LPNNRD. This agreement states that the applicant will refund cost-share funds if the project is removed, altered, or modified without the consent of the LPNNRD.

IX. STRUCTURE DESIGN AND CONSTRUCTION

A. The NRCS will be requested to survey, design, and supervise all structures approved by the LPNNRD Board.

B. Construction will not commence until formal notice to proceed is given by the LPNNRD. This notice will be given after NRD Board approval, and after receiving the applicant's deposit and signed cost-share agreement.

X. FINAL APPROVAL AND PAYMENT

A. Final Approval and Payment will occur when:

1. The project is completed and certified by the NRCS/NRD technician to meet all NRCS standards and specifications.
2. The completed application form NSWCP-3 is signed and returned to the LPNNRD with a copy of all project bills.

Xl. OPERATION AND MAINTENANCE

The landowner is responsible for all operation and maintenance after project construction.

XII. SMALL DAM DEPOSIT REQUIREMENT & REIMBURSEMENT

A. The applicant will be required to submit a $500 deposit to the NRD before a survey or design is started. The deposit will be returned to the applicant after NRCS approves the completed project and all paperwork is submitted and approved by the District. If the deposit is not received by February 1, the application will be canceled. If the applicant withdraws from the project after the design has been complete, the deposit will be retained by the LPNNRD unless conditions in B. apply.

B. If a landowner does not proceed with the small dam project because the final cost estimate is 40% or more over the original project estimate, the LPNNRD will return the $500 deposit based on financial hardship. All other conditions will be reviewed by the Projects Committee on a case-by-case basis.

LOWER PLATTE NORTH NRD
SWCP ATTACHMENT D
WINDBREAK RENOVATION PRACTICE

I. PURPOSE

To provide for the restoration of farmstead, acreage or field windbreaks that have been rendered substantially ineffective due to the death of trees or other windbreak plantings as a result of weather, disease, or other natural causes.

II. PLAN REQUIREMENT

A windbreak renovation plan is to be based on a plan reviewed and approved by a forester of the Nebraska Forest Service. The forester is to certify that the windbreak has lost its effectiveness, should be renovated and that they approve the plan of renovation.

III. SITE PREPARATION

Tree removal off the site is required to be accomplished in late fall/early winter at least before the planting occurs the following spring. The only area that is replanted with a new windbreak receives cost share for removal costs. Tree removal work should not be initiated until the application is approved by the Lower Platte North NRD and the landowner agrees to replant the windbreak in the same area.

IV. COST SHARE RATE AND MAXIMUM ASSISTANCE

The windbreak renovation cost-share payment will not be based on a cost greater than the county average unit cost adopted by the USDA-FSA. The renovation practice is not to include the replanting of the windbreak because of different cost-share percentage rates. The windbreak planting cost-share will be separate. The Lower Platte North NRD will cost share at a 50% rate, up to $1,000.

Tree planting cost-share is eligible for riparian buffers, farmsteads, acreages, field and livestock protection windbreaks. Windbreaks must contain 200 or more trees and shrubs which are purchased through and planted by the NRD. When the planting is strictly for wildlife habitat, a minimum of 300 trees/shrubs purchased and planted by the NRD is required.

LOWER PLATTE NORTH NRD
SWCP ATTACHMENT E
FOR EMERGENCY REPAIR OF CONSERVATION PRACTICES

I. PURPOSE

On occasion, the LPNNRD Board of Directors may approve local SWCP funds for the Repair of conservation practices damaged from intense rainstorms. The decision for approving emergency repair funds will be considered annually, with the location and total amount of available funds dependent on the severity of storm damage to conservation practices in designated areas in the District. When approved by the Board, Emergency repair funds will be allocated in the following manner:

A. The LPNNRD Board will consider approval of the amount and eligible area for emergency repair funds, with a recommendation from the Projects Committee. Typically, this will occur on or prior to the LPNNRD September Board Meeting.
B. Only eligible Conservation Practices, two years old and newer that were originally built to NRCS design specifications, will be eligible for cost-share assistance.
C. The committee will consider approval of emergency repair assistance only when it is determined by an NRCS technician that the damage was not due to landowner negligence in performing normal maintenance as outlined in NRCS O&M specifications.
D. To be eligible for emergency repair funds, the landowner must be following an approved NRCS farm plan.
E. Prior to LPNNRD approval, applications will receive recommendation s from LPNNRD and NRCS staff. The LPNNRD Projects Committee will prioritize application practices and areas.
F. Eligible assistance will be 50% of the approved amount up to a maximum of $1,000 per landowner per program period.

LOWER PLATTE NORTH NRD
SWCP ATTACHMENT F
2022 LANDS FOR CONSERVATION PROGRAM
)

Purpose: The Lands for Conservation program provides landowners with an incentive to get conservation structures constructed on the land during the growing season.

1. The Lands for Conservation program will be on contractual basis between the landowner (cooperator) and the Lower Platte North Natural Resources District for one year while conservation practices are being established. Applications deadline for each calendar year will be February 1.

2. Sediment and Water Control Basins with tile outlets and/or terraces with grassed waterways and terraces with tile outlets qualify for this program. Sediment and Water Control Basins/Terraces and/or waterways must be seeded during the contract period.

3. NRCS and/or NRD personnel will design terraces with waterways or tile drains or Sediment and Water Control Basins with tile outlets. These practices must protect the entire field on which they are established. However, the area under contract will be the smallest practical area to encompass the practices, as agreed upon with the cooperator.
4. Land enrolled in another program (ex: CRP) may not be eligible for Lands for Conservation contracts.

5. Sediment and Water Control Basins with tile outlets and terraces with waterways or tile outlets may be cost-shared through the EQIP program administered by Natural Resources Conservation Service (NRCS). If federal funds are not available, cost-sharing assistance may be available through LPNNRD's Soil & Water Conservation Cost-Share Program.

6. **Construction must be done between June 1 and September 15.** The field must be available for construction by August 1. The area enrolled in the LPNNRD Lands for Conservation will be planted to cover crop or a non-grain forage crop (forage sorghum, etc.) preceding and/or after construction. The crop or cover may be harvested or pastured during the contract period.

7. For 2022: Payment is $195 per acre*.

*Payment Rate will be reviewed annually. Payment rate is based on 2021 Nebraska Non-Irrigated Cropland Cash Rent Paid per Acre, Source: USDA National Agricultural Statistics Service. **Payment will not be processed and forward to the NRD applicant until the project (including the planting of the cover crop) has been certified as completed by the NRCS.**

8. If used for permanent pasture before or after the contract period, these areas are not eligible for the Lands for Conservation Program. Money received through this program resulting in permanent pasture after the contract period, must be returned. Land can be used for hayland as a normal part of the crop rotation.

9. If ownership of land changes during the contract period, the contract becomes void. The new owner may continue the contract, if agreed to with the Lower Platte North NRD.

10. Approval of contracts will be on a rotating basis.

11. The landowner will contract for the construction of Sediment and Water Control Basins, terraces, waterways, tile outlets and any other necessary construction.

12. Terraces, Sediment and Water Control Basins, waterways and tile outlets must be maintained for 10 years or as long as the current owner has control of the land, whichever is less.

13. Eligible Watersheds for the Lands for Conservation Program: Within the Wahoo Watershed, three of the HUC 12 sub watersheds were identified as highest priority areas for this program: North Fork-Wahoo Creek, Dunlop Creek and Miller Branch-Wahoo Creek. The Shell Creek Watershed. Applications OUTSIDE of priority watersheds will be evaluated after high priority applications.

14. Separate fund pool allotted in 2022 for the remainder of the LPNNRD outside of 319/NWQI watersheds.

hydrology

MDPI

Article

Application of Neural Networks for Hydrologic Process Understanding at a Midwestern Watershed

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Abstract: The Shell Creek Watershed (SCW) is a rural watershed in Nebraska with a history of chronic flooding. Beginning in 2005, a variety of conservation practices have been employed in the watershed. Those practices have since been credited with attenuating flood severity and improving water quality in SCW. This study investigated the impacts of 13 different controlling factors on flooding at SCW by using an artificial neural network (ANN)-based rainfall-runoff model. Additionally, flood frequency analysis and drought severity analysis were conducted. Special emphasis was placed on understanding how flood trends change in light of conservation practices to determine whether any relation exists between the conservation practices and flood peak attenuation, as the strategic conservation plan implemented in the watershed provides a unique opportunity to examine the potential impacts of conservation practices on the watershed. The ANN model developed in this study showed satisfactory discharge–prediction performance, with a Kling–Gupta Efficiency (KGE) value of 0.57. It was found that no individual controlling variable used in this study was a significantly better predictor of flooding in SCW, and therefore all 13 variables were used as inputs, which resulted in the satisfactory ANN model discharge–prediction performance. Furthermore, it was observed that after conservation planning was implemented in SCW, the magnitude of anomalous peak flows increased, while the magnitude of annual peak flows decreased. However, more comprehensive assessment is necessary to identify the relative impacts of conservation practices on flooding in the basin.

Keywords: rainfall-runoff modeling; watershed hydrology; artificial neural network; conservation practices; flood frequency analysis; drought analysis

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1. Introduction

Flooding is a significant and recurring issue in Nebraska. In the past 100 years alone, five historic floods have been recorded [1]. The most recent of those historic floods was the March 2019 flood, during which several new records were set for river crests, snowfall prior to the event, and precipitable water values [2]. The flood caused extensive damage to infrastructure and personal property, including the destruction of bridges and roads, the breaching of 50 levees, and more. Five lives were lost, and thousands more were forced to evacuate their homes and businesses [1]. By August of 2019, flood damage cost estimates had reached $3 billion [2].

In addition to the widespread infrastructure damage inflicted, Nebraska's agriculture industry also suffered heavy repercussions from the March 2019 flood. Cows and calves died or were stranded, crop fields were flooded or left covered in chunks of river ice, and grain stores were contaminated, resulting in approximately $400 million in cattle losses and $440 million in crop losses [3]. Destruction of roads due to the floods posed further challenges for farmers beyond immediate losses, as many farms suddenly became inaccessible or required detours of extra tens of miles to reach in order to tend to livestock. According to an estimate made by the President of the Nebraska Farm Bureau, the additional transportation costs of these detours, as well as related costs of fuel and feed, were costing the Nebraska cattle industry roughly $1 million a day at the time [4]. The flooding of March 2019 was a devastating example of the serious damage to crops and livestock that floods can inflict on farmers and rural areas.

The March 2019 flood occurred as a result of the culmination of several meteorological and hydrological events. The warm and wet start to winter resulted in unfrozen ground that was heavily saturated with moisture, which then froze following a shift to colder temperatures in late January; early winter conditions were approximately 1–2 °C warmer than average, while late January conditions ranged from 3–5 °C colder than average and resulted in frost depths of 60–90 cm. Record-breaking snowfall followed, developing a significant snowpack with a snow-water equivalent of 3–10 cm, and rivers froze, creating the potential for ice jams. When warmer temperatures returned coincident with a cyclone that brought 25–50 mm and 40–75 mm of rain across northeastern and central Nebraska, respectively, the excessive runoff generated from the combination of snowmelt, precipitation, and rain-on-snow events could not percolate into the frozen, saturated ground, thus overwhelming rivers and creating significant flooding [2].

The mechanism by which the March 2019 flood was produced, along with its repercussions, highlights the importance of understanding the interactions of antecedent hydrological and meteorological factors in creating flooding. Increased understanding of conditions that contribute to flooding can help with forecasting and decision-making [5]. As seen during the March 2019 flood, monitoring and modeling of several hydrological and meteorological inputs allowed for forecasts and warnings to be put out in advance of the flood event, which likely saved many lives and personal property [2]. Further improvements to flood models and additions to the understanding of flood development can aid in yielding more accurate and timely predictions for flooding.

This study aimed to contribute to the improvement of flood forecasting and hydrologic process understanding in a specific rural watershed in Nebraska, Shell Creek Watershed (SCW). Furthermore, preliminary insights were drawn from the results of this study regarding the effects of conservation practices on attenuating flooding in the watershed. SCW provides a unique example of a watershed that has had a comprehensive and strategic conservation plan aimed at addressing flooding and water quality issues, and this plan has been in place for a long enough span of time that observations can reasonably be drawn regarding the relationship between conservation practices and flood attenuation. This study opens the door to such discussion, laying groundwork and preliminary observations for future researchers to build upon when analyzing the impact of SCW's conservation plan on flooding.

SCW is a major tributary of the Platte River located in east-central Nebraska. The watershed is largely agrarian, with 93% of its area designated as agricultural land, and has a history of chronic flooding [6]. In the past 80 years, SCW experienced 17 river crests above flood stage, with an additional seven above action stage [7]. As previously exemplified, flooding can cause devastating damage and setbacks to Nebraskan farms through crop and cattle losses, making the frequent flooding of SCW an important matter of concern. In the early 1990s, some farmers began implementing conservation practices on their land in efforts to reduce flood risk on a small scale. Later, in 1999, the Shell Creek Watershed Improvement Group (SCWIG) organized to address flooding in SCW, then shifted their focus towards water quality impairments in the watershed and drove the development and implementation of the 2005 Shell Creek Watershed Management Plan. The plan was fully implemented in 2015; however, certain water quality impairments and other issues remained unresolved, warranting the development of the 2016 Shell Creek Watershed Environmental Enhancement Plan to improve soil health, reduce runoff, improve water quality, and address stream conditions impacted by watershed degradation. The 2016 plan is to be implemented in several phases extending to 2032 and beyond, and efforts will require a more detailed understanding of the hydrology of SCW [6]. The existing restoration efforts and conservation practices implemented over the course of these management plans have been credited anecdotally with somewhat reducing flooding, an observation that warrants exploration and discussion and, as yet, lacks validation. This paper's research on flood modeling of SCW will aid in addressing the demand for further understanding of SCW hydrological processes, investigate potential changes in streamflow patterns, and support the improvement of forecasting for the watershed's frequent floods. Furthermore, analysis of the impact conservation practices have had on flood attenuation in the watershed will aid managers in making decisions regarding future conservation implementations.

To model flooding in SCW, a feedforward artificial neural network (ANN) was developed, trained, and tested in MATLAB. ANNs are useful for their ability to determine relationships between given inputs and recorded outputs of a process without explicit physical process information [8–10] and have been successfully employed in several hydrological applications [11–15].

This study designed and trained a single-hidden-layer feedforward ANN to model the rainfall-runoff process in SCW using varying combinations of potential flooding factors. Building a rainfall-runoff model allows for a deeper understanding of the hydrological processes, specifically flooding, in SCW, and aid in the accomplishment of the four main objectives of this study: (1) characterizing the efficacy of the selected controlling factors in SCW flood prediction, (2) building a rainfall-runoff model for the watershed using ANN, (3) assessing drought intensity and flood frequency in the watershed, and (4) drawing preliminary insights on the effects of conservation practices on flooding in the watershed.

2. Materials and Methods

2.1. Study Area

Shell Creek Watershed is a rural Nebraskan watershed that serves as a major tributary of the Lower Platter River, which eventually feeds into the Missouri River. Approximately 193 km long and spanning 123,391 hectares of land, the watershed runs through Antelope County, Boone County, Madison County, Platte County, and Colfax County. The cropland map of SCW is shown in Figure 1. Land use in SCW is predominantly agricultural, with 93% of the watershed area dedicated to farmland. The main agricultural crops of the watershed by land-use area are corn (48%) and soy (28%), and other agricultural products include swine, cattle, and alfalfa. Developed land only takes up about 4% of SCW. Land-use immediately adjacent to the channel (305 m to either side) is 73% crop cultivation and 11% grassland and grazing, with the rest populated by forest, wetlands, or development. In the upper half of SCW, cropland is often farmed up to the edge of the channel. In the lower half, the edges of the channel are typically lined with a narrow forest buffer [6].

The meteorological patterns of SCW are seasonal, and thus average temperature, precipitation, and streamflow in the region vary by season. Summers are warm, with an average temperature of 23.9 °C. Precipitation falls as rain in the form of showers and storms during summer, reaching a cumulative 50.8 cm from April to September out of the total annual 66 cm. The average summer surface water flow is 2.04 m^3/s. During winter, temperatures average −4.4 °C, and precipitation is mainly in the form of snow. Average snowfall is about 63.5 cm, and average surface water flow is 0.71 m^3/s. The average mid-afternoon relative humidity in SCW is 60% [6].

Like most of eastern Nebraska, SCW is characterized by rolling hills of easily erodible soils [6]. The majority of soils found in SCW are classified in the B Hydrologic Soil Group: moderately deep to deep soils that are between 10% and 20% clay and 50% to 90% sand in composition. These soils have a moderate infiltration rate when thoroughly wet [16]. SCW also contains a sizeable amount of loess [17], silt blankets of which eastern Nebraska has some of the thickest in the Midwest. Loess is highly erodible when wet and thus contributes significantly to the channel stability problems observed in SCW. There are three main types of bedrock in SCW, which divide the watershed into thirds; the western third is composed of mudstone and sandstone, the middle third of limestone, and the lower third of shale. Bedrock rarely impacts stream processes in SCW.

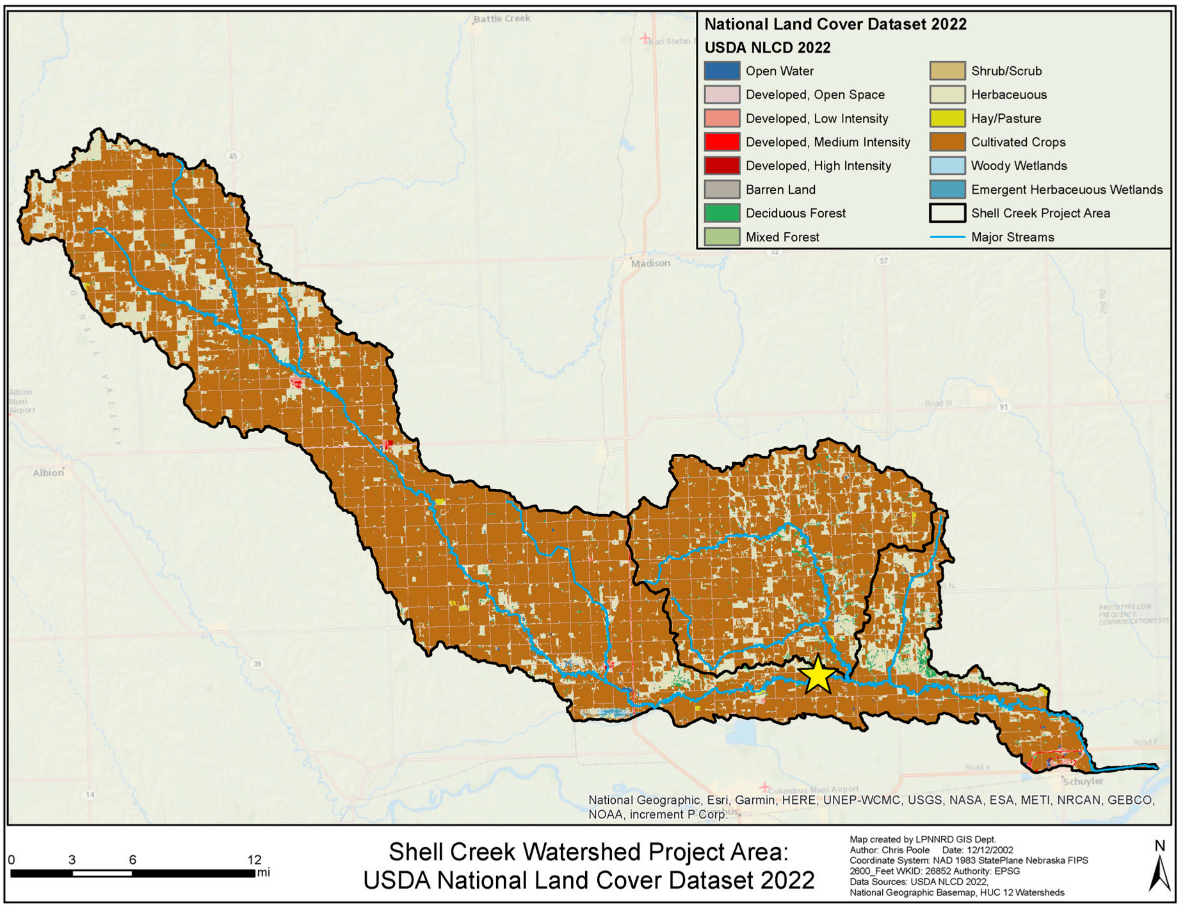


Figure 1. Shell Creek Watershed with USDA 2022 land cover data. The location of the streamflow gauge used for this study is indicated by a yellow star.

The designated beneficial uses of Shell Creek are recreation, aquatic life, agricultural water supply, and aesthetics. However, a history of agricultural use and anti-conservationist attitudes and practices left Shell creek impaired in the areas of recreation and aquatic life by Atrazine, selenium, and *Escherichia coli* (*E. coli*) [18]. Furthermore, historic anthropogenic hydrological and environmental modification in the way of clearing large tracts of land for cultivation has resulted in an increased rate and volume of storm flow in SCW, increasing the risk and frequency of flooding and accelerating erosion. Since 1999, SCWIG has been working to address these issues systematically on a watershed scale. The result of their efforts was the development of the 2005 Shell Creek Watershed Management Plan, which focused on both the quantity and quality of runoff to resolve flooding and water quality issues in Shell Creek. The 2016 Shell Creek Watershed Environmental Enhancement Plan was subsequently developed to address persisting water quality impairments not resolved by the 2005 plan. Through these plans and the work of SCWIG and SCW landowners, more than 340 conservation practices have been implemented on the land. These practices include no-till farming, cover crops, and filter and buffer strips and have resulted in the successful delisting of Shell Creek for aquatic life impairment due to Atrazine in 2018 [19]. Outside of improvements to water quality, these conservation practices have additionally been credited with alleviating flooding somewhat in SCW [20].

2.2. Data

The majority of hydrological and meteorological data for this study were obtained from Phase 2 of the North American Land Data Assimilation System [21,22]. The available dataset includes precipitation totals (PCP), above-ground convective available potential energy (CAPE), the fraction of total precipitation that is convective (CNFRAC), longwave radiation flux downwards (DLRWF), shortwave radiation flux downwards (DSWRF), potential evaporation (PEVAP), surface pressure (S.P.), specific humidity (S.H.), temperature, zonal wind speed (UGRD), and meridional wind speed (VGRD), and starts from January 1979. Hourly data for these variables were masked to the study region, then aggregated to daily averages. Daily snow water equivalent (SWE) data were pulled from the National Snow and Ice Data Center [23], and daily groundwater level (GWL) data were obtained from the National Water Information System (NWIS). A large number of initial variables was selected intentionally, as it allows for the narrowing down of variables to determine what factors are relevant for flooding in SCW—one of the main objectives of this study.

Discharge data were obtained from the U.S. Geological Survey (USGS) from a streamflow gauge near Columbus, NE. The Columbus gauge is the only gauge for Shell Creek that provides daily discharge data to date, and as discharge is the target variable in our rainfall-runoff model, the study region and time period for this research are restricted by the location and available data of this gauge. The Columbus gauge is located upstream from the point where SCW flows into the Lower Platte River and just slightly upstream from where Loseke Creek feeds into Shell Creek, so this study will focus on the portion of the watershed above the gauge and exclude the downstream area beyond Columbus. Approved daily discharge data from the Columbus gauge only extend as far back as 1990, and thus the total time interval used for variable selection and model training in this work is from 1990 to 2020.

While daily discharge data from the Columbus gauge are only available from 1990, annual peak flow data from the same gauge are documented and available all the way back to 1947, with the exception of 1976 and 1977. These annual peak flow data from the USGS are used for flood frequency analysis of the watershed. Drought analysis was conducted using NLDAS precipitation data from 1982 to 2020.

2.3. Model: Artificial Neural Network

Artificial neural networks are machine learning models loosely based on the structure of biological networks in the brain. These networks are composed of artificial neurons organized into distinct layers—the input layer, hidden layers, and output layer—each of which contains at least one neuron. Data inputs are run from the input layer through the hidden layers to the output layer, where a prediction is output. Neurons in the hidden layers and output layer take the outputs of other neurons as inputs, then compute nonlinear transformations of those inputs to generate their own outputs. In recurrent neural networks, a neuron may take the outputs of other neurons from the previous layer and from within the same layer. In feedforward neural networks (FFNNs), neurons only receive outputs as inputs from the previous layer.

In an ANN, a connection between two neurons has a weight associated with it that represents the connection strength. Changing these weights of an ANN changes the final output of the model, and thus it is necessary for such weights to be adjusted to optimize the performance of the model. This is done through training. Two widely used categories of ANN training are supervised and unsupervised training (note that there are other types of training as well, such as semi-supervised or self-supervised training, which are not discussed here). Supervised training is a method in which an established pair of inputs and outputs is compared against the model's outputs for the same established data inputs, and then feedback is given in order to minimize the deviation of the model outputs from the expected outputs. Unsupervised learning is a method in which unlabeled training data (data without a target variable) is given to an algorithm, from which the algorithm then identifies patterns and categories on its own. This study employed supervised learning to train the ANN model.

A common method used for adjusting network weights in supervised training is error backpropagation. Backpropagation compares the network output for a set of inputs with the observed target, then evaluates the error with a loss function. This error is then propagated backward to adjust connection weights and improve the accuracy of the model.

This study used a FFNN with a single hidden layer to model rainfall-runoff processes in SCW. A single-layer model was chosen for this research as preliminary testing of a single dataset on both a single-layer and double-layer model yielded nearly identical results, making the added complexity of the double-layer ANN redundant.

ANN codes were written in MATLAB, and all datasets were normalized using z-score normalization prior to input to the ANN according to the following expression:

$$z = \frac{x - x_{mean}}{\sigma}$$

where x is the data point, x_{mean} is the mean value of the data, and σ is the standard deviation of the data. Once data had been normalized, they were used in the training of an ANN whose number of neurons in the hidden layer was varied from 1 to 50. The model was trained on 70% of the dataset, then validated on the remaining 30% of the data. Mean squared error (MSE) from validation for the output of each model was compared, and a number of neurons between 10 and 50 were then selected for the prediction ANN model by determining which ANN had the lowest MSE after training and validation. These bounding values of 10 and 50 neurons were chosen in order to ensure the selection of a model that was neither oversimplified nor overly complex.

Following training, the selected ANN model was made to predict discharge, and the performance of the model was measured using the Kling–Gupta efficiency (KGE) [24]. KGE is a statistic that compares the bias, variability, and timing of a model's output to that of the observed data, and is calculated as follows:

$$KGE = 1 - \sqrt{(r-1)^2 + (\alpha - 1)^2 + (\beta - 1)^2}$$

where r is the linear correlation coefficient, α a is a measure of relative variability in the simulated and observed values, and β represents bias. KGE values range from negative infinity to 1, with 1 indicating that a model's outputs perfectly match with the observed target data. The closer a KGE value is to 1, the better the model is performing.

The ANN was trained and run numerous times, and on data for three different time periods: the full period, 1990–2020; the pre-planning period, 1990–2004; and the post-planning period, 2005–2020. In this paper, the pre-planning period is sometimes noted as the non-conservation period, and the post-planning period is sometimes noted as the conservation period. Discharge was the target variable for all trials. The first trial for each period included all predictive variables, and its KGE was recorded as a reference KGE for future trials. Leave-one-out analysis was then conducted where the model for each period was run multiple times, each with a different variable left out, and the resulting KGE of each trial was compared to the reference KGE for that time period in order to determine the respective influence of each variable on the model's output accuracy and performance. The least influential variables were eliminated, and the process was repeated until the most effective model had been obtained.

2.4. Flood Frequency Analysis

Flood frequency analysis is a method employed in hydrology to estimate the exceedance probabilities corresponding to specific streamflow values for a given river. Annual peak flow or peak-over-threshold data existing over a sizeable number of consecutive years (typically more than 30) were collected and used to fit probability distribution functions from which the exceedance probabilities can be calculated. In this study, flood frequency analysis was conducted using the U.S. Army Corps of Engineers Hydrologic Engineering Center's (HEC) Statistical Software Package (HEC-SSP 2.2). Flood frequency analysis for SCW was also broken into three different time periods to allow for the examination and identification of flood frequency differences before and after the implementation of conservation practices. These periods are the full period, 1947–2020, the pre-planning period, 1947–2004, and the post-planning period, 2005–2020. However, only results from the full period and pre-planning period were analyzed in this paper, as the post-planning period extends only 15 years back, so it would not be a reliable source to draw conclusions from regarding flood frequencies. Conclusions about flood frequency changes during the post-planning period were instead drawn from the comparison of the full period and the pre-planning period. It is to be noted that there always has been some level of conservation in the watershed, but the key to success in the Shell Creek watershed was the development and implementation of the comprehensive and strategic plan to address the flooding and water quality issues as opposed to random acts of conservation.

2.5. Drought Analysis

Droughts are often measured using drought indexes, which analyze data for selected drought indicators over various time intervals in order to output a drought index value. This drought index value is a single number interpreted on a range from abnormally wet to abnormally dry. In order to conduct a drought analysis for SCW, this study employed the Standard Precipitation Index (SPI) [25], which compares actual precipitation accumulation over a region for a certain time period to the probability of precipitation according to historical records for that same time period. SPI values indicate the number of standard deviations from mean moisture conditions, with positive SPI values representing wet conditions and negative SPI values representing dry conditions. SPI values ranging in magnitude from 0 to 0.99 indicate mild conditions, from 1 to 1.49 indicate moderate conditions, from 1.5 to 1.99 indicate severe conditions, and 2 or above indicate extreme conditions [25]. In this study, SPI was run for 1-month, 3-month, 6-month, and 12-month time intervals. Inferences about soil moisture levels in an area can be drawn from the 3-month SPI, while SPI values corresponding to longer timescales (e.g., 6- to 12-month) relate information about wet and dry periods.

2.6. Analysis Framework

Figure 2 shows the analysis framework followed in this study. In order to determine variables relevant to flooding, both model-free and model-based elimination were employed. Once data were masked to study area and aggregated to daily data, pair plots and cross-correlation plots were created that plotted each variable individually against the target variable discharge, as well as all variables against each other. These plots were generated for the three time intervals previously mentioned: the full time period, 1990–2020; the pre-planning period, 1990–2004; and the post-planning period, 2005–2020. This step allowed for the examination of relationships between each variable and the target variable and the identification of multicollinearity between independent variables. The variables were then run through the ANN, which first underwent training and validation with the data, then generated predictions for the target variable discharge. These predictions were evaluated using KGE, and using those evaluations, the variables most relevant to flooding were determined. This identification of factors and conditions conducive to flooding allowed for an improved understanding of SCW hydrological processes.

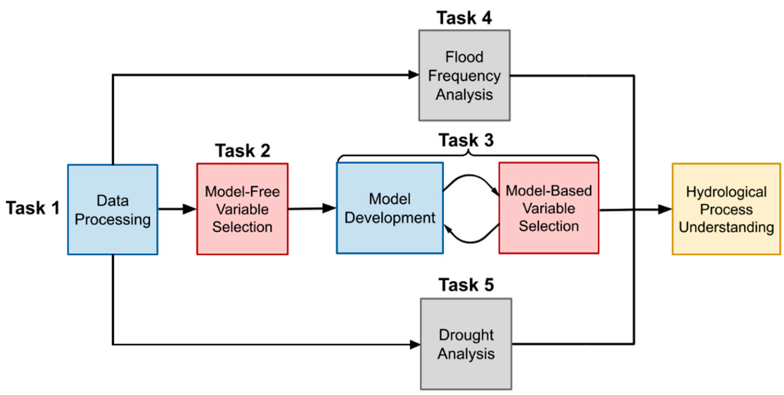


Figure 2. Flowchart depicting the analysis framework for this study.

Additional pathways towards improved hydrologic understanding taken on in this research are flood frequency analysis and drought analysis. Using USGS annual peak flow data, flood frequency analysis was carried out to identify the exceedance probabilities of streamflow in SCW. Using long-term precipitation data, drought analysis was conducted with the SPI in order to better understand patterns of dryness and wetness in SCW.

3. Results

3.1. Model-Free Variable Selection

Figure 3 shows a pair plot of the cross-correlation between the selected predictive variables for the full time period of study, 1990–2020. From the figure, it can be seen that temperature shows a relatively high correlation with specific humidity, potential evaporation, and longwave radiation flux downwards. Specific humidity additionally showed a good correlation with above-ground convective available potential energy and longwave radiation flux downwards. Shortwave radiation flux downwards displayed a fairly good correlation with potential evaporation. These correlation patterns between variables held true not only for the full time period but for the pre-planning and post-planning periods as well (see Appendix A for cross-correlation pair plots for each period). Similar patterns of occurrence between variables can indicate similar potential efficiency in flood prediction, making some of these variables candidates for removal in order to reduce redundancies before inputting data into the ANN. However, none of the predictive variables showed a good correlation with the target variable, discharge, as evidenced in Figure 4. The correlation coefficient (r) is a measure of the relationship between two variables and exists on a scale from -1 to 1; 1 represents perfect positive correlation, -1 represents perfect negative correlation, and 0 indicates no correlation. All correlation coefficients found for the SCW data between the predictive variables and target variable were within ± 0.2 of zero, indicating a very poor correlation. For both the full period and the post-planning period, precipitation was the most closely correlated variable to discharge, with r values of only 0.16 and 0.18, respectively. The most highly correlated variable in the pre-planning period was the fraction of total precipitation that is convective, with an r value of 0.14. Due to the low across-the-board low correlations, it was decided that all variables would be carried over to the ANN phase of variable selection instead of eliminating variables with low target correlations or selected variables with close cross-correlations.

3.2. Model-Based Variable Selection

The ANN was initially trained, validated, and run for all three time periods with all variables included as inputs in order to determine reference KGE values for model performance. The resulting reference KGEs for the total time period, pre-planning period, and post-planning period were 0.3624, 0.1740, and 0.5666, respectively. The components of the KGE score—correlation (r), bias ratio (β), and variability ratio (α)—for the total time period were 0.5103, 0.9037, and 0.6033, respectively. For the pre-planning period, r was 0.4397, β was 0.8876, and α was 0.4036. For the post-planning period, r, β, and α were 0.6891, 0.7573, and 0.8204, respectively.

Following the determination of the reference KGEs, the leave-one-out process was then conducted with the model for each time period, and the percent change in model performance from the reference KGE was recorded for each trail. Figure 5 displays these percentage changes. In both the full period and the post-planning period, there were no instances of variable removal improving model performance. However, the pre-planning period showed four instances of model performance improving with the removal of certain variables. For the full period, the three greatest performance drops resulted from the removal of snow water equivalent (-104.64%), shortwave radiation flux downwards (-102.98%), and specific humidity (-97.05%). The post-planning period saw its three greatest model performance drops from the removal of shortwave radiation flux downwards (-102.54%), precipitation (-97.49%), and specific humidity (-91.86%). The pre-planning period saw model performance improvement with the removal of temperature, potential evaporation, convective available potential energy, and meridional wind speed, the highest of which was potential evaporation (34.14%). The largest performance drop in the pre-planning period was due to the removal of groundwater level (−96.72%).

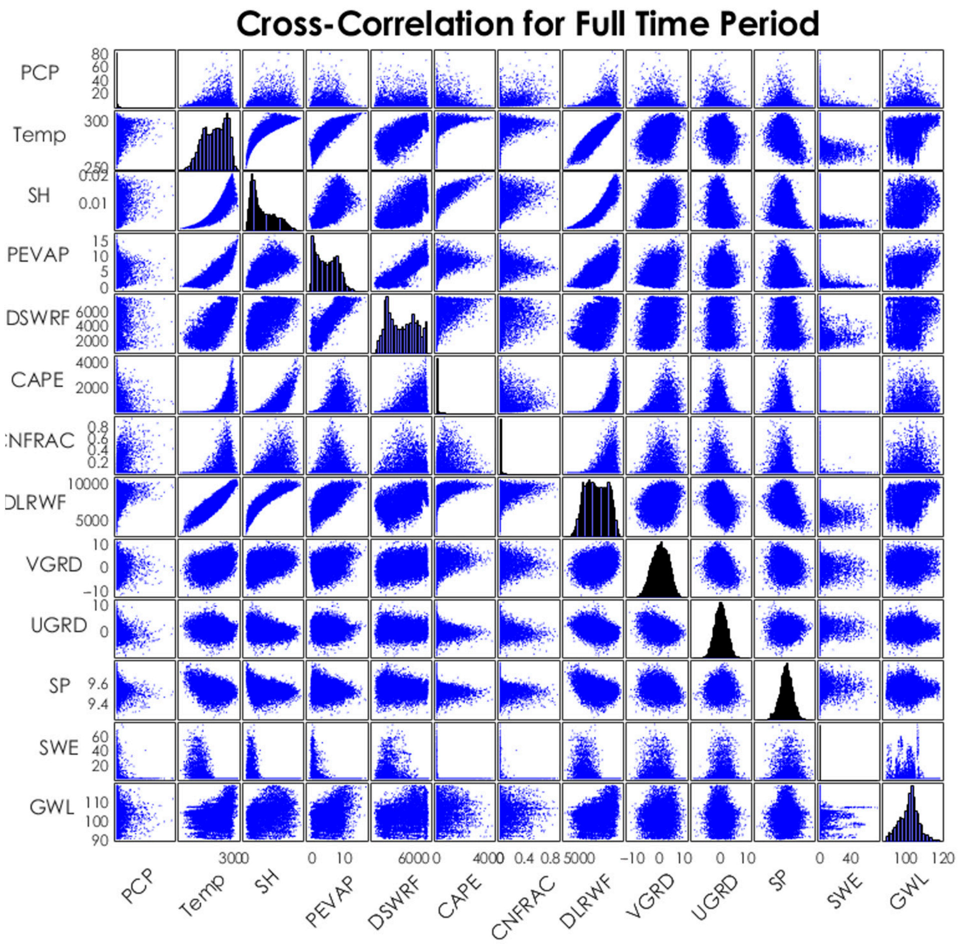


Figure 3. Cross-correlation pair plot for all 13 predictive variables over the full time period.

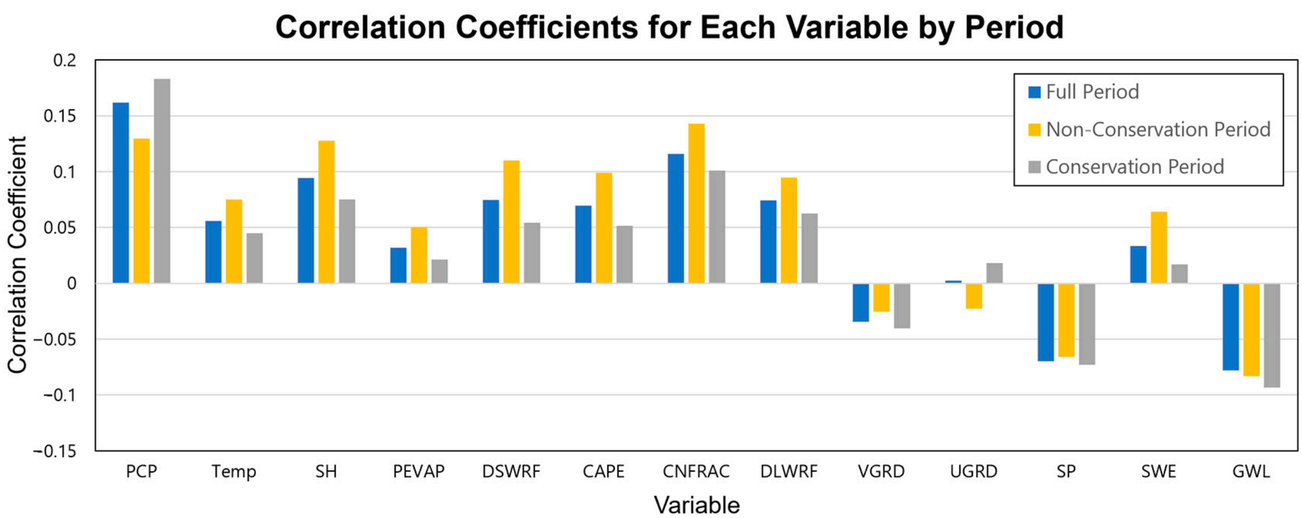


Figure 4. Correlation coefficients between each variable and the target variable by time period.

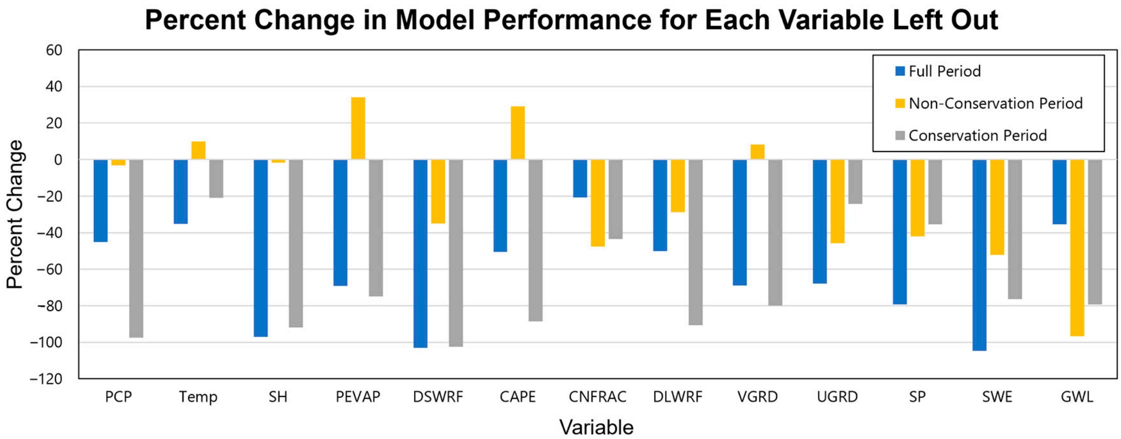


Figure 5. Percent change in model performance by time period due to each variable left out.

3.3. Flood Frequency Analysis

Computed streamflow and their corresponding return periods for both the full period and pre-planning period are shown in Figure 6. For each return period, computed curve flow is consistently higher for the full period flood frequency analysis than the pre-planning period flood frequency analysis, with the exception of the 2-year return period.

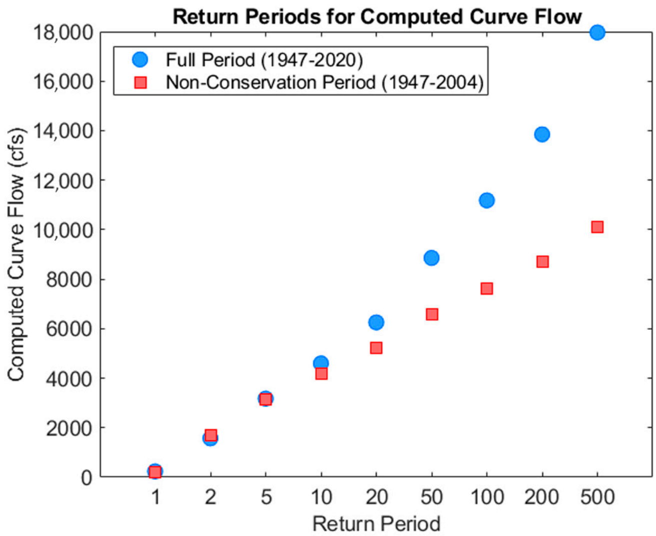


Figure 6. Return periods for the computed curve flows of the full period and the non-conservation period.

Flood frequency analysis for the post-planning period was not included in this analysis as the post-planning period only extends 15 years, which is too short of a time span to produce reliable flood frequency results. To see flood frequency analysis results for the post-planning period and two halves of the pre-planning period, as well as tabulated results for the flood frequency analysis, see Appendix B.

3.4. Drought Analysis

Figure 7 shows the 1-month, 3-month, 6-month, and 12-month SPI values for SCW plotted over time from 1982–2020 (See Appendix C for each SPI timescale plotted individually). From the 12-month SPI, moderate wet periods can be seen during 1984, 1987, 1994, 1995, 2010, 2011, 2016, and 2019. Severe wet periods were observed in 1983, 1993, 1999, 2007, and 2008 (which reached extreme levels mid-year). Moderate dry periods can be seen during 1991, 1997, 2002, and 2014, severe dry periods occurred during 1988, 2000, and 2020, and extremely dry periods took place in 1989, 1990, and from the end of 2012 to the beginning of 2013. From the 3-month SPI, one can speculate some patterns of dryer soil moisture conditions in winter, and wetter conditions in spring, summer, and fall. However, summer soil moisture occasionally drops, so spring and fall appear to show more consistently moist conditions. Wet and dry periods indicated by the drought analysis were used for deeper understanding and discussion of individual variable prediction efficacy in Section 4.1.

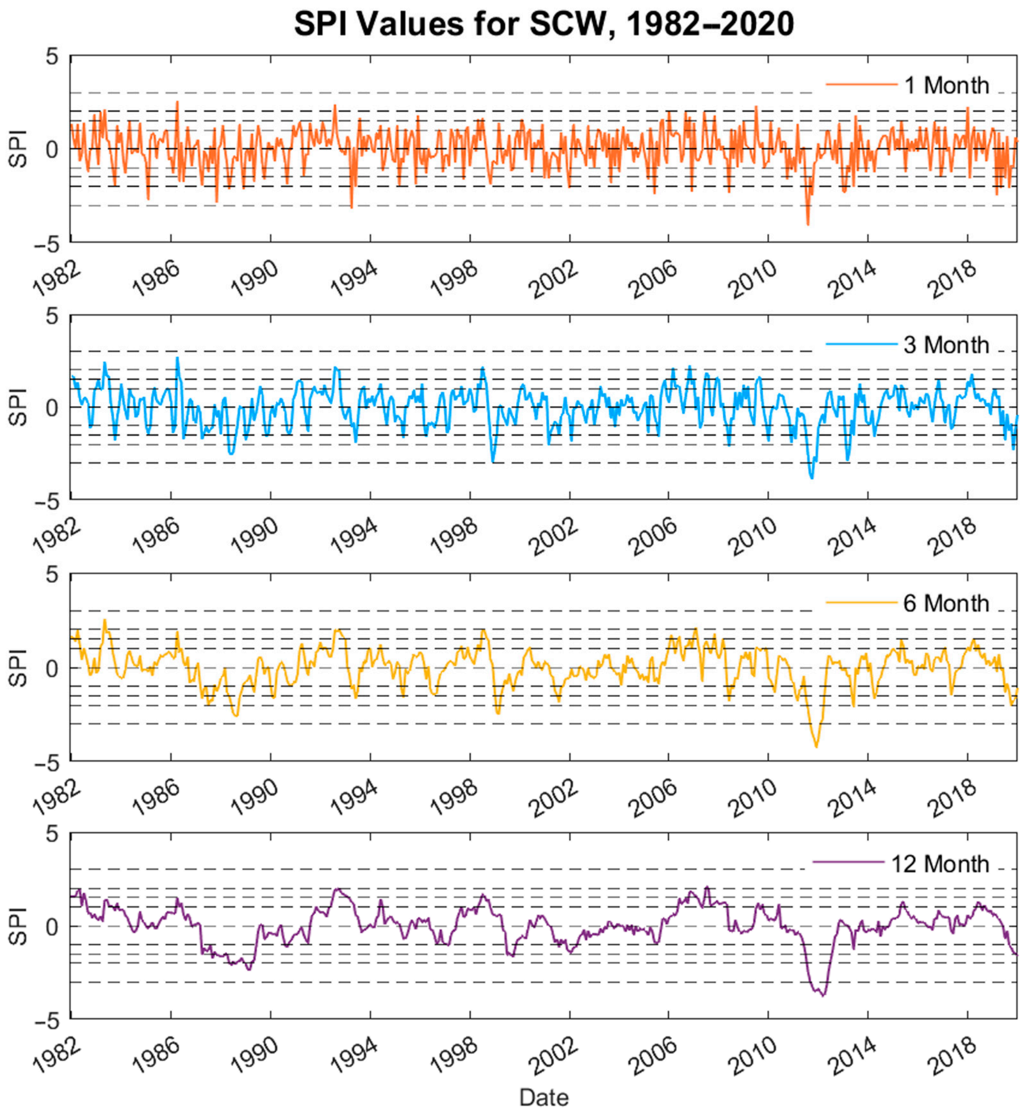


Figure 7. 1-month, 3-month, 6-month, and 12-month SPI values for SCW plotted over time from 1982–2020.

4. Discussion

4.1. Individual Variable Prediction Efficacy

Individual variable prediction efficacy was primarily determined through analysis of the correlation coefficients for each variable found in Section 3.2 of Results. The low across-the-board correlation between predictive variables and the target variable, discharge, suggests that no one factor (of those included in this study) is a good indicator of flooding. However, if one were to select for the highest individual variable prediction efficacy, precipitation is the variable most tied to discharge in SCW. Precipitation saw the highest correlation with discharge for the full period and post-planning period and was the second most correlated variable for the pre-planning period after the fraction of precipitation that is convective, another precipitation-related statistic.

The precipitation-to-discharge relationship is also supported by the SPI results found in the drought analysis. For example, from the 12-month SPI, one can see multiple instances of marked wet periods coinciding with past floods. Major examples include 1982, 1993, and 2008: 1982 had peak SPI values above 1.5 (well within the wet range) and 2 large floods; 1993 had major flooding and showed a sharp increase in SPI (and therefore precipitation) mid-year that reached into the moderately wet range (SPI > 2); 2008 had an SPI value that reached the moderately wet range, and had an annual peak flow that is the highest of those on record. However, there were also some cases where flooding coincided with dry or average moisture periods, so the SPI results were fairly consistent with the low precipitation–discharge relationship observed in the model-free variable selection.

One variable not considered in this study was soil moisture, however results of the drought analysis suggest that this variable be taken into account for flood prediction in future studies. The majority of flooding in SCW takes place during spring and summer [7], and according to results from the 3-month SPI, spring and summer in SCW typically have higher soil moisture levels than winter. This suggests a potential correlation between discharge and soil moisture, though that relationship should be validated with data and cannot be confirmed from the results of this research.

4.2. Model Prediction

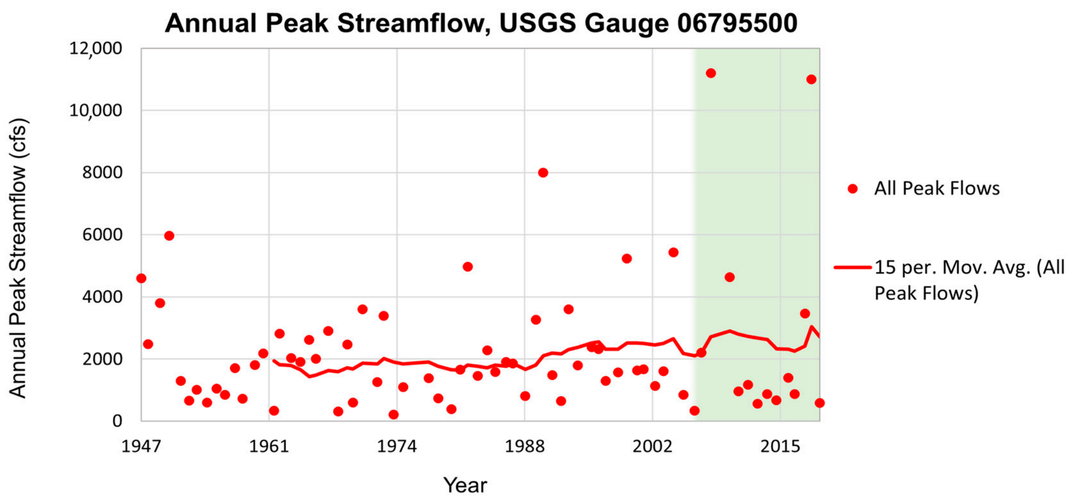
The across-the-board low variable-target correlations found in this study could have the implication that a combination of factors is the more reliable route for discharge prediction. Indeed, from the ANN leave-one-out analysis results detailed in Section 3.2, it can be seen that model prediction performance is better when all 13 predictive variables are included as inputs (with the exception of the pre-planning period), as shown in Figure 6. Since the full-period and post-planning period models showed performance drops solely with the removal of variables, their final and most successful versions included all input variables. For the full period, the best model included 32 hidden neurons and had a KGE value of 0.36. The best model for the post-planning period had 45 neurons in the hidden layer and a KGE of 0.57. For the pre-planning period, performance increased slightly with the individual removal of certain variables; however, the removal of combinations of multiple variables again resulted in decreased performance. Thus, the pre-planning period model with the highest performance was simply the one that excluded potential evaporation—the variable that caused the greatest performance increase when left out—and included all other input variables. This pre-planning model had 11 hidden neurons and a KGE of 0.23.

The KGE values for these models indicate functional prediction performance of varying degrees of acceptability, as all final model KGEs were positive. Of these final proposed models, the post-planning period model showed the best relative performance as its KGE value of 0.57 was closest to 1. The low variable-target correlations of the input variables used in the models justify acceptance of this 0.57 KGE value for the post-planning period as satisfactory performance. To increase the robustness of the model, more data would be needed for both before and after the initiation of conservation practices in the watershed.

4.3. Changes in Flood Intensity

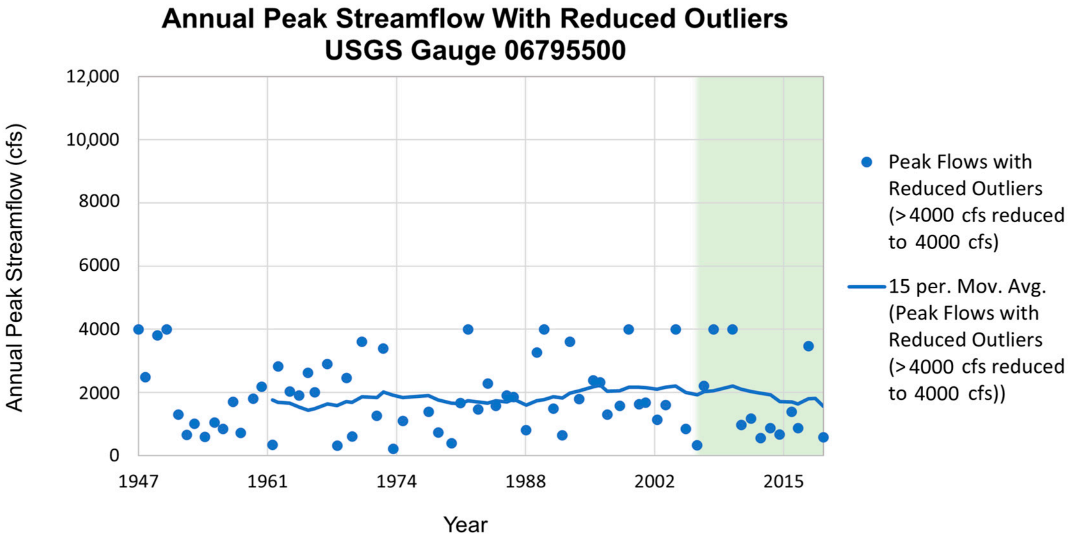
Comparison between the results of the flood frequency analysis of the full period and the pre-planning period (from Section 3.3) allows for insight into patterns of flood frequency and magnitude during the post-planning period. From the examination of higher-probability flows (those with lower return periods) for both periods, it can be seen that the full period has lower corresponding streamflow values than the pre-planning period, indicating that more common flows have decreased in magnitude during the post-planning period. However, for lower-probability flows (those with higher return periods), differences between corresponding flow values for the full period and the pre-planning period become increasingly pronounced, with the full period having higher flow values for return periods greater than 2 years. This indicates a marked increase in the magnitude of extreme flows during the post-planning period. These anomalous, high-magnitude flows could potentially be attributed in part to climate intensification, as was the case with the 2019 flood. In the Midwest, climate change has been linked to increased annual precipitation and higher intensity rainstorms [26], which in turn could contribute to increased flooding. In fact, increased precipitation in the region is projected to drive 10–30% increases in 100-year peak daily streamflows by the 2080s [27]. Historical data further support the possibility that climate change may be linked to increased peak flow magnitudes, as analysis of 100 years of US watershed data has brought to light increases in flooding in the northern eastern prairies and parts of the Midwest, particularly over recent decades [28].

The findings of the flood frequency analyses comparison are supported by Figure 8; Figure 8a shows annual peak flows and their 15-year moving average for SCW. Figure 8b shows the same SCW peak flow data, but with outliers above 4000 cfs, or 113.27 m^3/s, reduced to 4000 cfs in order to more closely examine the typical behavior of streamflow by minimizing added variability from very high extremes. From Figure 8a, instances of abnormally high magnitude flows during the post-planning period can be observed, consistent with the notably increasing difference between computed flows for the full period and pre-planning period in the flood frequency analysis. Conversely, the 15-day average for the modified dataset in Figure 8b shows an overall downward trend in annual peak flow during the post-planning period, consistent with the implications of the lower streamflow values corresponding to lower return periods in the full period flood frequency analysis. In the early post-planning period, this downward trend is very mild, but it becomes more pronounced starting roughly 10 years after the advent of the post-planning period in 2005. During the 10 years immediately prior to the post-planning period, peak flows appeared to have stabilized at just above 2000 cfs, or 56.63 m^3/s, before which could be observed an increasing trend in peak flows. The period of stabilization beginning in the 1990s could be explained by the preliminary conservation practices that began in the early 1990s, prior to the 2005 Shell Creek Watershed Management Plan. This trend of flood peak stabilization and subsequent decrease, with the exception of some high outliers later in the record, suggests that the conservation practices implemented beginning in the early 1990s and adopted more widely in 2005 through the SCW Management Plan may have had an impact on attenuating flood peaks, while climate change may be playing a role in intensifying flood peaks. Further research is necessary to disentangle the impacts of conservation practices and climate change on the watershed.



(**a**)

Figure 8. *Cont.*



(**b**)

Figure 8. Unmodified and modified peak flow data for SCW, with the green section of each graph indicating the years of the post-planning period. (**a**) Annual peak flow data for SCW are plotted in red points. The 15-year moving average for the data is indicated by a red line. (**b**) Annual peak flow data for SCW with outliers above 4000 cfs reduced to 4000 cfs is plotted above in blue points. The blue line indicates the 15-year moving average for the modified peak streamflow data.

5. Conclusions

In this study, Shell Creek Watershed was examined in order to identify the respective influence of selected controlling factors on the hydrology of the catchment, improve understanding of hydrological processes there, and develop an effective rainfall-runoff model for the watershed using ANN. An additional intention of the work was to identify any possible relationship between changes in flood severity and the implementation of conservation practices. Variable selection was broken into three time periods determined by the start of widespread conservation practice implementation in SCW: the full time period (1990–2020), the pre-planning period (1990–2004), and the post-planning period (2005–2020). Model-free and model-based variable selection were used to identify variable influence on flooding, following which ANN rainfall-runoff models were developed using the optimal combination of input variables for each period. Additionally, drought and flood frequency analyses were conducted to improve hydrological understanding of the watershed. Their results contributed to analyses of the efficacy of certain variables in discharge prediction and the identification of changes in peak flow trends.

From the results and analysis of this work, several conclusions can be drawn, as well as some suggestions for future study. In terms of individual variable predictability, our results suggest that of the variables considered, precipitation is most tied to flooding in SCW. However, the correlation between precipitation and discharge for SCW is still quite low, so dependence solely on this factor for discharge prediction is discouraged. Instead, a combination of all variables is encouraged for this purpose. Out of all of the models developed in this study, the model for the post-planning period more closely reflects the current conditions of the watershed and has overall good prediction performance, making it the strongest candidate for discharge prediction in SCW. This model included all variables used in this study as inputs; however, future work may benefit from the investigation and inclusions of soil moisture, as the 3-month SPI results implied cases of high soil moisture coinciding with flooding. With regard to the relationship between flood-change and conservation implementation, flooding has seen an overall decrease in intensity during the post-planning period (with the exception of a few outliers); however, more intensive investigation is warranted to determine a cause for this trend. Furthermore, the incorporation of climate change effects on SCW in such future studies may aid in shedding light on flood trend shifts and the appearance of anomalous flows. Understanding the potentially countering effects of climate change and conservation practices on flooding is crucial to advancing our fundamental understanding of the hydrological processes in the basin. This will require a more in-depth investigation with high-resolution remote sensing datasets and advanced hydrologic modeling.

Author Contributions: Conceptualization, A.A. and T.R.; methodology, A.A. and T.R.; software, A.A. and T.R.; formal analysis, A.A.; investigation, A.A.; resources, A.A. and T.R.; data curation, S.R.K. and I.K.; writing—original draft preparation, A.A.; writing—review and editing, A.A., S.R.K., I.K., J.E., E.T. and T.R.; visualization, A.A.; supervision, T.R.; funding acquisition, A.A. and T.R. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement: Publicly available datasets were analyzed in this study. The NLDAS-2 data presented in this study is openly available in NLDAS Primary Forcing Data L4 Hourly 0.125 × 0.125 degree V002 at 10.5067/6J5LHHOHZHN4. The NWIS data can be found here: https://maps.waterdata.usgs.gov/mapper, accessed on 1 November 2022. The USGS data can be found here: https://waterdata.usgs.gov/ne/nwis/uv/?site_no=06795500. The NSIDC can be found here: https://nsidc.org/data/NSIDC-0719/versions/1, accessed on 1 November 2022.

Acknowledgments: Special thanks to Mark Seier, Gene Wissenburg, and Matt Bailey for their help and enthusiasm in connecting us with background information about SCW and touring us around the watershed. We thank Chris Poole from the Lower Platte North Natural Resources District for his help in creating Figure 1.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

This appendix includes cross-correlation plots with all input variables included for all three time periods of study.

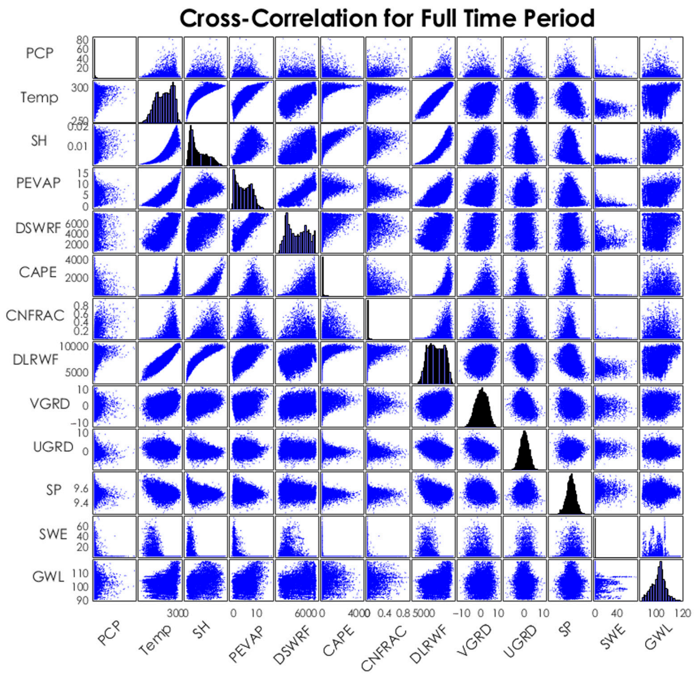

Figure A1. Cross-correlation pair plot for all 13 predictive variables over the full time period (1990–2020).

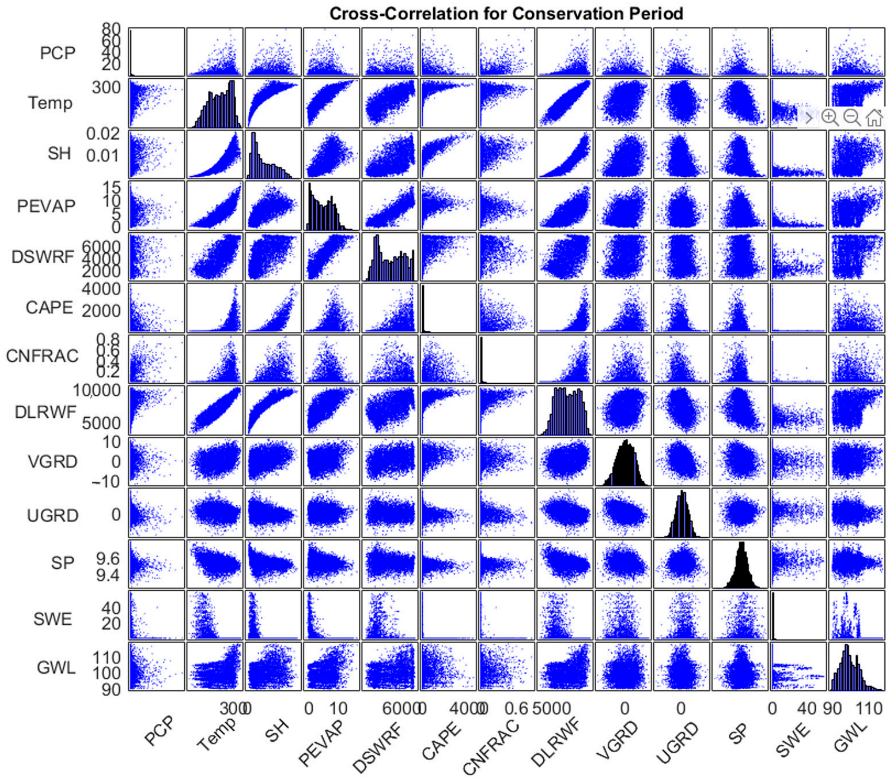

Figure A2. Cross-correlation pair plot for all 13 predictive variables over the conservation period (2005–2020).

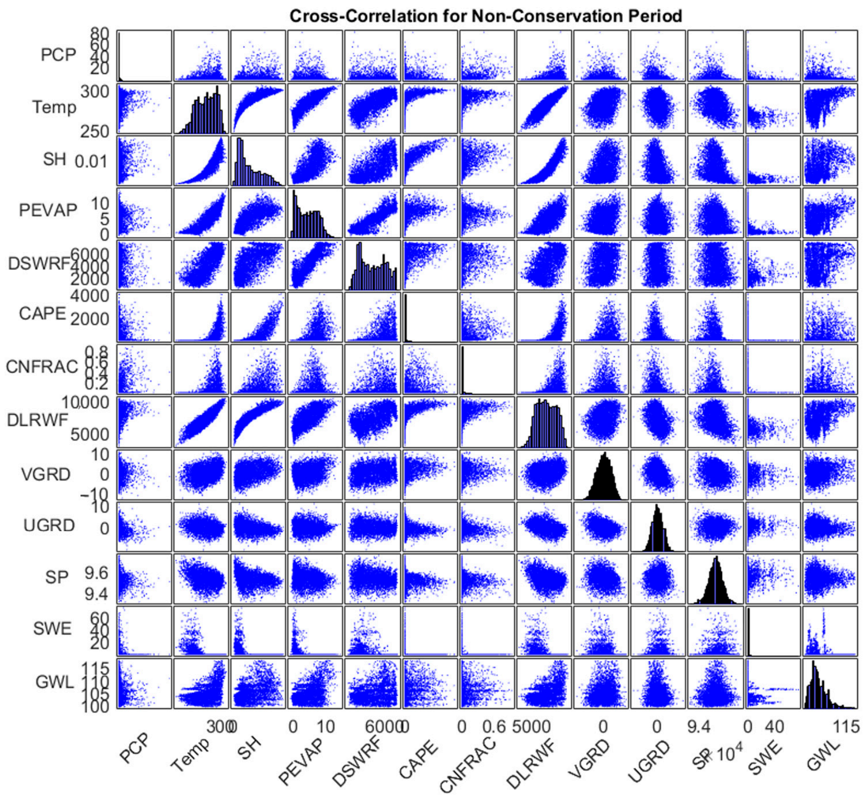

Figure A3. Cross-correlation pair plot for all 13 predictive variables over the non-conservation period (1990–2004).

Appendix B

This appendix includes flood frequency analysis results for the post-planning period and two halves of the pre-planning period, as well as tabulated results for flood frequency analysis.

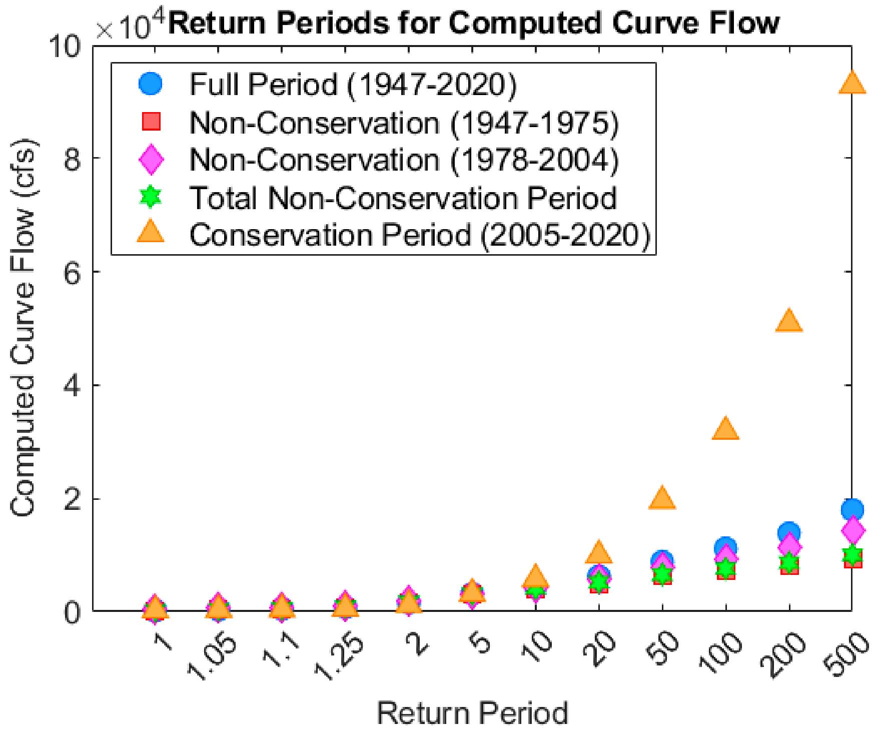

Figure A4. Flood frequency analysis results for 5 different time periods: The full period (1947–2020), the total non-conservation period (1947–1975), the first half of the non-conservation period (1947–1975), the second half of the non-conservation period (1978–2004), and the conservation period (2005-2020). Peak flow data was missing for the years 1976 and 1977, accounting for the break between the two non-conservation time periods.

Table A1. Return periods and their corresponding computed curve flows for the full time period, total pre-planning period, and the post-planning period.

Full Time Period		Total Pre-Planning Period		Post-Planning Period	
Return Period	**Computed Curve Flow (cfs)**	**Return Period**	**Computed Curve Flow (cfs)**	**Return Period**	**Computed Curve Flow (cfs)**
1	259.9	1	214.2	1	259.9
1.05	354	1.05	420.2	1.05	354
1.1	436.4	1.1	588.5	1.1	436.4
1.25	588.9	1.25	867.2	1.25	588.9
2	1222.1	2	1713.5	2	1222.1
5	3181.5	5	3136.1	5	3181.5
10	5783.7	10	4177.3	10	5783.7
20	9990	20	5216.1	20	9990
50	19,604.1	50	6594.8	50	19,604.1
100	31,838.9	100	7643.1	100	31,838.9
200	50,899.6	200	8695.1	200	50,899.6
500	92,883.2	500	10,088.9	500	92,883.2

Table A2. Return periods and their corresponding computed curve flows for the two halves of the pre-planning period.

Pre-Planning Period (1947–1975)		Pre-Planning Period (1978–2004)	
Return Period	**Computed Curve Flow (cfs)**	**Return Period**	**Computed Curve Flow (cfs)**
1	146.2	1	396.5
1.05	322.7	1.05	610.1
1.1	476	1.1	771.2
1.25	739.5	1.25	1028.5
2	1571.1	2	1807.7
5	2985	5	3232.6
10	4002.8	10	4410.9
20	4995.7	20	5722.3
50	6274	50	7700.4
100	7214.6	100	9407.8
200	8131.1	200	11,318.9
500	9303.8	500	14,192.1

Appendix C

This appendix contains the 1-month, 3-month, 6-month, 12-month, and combined SPI results expanded and plotted in individual figures.

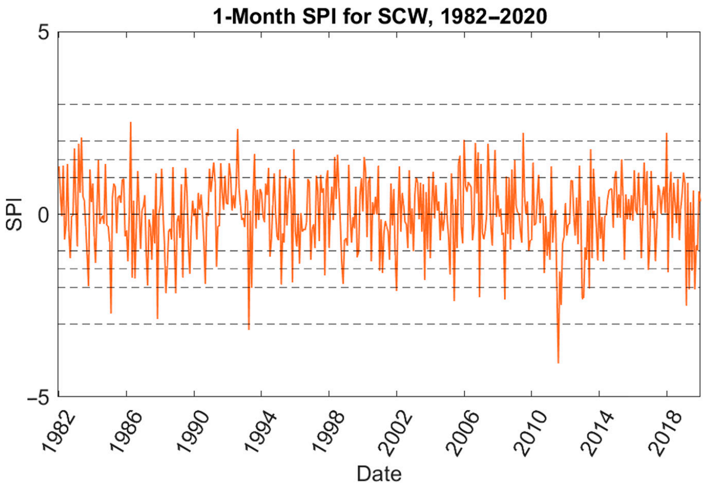

Figure A5. 1-Month SPI from 1982 to 2020.

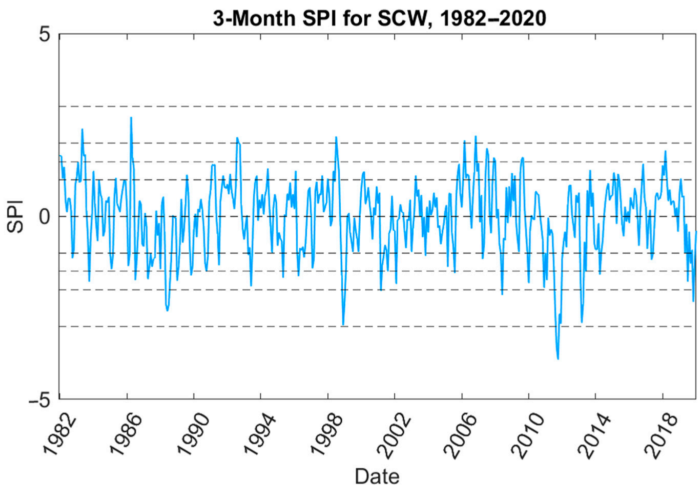

Figure A6. 3-Month SPI from 1982 to 2020.

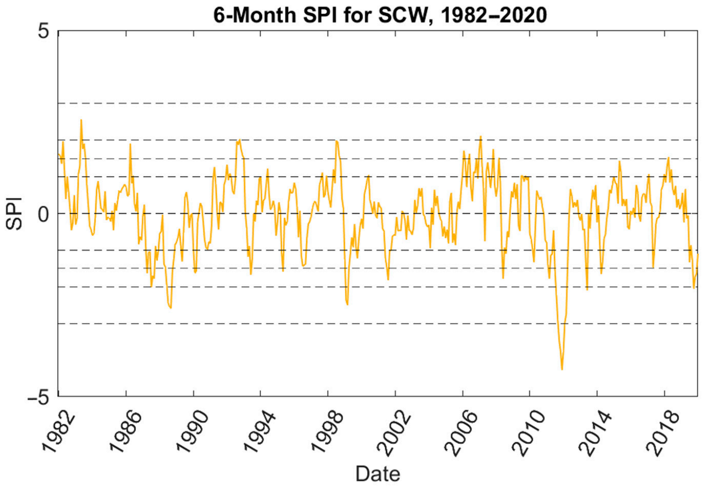

Figure A7. 6-Month SPI from 1982 to 2020.

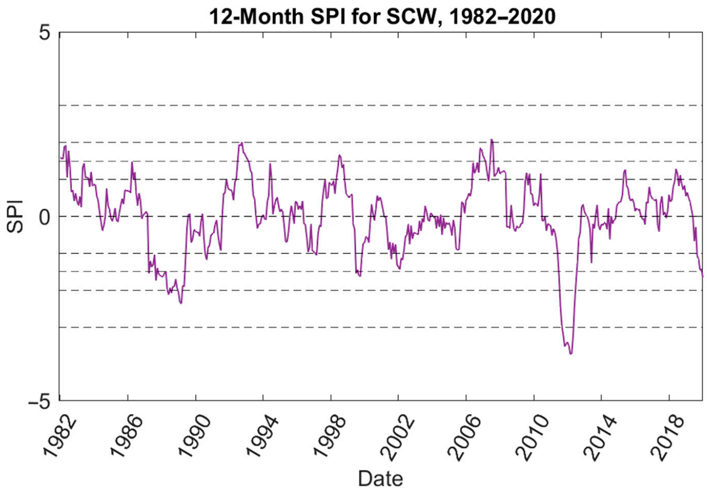

Figure A8. 12-Month SPI from 1982 to 2020.

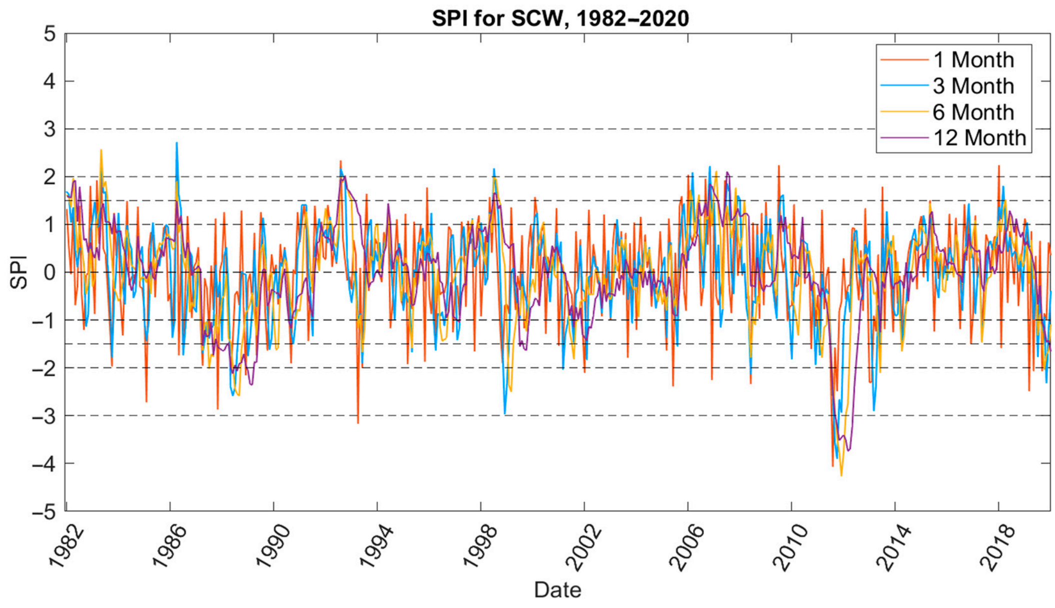

Figure A9. 1-, 3-, 6-, and 12-Month SPI from 1982 to 2020 plotted on the same axes.

Appendix D

This appendix includes some information about the current state of flood forecasting in the basin.

SCW's floodplains have been recorded and made publicly available on the Nebraska Department of Natural Resources (NeDNR) Floodplain Management Interactive Map, which can be found at the following link: https://gis.ne.gov/portal/apps/webappviewer/index.html?id=7bc8738d3d8f4e87823cc604543b7ddf, accessed on 1 November 2022.

Forecasting takes place primarily at Shell Creek near Columbus, NE, as that is the only gauge that provides daily streamflow data to date. River forecasts in this location rely on past precipitation and predicted precipitation amounts for the 48 h following the time of issuance for the forecast. Forecasts are only issued as needed during times of high water, and thus are not routinely available [7].

Information about data and measurements taken at the USGS 06795500 Shell Creek near Columbus, Nebraska stream site can be found at the following link: https://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=06795500 (accessed on 9 November 2022).

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Shell Creek Research Group
2023 Order Request
Newman Grove High School

Forestry Suppliers 205 West Rankin St Jackson, MS 39201 800-647-5368					
	Description	Item Number	Price	Quantity	Total
	Nitrate Test Kit	94834	$66.95	4	$267.80
	Phosphate Test Kit	94837	$56.25	1	$56.25
	pH Test Kit	94836	$74.95	1	$74.95
	Chest Waders	94507	$122.25	1	$122.25
	Chest Waders	94510	$122.25	1	$122.25
	1 ml pipettes	53891	$7.25	5	$36.25
Vernier 13979 SW Millikan Way Beaverton, OR 97005 1-888-837-6437 www.vernier.com					
	LabQuest 3	LABQ3	$399.00	1	$399.00
	Go Direct Optical Dissolved	GDX-ODO	$359.00	1	$359.00
	ODO Clamp	GDX-Clamp	$14.00	1	$14.00
	ODO Cap	GDX-ODO-CAP	$79.00	2	$158.00
				TOTAL	#######

Progress Report for Wahoo Creek Watershed Dams Sites

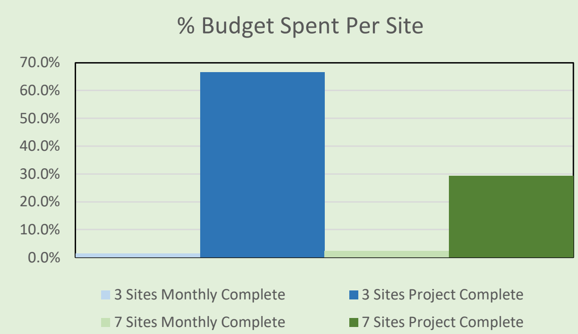
Lower Platte North NRD

For Work Compled During The Month Of : December, 2022
(through 12/31/22)

Project # 018-3423 Dam Site 26A, 26B, &27 Project Phase	Phase Budget	Billings for Month: Current Earned/Billings	Billings for Month: % Completed This Month	Project Total Billings to Date: JTD Earned/Billings	Project Total Billings to Date: % Completed Overall
010 - Project Management/Meetings	$ 23,213		0.0%	$ 12,109.75	52.2%
020 - Geotechnical Engineering	$ 224,493		0.0%	$ 224,785.21	100.1%
030 - Dam Design	$ 184,885	$ 9,431.75	5.1%	$ 168,732.62	91.3%
040 - Permitting	$ 86,634		0.0%	$ 35,774.94	41.3%
050 - Survey and Legal Descriptions	$ 11,142		0.0%	$ 23,636.47	212.1%
060 - Community/Public Participation	$ -			$ -	
070 - Construction Services	$ 171,962			$ 1,590.75	
				$ -	
3 Sites Totals	$ 702,329	$ 9,431.75	1.3%	$ 466,629.74	66.4%

Project # A18-3423 (separate invoice) Sites 55, 66, 77, 82, 84, 85, &86 Project Phase	Phase Totals	Billings for Month: Current Earned/Billings	Billings for Month: % Completed This Month	Project Total Billings to Date: JTD Earned/Billings	Project Total Billings to Date: % Completed Overall
100 - Project Management/Meetings	$ 60,813	$ 1,205.80	2.0%	$ 25,704.88	42.3%
110 - Geotechnical Engineering	$ 592,047	$ 14,327.40	2.4%	$ 352,680.66	59.6%
120 - Dam Design	$ 425,202	$ 21,535.21	5.1%	$ 114,489.39	26.9%
130 - Permitting	$ 244,810	$ 4,407.20	1.8%	$ 69,119.27	28.2%
140 - Survey and Legal Descriptions	$ 28,165	$ 1,341.94	4.8%	$ 13,327.70	47.3%
150 - Community/Public Participation	$ 30,000		0.0%	$ 5,899.20	19.7%
160 - Other	$ -			$ -	
170- Construction Services	$ 603,992			$ -	
7 Sites Totals	$ 1,985,029	$ 42,817.55	2.2%	$ 581,221.10	29.3%

Billings For Month	**$ 52,249.30**
Total Billings To Date	$ 1,047,850.84
Project Budget	$ 2,687,358
Budget Remaining	$ 1,639,507.16



Summary Of Work Completed This Month	
Sites 26A, 26B, & 27	Sites 55,66,77,82,84,85, & 86
-Principal spillway update	- H&H design and centerline layout
-Speciciations updates	-Geotechnical analysis for sites 55, 66, & 77
-NRCS comments updates for principal spillway and plunge pool	-Processing of collected survey information
-NEScap environmental report updates	-Topo for Site 77
-Finalize geotechnical reports	-Project Management
-Riser structural design	-Triaxial testing for all sites
	-SITES reviews for auxiliary spillways
	-NeSCAP Scoring and Maps

Planned Work For Next Month	
Site 26A, 26B, & 27	Sites 55, 66, 77, 82, 84, 85, & 86
-Finishing up 90% submittal	-H&H design, centeriline layout, and auxiliary spillway design
	-Geotechnical laboratory testing
	-Mitigation discussions and design
	-Topographic survey and picking up section corners

For questions regarding billings, please contact Andrew Phillips at (402) 440-8807 or aphillips@olsson.com

Invoice

olsson

601 P St Suite 200
PO Box 84608
Lincoln, NE 68501-4608
Tel 402.474.6311, Fax 402.474.5063

January 12, 2023
Invoice No: 445545

Invoice Total $42,817.55

Ryan Chapman
Lower Platte North NRD
PO Box 126
Wahoo, NE 68066-0126

Olsson Project # A18-34230 Lower Platte North NRD Wahoo Creek Watershed & 7 Dam Sites Phase II

Professional services rendered December 4, 2022 through December 31, 2022 for work completed in accordance with agreement.

Phase 100 Sites 55 66 77 82 83 84 85 86 Project Management

Labor

	Hours	Amount	
Principal	5.00	1,205.80	
Totals	5.00	1,205.80	
Total Labor			**1,205.80**

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	1,205.80	24,499.08	25,704.88
Limit			62,400.00
Balance Remaining			36,695.12

Total this Phase $1,205.80

Phase 110 Geotechnical Engineering

Labor

	Hours	Amount	
Assistant Engineer	.75	67.85	
Technician	8.75	620.90	
Principal	5.00	1,097.25	
Project Professional	53.25	7,147.75	
Assistant Professional	5.00	223.65	
Totals	72.75	9,157.40	
Total Labor			**9,157.40**

Unit Billing

Atterberg Limit	
1 Test @ $95/Test	95.00
1 Tests @ $95/Test	95.00
2 Tests @ $95/Test	190.00
Disperson - Pinhole	
2 Test @ $130/Test	260.00

Dry Density Test					
1 Tests @ $30/Test				30.00	
Moisture Content					
1 Tests @ $20/Test				20.00	
One-Dimensional Consolidation Test					
1 Tests @ $165/Test				165.00	
1 Tests @ $165/Test				165.00	
1 Tests @ $165/Test				165.00	
P-200 Sieve Test					
1 Tests @ $45/Test				45.00	
Triaxial Comp Cons Drained-Intact					
1 Test @ $1,925/Test				1,925.00	
Triaxial Comp Cons Undrained-Intact					
1 Test @ $1,925/Test				1,925.00	
Unconfined Compress Strgth - Soils					
2 Tests @ $45/Test				90.00	
Total Units				**5,170.00**	**5,170.00**

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	14,327.40	338,353.26	352,680.66
Limit			607,460.00
Balance Remaining			254,779.34

Total this Phase **$14,327.40**

Phase 120 Dam Design

Labor

	Hours	**Amount**	
Assistant Professional	165.50	15,804.45	
Designer	48.50	5,730.76	
Totals	214.00	21,535.21	
Total Labor			**21,535.21**

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	21,535.21	92,954.18	114,489.39
Limit			436,278.00
Balance Remaining			321,788.61

Total this Phase **$21,535.21**

Phase 130 Permitting

Labor

	Hours	**Amount**	
Assistant Professional	45.50	4,407.20	
Totals	45.50	4,407.20	
Total Labor			**4,407.20**

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	4,407.20	64,712.07	69,119.27
Limit			251,140.00
Balance Remaining			182,020.73

Total this Phase **$4,407.20**

Phase 140 Survey & Legal Descriptions

Labor

	Hours	**Amount**	
Survey 2-Man Crew	8.50	786.68	
Survey Crew Support	8.50	472.01	
Totals	17.00	1,258.69	
Total Labor			**1,258.69**

Unit Billing

Field Vehicle 1457	111.0 Miles @ 0.75	83.25	
Total Units		**83.25**	**83.25**

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	1,341.94	11,985.76	13,327.70
Limit			28,875.00
Balance Remaining			15,547.30

Total this Phase **$1,341.94**

AMOUNT DUE THIS INVOICE **$42,817.55**

Outstanding Invoices

Number	**Date**	**Balance**
443248	12/19/2022	40,128.20
Total		**40,128.20**

Authorized By: Andrew Phillips

Invoice

601 P St Suite 200
PO Box 84608
Lincoln, NE 68501-4608
Tel 402.474.6311, Fax 402.474.5063

olsson

January 12, 2023
Invoice No: 445542

Invoice Total $9,431.75

Ryan Chapman
Lower Platte North NRD
PO Box 126
Wahoo, NE 68066-0126

Olsson Project # 018-34230 Lower Platte North NRD Wahoo Creek Watershed & 3 Dam Sites
Professional services rendered December 4, 2022 through December 31, 2022 for work completed in accordance with agreement.

Phase 030 Dam Design 26a, 26b, 27

Labor

	Hours	**Amount**	
Principal	4.50	734.18	
Assistant Professional	7.00	674.87	
Designer	23.50	2,776.76	
CAD Operator	68.25	5,245.94	
Totals	103.25	9,431.75	
Total Labor			**9,431.75**

Total this Phase $9,431.75

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	9,431.75	457,197.99	466,629.74
Limit			702,329.00
Balance Remaining			235,699.26

AMOUNT DUE THIS INVOICE $9,431.75

Outstanding Invoices

Number	**Date**	**Balance**
443247	12/19/2022	9,835.44
Total		**9,835.44**

Email invoice to: rchapman@lpnnrd.org

Authorized By: Andrew Phillips

INVOICE PAYMENT IS REQUESTED WITHIN 30 DAYS

Progress Report for Wahoo Creek Watershed Dams Sites

Lower Platte North NRD

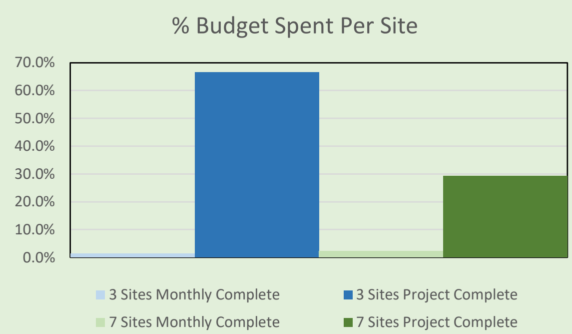
olsson

For Work Compled During The Month Of : December, 2022
(through 12/31/22)

Project # 018-3423 Dam Site 26A, 26B, &27 Project Phase	Phase Budget	Billings for Month: Current Earned/Billings	Billings for Month: % Completed This Month	Project Total Billings to Date: JTD Earned/Billings	Project Total Billings to Date: % Completed Overall
010 - Project Management/Meetings	$ 23,213		0.0%	$ 12,109.75	52.2%
020 - Geotechnical Engineering	$ 224,493		0.0%	$ 224,785.21	100.1%
030 - Dam Design	$ 184,885	$ 9,431.75	5.1%	$ 168,732.62	91.3%
040 - Permitting	$ 86,634		0.0%	$ 35,774.94	41.3%
050 - Survey and Legal Descriptions	$ 11,142		0.0%	$ 23,636.47	212.1%
060 - Community/Public Participation	$ -			$ -	
070 - Construction Services	$ 171,962			$ 1,590.75	
				$ -	
3 Sites Totals	$ 702,329	$ 9,431.75	1.3%	$ 466,629.74	66.4%

Project # A18-3423 (separate invoice) Sites 55, 66, 77, 82, 84, 85, &86 Project Phase	Phase Totals	Billings for Month: Current Earned/Billings	Billings for Month: % Completed This Month	Project Total Billings to Date: JTD Earned/Billings	Project Total Billings to Date: % Completed Overall
100 - Project Management/Meetings	$ 60,813	$ 1,205.80	2.0%	$ 25,704.88	42.3%
110 - Geotechnical Engineering	$ 592,047	$ 14,327.40	2.4%	$ 352,680.66	59.6%
120 - Dam Design	$ 425,202	$ 21,535.21	5.1%	$ 114,489.39	26.9%
130 - Permitting	$ 244,810	$ 4,407.20	1.8%	$ 69,119.27	28.2%
140 - Survey and Legal Descriptions	$ 28,165	$ 1,341.94	4.8%	$ 13,327.70	47.3%
150 - Community/Public Participation	$ 30,000		0.0%	$ 5,899.20	19.7%
160 - Other	$ -			$ -	
170- Construction Services	$ 603,992			$ -	
7 Sites Totals	$ 1,985,029	$ 42,817.55	2.2%	$ 581,221.10	29.3%

Billings For Month	**$ 52,249.30**
Total Billings To Date	$ 1,047,850.84
Project Budget	$ 2,687,358
Budget Remaining	$ 1,639,507.16



Summary Of Work Completed This Month

Sites 26A, 26B, & 27	Sites 55,66,77,82,84,85, & 86
-Principal spillway update	- H&H design and centerline layout
-Speciciations updates	-Geotechnical analysis for sites 55, 66, & 77
-NRCS comments updates for principal spillway and plunge pool	-Processing of collected survey information
-NEScap environmental report updates	-Topo for Site 77
-Finalize geotechnical reports	-Project Management
-Riser structural design	-Triaxial testing for all sites
	-SITES reviews for auxiliary spillways
	-NeSCAP Scoring and Maps

Planned Work For Next Month

Site 26A, 26B, & 27	Sites 55, 66, 77, 82, 84, 85, & 86
-Finishing up 90% submittal	-H&H design, centeriline layout, and auxiliary spillway design
	-Geotechnical laboratory testing
	-Mitigation discussions and design
	-Topographic survey and picking up section corners

For questions regarding billings, please contact Andrew Phillips at (402) 440-8807 or aphillips@olsson.com

Invoice

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January 12, 2023
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Invoice Total $9,431.75

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Olsson Project # 018-34230 Lower Platte North NRD Wahoo Creek Watershed & 3 Dam Sites
Professional services rendered December 4, 2022 through December 31, 2022 for work completed in accordance with agreement.

Phase 030 Dam Design 26a, 26b, 27

Labor

	Hours	Amount	
Principal	4.50	734.18	
Assistant Professional	7.00	674.87	
Designer	23.50	2,776.76	
CAD Operator	68.25	5,245.94	
Totals	103.25	9,431.75	
Total Labor			**9,431.75**

Total this Phase **$9,431.75**

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	9,431.75	457,197.99	466,629.74
Limit			702,329.00
Balance Remaining			235,699.26

AMOUNT DUE THIS INVOICE **$9,431.75**

Outstanding Invoices

Number	Date	Balance
443247	12/19/2022	9,835.44
Total		**9,835.44**

Email invoice to: rchapman@lpnnrd.org

Authorized By: Andrew Phillips

INVOICE PAYMENT IS REQUESTED WITHIN 30 DAYS

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olsson

January 12, 2023
Invoice No: 445545

Invoice Total $42,817.55

Ryan Chapman
Lower Platte North NRD
PO Box 126
Wahoo, NE 68066-0126

Olsson Project # A18-34230 Lower Platte North NRD Wahoo Creek Watershed & 7 Dam Sites Phase II

Professional services rendered December 4, 2022 through December 31, 2022 for work completed in accordance with agreement.

Phase 100 Sites 55 66 77 82 83 84 85 86 Project Management

Labor

	Hours	Amount	
Principal	5.00	1,205.80	
Totals	5.00	1,205.80	
Total Labor			**1,205.80**

Billing Limits	**Current**	**Prior**	**To-Date**
Total Billings	1,205.80	24,499.08	25,704.88
Limit			62,400.00
Balance Remaining			36,695.12

Total this Phase $1,205.80

Phase 110 Geotechnical Engineering

Labor

	Hours	Amount	
Assistant Engineer	.75	67.85	
Technician	8.75	620.90	
Principal	5.00	1,097.25	
Project Professional	53.25	7,147.75	
Assistant Professional	5.00	223.65	
Totals	72.75	9,157.40	
Total Labor			**9,157.40**

Unit Billing

Atterberg Limit	
1 Test @ $95/Test	95.00
1 Tests @ $95/Test	95.00
2 Tests @ $95/Test	190.00
Disperson - Pinhole	
2 Test @ $130/Test	260.00

Dry Density Test			
1 Tests @ $30/Test		30.00	
Moisture Content			
1 Tests @ $20/Test		20.00	
One-Dimensional Consolidation Test			
1 Tests @ $165/Test		165.00	
1 Tests @ $165/Test		165.00	
1 Tests @ $165/Test		165.00	
P-200 Sieve Test			
1 Tests @ $45/Test		45.00	
Triaxial Comp Cons Drained-Intact			
1 Test @ $1,925/Test		1,925.00	
Triaxial Comp Cons Undrained-Intact			
1 Test @ $1,925/Test		1,925.00	
Unconfined Compress Strgth - Soils			
2 Tests @ $45/Test		90.00	
Total Units		**5,170.00**	**5,170.00**

Billing Limits	Current	Prior	To-Date
Total Billings	14,327.40	338,353.26	352,680.66
Limit			607,460.00
Balance Remaining			254,779.34

Total this Phase **$14,327.40**

Phase 120 Dam Design

Labor

	Hours	Amount	
Assistant Professional	165.50	15,804.45	
Designer	48.50	5,730.76	
Totals	214.00	21,535.21	
Total Labor			**21,535.21**

Billing Limits	Current	Prior	To-Date
Total Billings	21,535.21	92,954.18	114,489.39
Limit			436,278.00
Balance Remaining			321,788.61

Total this Phase **$21,535.21**

Phase 130 Permitting

Labor

	Hours	Amount	
Assistant Professional	45.50	4,407.20	
Totals	45.50	4,407.20	
Total Labor			**4,407.20**

Billing Limits	**Current**	**Prior**	**To-Date**	
Total Billings	4,407.20	64,712.07	69,119.27	
Limit			251,140.00	
Balance Remaining			182,020.73	
		Total this Phase		**$4,407.20**

Phase 140 Survey & Legal Descriptions

Labor

	Hours	**Amount**	
Survey 2-Man Crew	8.50	786.68	
Survey Crew Support	8.50	472.01	
Totals	17.00	1,258.69	
Total Labor			**1,258.69**

Unit Billing

Field Vehicle 1457	111.0 Miles @ 0.75	83.25	
Total Units		**83.25**	**83.25**

Billing Limits	**Current**	**Prior**	**To-Date**	
Total Billings	1,341.94	11,985.76	13,327.70	
Limit			28,875.00	
Balance Remaining			15,547.30	
		Total this Phase		**$1,341.94**

AMOUNT DUE THIS INVOICE **$42,817.55**

Outstanding Invoices

Number	**Date**	**Balance**
443248	12/19/2022	40,128.20
Total		**40,128.20**

Authorized By: Andrew Phillips

Summary of Conceptual Project Costs

	Rawhide WFPO - NW Fremont		
Project Costs	**Total**	***NRCS Share***	***Local Share***
DC1-21, Airport Detention	**$13,713,240**	*$10,642,940*	*$3,070,300*
DC1-13, Merlyn England Detention	**$19,182,600**	*$14,823,700*	*$4,358,900*
L1-11, Rawhide Creek Berms	**$7,849,340**	*$6,956,340*	*$893,000*
L1-1, Fremont Cutoff Rd Raise and Brush Creek Berm	**$1,601,050**	*$1,457,850*	*$143,200*
C1-2, County Road S Ditch	~~**$5,890,600**~~	~~*$5,352,200*~~	~~*$538,400*~~
TOTAL	~~**$48,236,830**~~	~~*$39,233,030*~~	~~*$9,003,800*~~
	$42,346,230	$33,880,830	$8,465,400

Summary of Conceptual Project Costs

		Rawhide WFPO	DC1-21	DC1-13	L1-11	L1-1	C1-2
	Item	TOTAL	Airport Det.	Merlyn England Det.	Rawhide Creek Berms	Fremont Cutoff and Brush Creek	County Road S Ditch
Sponsor Costs	Property Rights	$6,201,000	$2,310,000	$3,300,000	$396,000	$39,000	$156,000
	Project Administration*	$1,557,100	$422,400	$588,300	$276,100	$57,900	$212,400
	Permitting	$1,245,700	$337,900	$470,600	$220,900	$46,300	$170,000
	SUBTOTAL	**$9,003,800**	**$3,070,300**	**$4,358,900**	**$893,000**	**$143,200**	**$538,400**
	Local/WSF	*$3,601,520 $5,402,280*	*$1,228,120 $1,842,180*	*$1,743,560 $2,615,340*	*$357,200 $535,800*	*$57,280 $85,920*	*$215,360 $323,040*
WFPO Costs	Engineering	$8,096,000	$2,196,200	$3,058,900	$1,435,500	$300,900	$1,104,500
	Construction	$31,137,030	$8,446,740	$11,764,800	$5,520,840	$1,156,950	$4,247,700
	SUBTOTAL	**$39,233,030**	**$10,642,940**	**$14,823,700**	**$6,956,340**	**$1,457,850**	**$5,352,200**
	Total Installation Cost	**$48,236,830**	**$13,713,240**	**$19,182,600**	**$7,849,340**	**$1,601,050**	**$5,890,600**
	Annual O&M**	$233,528	$63,351	$88,236	$41,406	$8,677	$31,858

* Estimated at 5% of Construction

** Estimated at 0.75% of Construction

For a Flood Control purpose WFPO project:

NRCS Pays 100% of Design (Engineering) and Construction

Sponsor Pays 100% of Land Rights and Permitting

[redacted]

[redacted]

[redacted]

Rawhide WFPO
JEO Project Number: 200881

Dodge County
January 2023

Conceptual Cost Opinion

Item	Unit	Quantity	Alternative - DC1-21 - Airport Detention Unit Price	Total
Mobilization	LS	1	$ 474,000.00	$ 474,000.00
Bonding and Insurance	LS	1	$ 158,000.00	$ 158,000.00
Clearing and Grubbing	LS	1	$ 90,000.00	$ 90,000.00
Temporary Traffic Control Measures	LS	1	$ -	$ -
Excavation, Established Quantity	CY	1,027,250	$ 5.00	$ 5,136,250.00
Earthwork Measured in Embankment (Established Quantity)	CY	7,800	$ 20.00	$ 156,000.00
Bridge Removal and Replacement	SF	600	$ 500.00	$ 300,000.00
18" RCP, Class III	LF	40	$ 250.00	$ 10,000.00
18" RCP Flared End Section	EA	1	$ 1,700.00	$ 1,700.00
Concrete Headwall	EA	1	$ 7,500.00	$ 7,500.00
Automatic Flap Gate	EA	0	$ 10,000.00	$ -
Crushed Rock Base Course	TONS	0	$ 75.00	$ -
Gravel Surface Course	TONS	0	$ 90.00	$ -
Rock Riprap	TONS	50	$ 110.00	$ 5,500.00
Remove Pavement	SY	0	$ 25.00	$ -
7" Concrete Pavement	SY	0	$ 100.00	$ -
Silt Fence, Low Porosity	LF	0	$ 4.00	$ -
Seeding, Fertilizer and Mulch	ACRE	140	$ 5,000.00	$ 700,000.00
CONSTRUCTION SUBTOTAL				***$7,038,950.00***
CONSTRUCTION with 20% CONT				**$8,446,740.00**
Mitigation Costs				
Recreation Facilities				**$0.00**
Land Acquisition				
Land	ACRE	140	$ 15,000.00	$ 2,100,000.00
Home Buyout	EA	0	$ 250,000.00	$ -
Hold	LS	0	$ -	$ -
Hold	LS	0	$ -	$ -
	Land Acquisition Subtotal			$2,100,000.00
	Legal Fees, Appraisals, Etc			$210,000.00
		LAND ACQUISITION TOTAL		**$2,310,000.00**
Engineering				
Design, Geotech, & Bidding	LS	1	$ 1,351,500.00	$ 1,351,500.00
Permitting	LS	1	$ 337,900.00	$ 337,900.00
Construction Engineering & Material Testing	LS	1	$ 844,700.00	$ 844,700.00
ENGINEERING SUBTOTAL				**$2,534,100.00**
SUBTOTAL PROJECT COST				**$13,290,840.00**
Sponsor Admin and Other Fees				$422,400.00
TOTAL PROJECT COST				**$13,713,240.00**

Rawhide WFPO
JEO Project Number: 200881

Dodge County
January 2023

Conceptual Cost Opinion

			Alternative - DC1-13 - Merlyn England Detention	
Item	**Unit**	**Quantity**	**Unit Price**	**Total**
Mobilization	LS	1	$ 655,000.00	$ 655,000.00
Bonding and Insurance	LS	1	$ 219,000.00	$ 219,000.00
Clearing and Grubbing	LS	1	$ 200,000.00	$ 200,000.00
Temporary Traffic Control Measures	LS	1	$ -	$ -
Excavation, Established Quantity	CY	1,520,000	$ 5.00	$ 7,600,000.00
Earthwork Measured in Embankment (Established Quantity)	CY	3,100	$ 20.00	$ 62,000.00
Bridge Removal and Replacement	SF	0	$ 500.00	$ -
24" RCP, Class III	LF	80	$ 300.00	$ 24,000.00
24" RCP Flared End Section	EA	2	$ 2,000.00	$ 6,000.00
48" RCP Class III	LF	0	$ 500.00	$ -
48" RCP Flared End Section	EA	0	$ 3,000.00	$ -
Concrete Headwall	EA	2	$ 7,500.00	$ 15,000.00
Automatic Flap Gate	EA	0	$ 10,000.00	$ -
Crushed Rock Base Course	TONS	0	$ 75.00	$ -
Gravel Surface Course	TONS	0	$ 90.00	$ -
Rock Riprap	TONS	100	$ 110.00	$ 11,000.00
Remove Pavement	SY	0	$ 25.00	$ -
7" Concrete Pavement	SY	0	$ 100.00	$ -
Silt Fence, Low Porosity	LF	3,000	$ 4.00	$ 12,000.00
Seeding, Fertilizer and Mulch	ACRE	200	$ 5,000.00	$ 1,000,000.00
CONSTRUCTION SUBTOTAL				***$9,804,000.00***
CONSTRUCTION with 20% CONT				**$11,764,800.00**
Mitigation Costs				
Recreation Facilities				$0.00
Land Acquisition				
Land	ACRE	200	$ 15,000.00	$ 3,000,000.00
Home Buyout	EA	0	$ 100,000.00	$ -
Hold	LS	0	$ -	$ -
Hold	LS	0	$ -	$ -
		Land Acquisition Subtotal		$3,000,000.00
		Legal Fees, Appraisals, Etc	10%	$300,000.00
			LAND ACQUISITION TOTAL	**$3,300,000.00**
Engineering				
Design, Geotech, & Bidding	LS	1	$ 1,882,400.00	$ 1,882,400.00
Permitting	LS	1	$ 470,600.00	$ 470,600.00
Construction Engineering & Material Testing	LS	1	$ 1,176,500.00	$ 1,176,500.00
ENGINEERING SUBTOTAL				**$3,529,500.00**
SUBTOTAL PROJECT COST				**$18,594,300.00**
Sponsor Admin and Other Fees				$588,300.00
TOTAL PROJECT COST				**$19,182,600.00**

Rawhide WFPO
JEO Project Number: 200881

Dodge County
January 2023

Conceptual Cost Opinion

			Alternative - L1-11 Rawhide Creek Berms	
Item	**Unit**	**Quantity**	**Unit Price**	**Total**
Mobilization	LS	1	303,000.00	303,000.00
Bonding and Insurance	LS	1	101,000.00	101,000.00
Clearing and Grubbing	LS	1	165,000.00	165,000.00
Temporary Traffic Control Measures	LS	1	0.00	0.00
Excavation, Established Quantity	CY	4,600	10.00	46,000.00
Earthwork Measured in Embankment (Established Quantity)	CY	20,500	20.00	410,000.00
Bridge Removal and Replacement	SF	4,500	500.00	2,250,000.00
36" RCP, Class III	LF	240	400.00	96,000.00
36" RCP Flared End Section	EA	6	2,500.00	15,000.00
Concrete Headwall	EA	6	7,500.00	45,000.00
Automatic Flap Gate	EA	6	10,000.00	60,000.00
Double 4'x4' Box Culvert	LF	100	3,000.00	300,000.00
Crushed Rock Base Course	TONS	2,560	75.00	192,000.00
Gravel Surface Course	TONS	1,280	90.00	115,200.00
Rock Riprap	TONS	125	100.00	12,500.00
Remove Pavement	SY	0	25.00	0.00
7" Concrete Pavement	SY	0	100.00	0.00
Silt Fence, Low Porosity	LF	40,000	4.00	160,000.00
Seeding, Fertilizer and Mulch	ACRE	33	10,000.00	330,000.00
CONSTRUCTION SUBTOTAL				***$4,600,700.00***
CONSTRUCTION with 20% CONT				**$5,520,840.00**
Mitigation Costs				
Recreation Facilities				**$0.00**
Land Acquisition				
Land	ACRE	24.0	15,000.00	360,000.00
Home Buyout	EA	0.0	100,000.00	0.00
Hold	LS	0.0	0.00	0.00
Hold	LS	0.0	0.00	0.00
		Land Acquisition Subtotal		$360,000.00
		Legal Fees, Appraisals, Etc	10%	$36,000.00
			LAND ACQUISITION TOTAL	**$396,000.00**
Engineering				
Design, Geotech, & Bidding	LS	1	$ 883,400.00	$ 883,400.00
Permitting	LS	1	$ 220,900.00	$ 220,900.00
Construction Engineering & Material Testing	LS	1	$ 552,100.00	$ 552,100.00
ENGINEERING SUBTOTAL				**$1,656,400.00**
SUBTOTAL PROJECT COST				**$7,573,240.00**
Sponsor Admin and Other Fees				$276,100.00
TOTAL PROJECT COST				**$7,849,340.00**

Rawhide WFPO
JEO Project Number: 200881

Dodge County
January 2023

Conceptual Cost Opinion

			Alternative - L1-1 Cutoff Rd + Brush Berm	
Item	**Unit**	**Quantity**	**Unit Price**	**Total**
Mobilization	LS	1	$ 64,000.00	$ 64,000.00
Bonding and Insurance	LS	1	$ 22,000.00	$ 22,000.00
Clearing and Grubbing	LS	1	$ 30,000.00	$ 30,000.00
Temporary Traffic Control Measures	LS	1	$ 30,000.00	$ 30,000.00
Excavation, Established Quantity	CY	0	$ 10.00	$ -
Earthwork Measured in Embankment (Established Quantity)	CY	7,950	$ 20.00	$ 159,000.00
Bridge Removal and Replacement	SF	0	$ 500.00	$ -
48" RCP Class III	LF	160	$ 500.00	$ 80,000.00
48" RCP Flared End Section	EA	4	$ 3,000.00	$ 12,000.00
Concrete Headwall	EA	4	$ 7,500.00	$ 30,000.00
Automatic Flap Gate	EA	4	$ 10,000.00	$ 40,000.00
Crushed Rock Base Course	TONS	3,000	$ 75.00	$ 225,000.00
Gravel Surface Course	TONS	1,500	$ 90.00	$ 135,000.00
Rock Riprap	TONS	192	$ 110.00	$ 21,120.00
Remove Pavement	SY	0	$ 25.00	$ -
7" Concrete Pavement	SY	0	$ 100.00	$ -
Silt Fence, Low Porosity	LF	14,000	$ 4.00	$ 56,000.00
Seeding, Fertilizer and Mulch	ACRE	6	$ 10,000.00	$ 60,000.00
CONSTRUCTION SUBTOTAL				***$964,120.00***
CONSTRUCTION with 20% CONT				**$1,156,950.00**
Mitigation Costs				
Recreation Facilities				$0.00
Land Acquisition				
Land	ACRE	2	$ 15,000.00	$ 30,000.00
Home Buyout	EA	0	$ 100,000.00	$ -
Hold	LS	0	$ -	$ -
Hold	LS	0	$ -	$ -
		Land Acquisition Subtotal		$30,000.00
		Legal Fees, Appraisals, Etc	30%	$9,000.00
			LAND ACQUISITION TOTAL	**$39,000.00**
Engineering				
Design, Geotech, & Bidding	LS	1	$ 185,200.00	$ 185,200.00
Permitting	LS	1	$ 46,300.00	$ 46,300.00
Construction Engineering & Material Testing	LS	1	$ 115,700.00	$ 115,700.00
ENGINEERING SUBTOTAL				**$347,200.00**
SUBTOTAL PROJECT COST				**$1,543,150.00**
Sponsor Admin and Other Fees				$57,900.00
TOTAL PROJECT COST				**$1,601,050.00**

Rawhide WFPO
JEO Project Number: 200881

Dodge County

January 2023

Conceptual Cost Opinion

Item	Unit	Quantity	Alternative - C1-2 County Road S Ditch	
			Unit Price	Total
Mobilization	LS	1	$ 238,000.00	$ 238,000.00
Bonding and Insurance	LS	1	$ 80,000.00	$ 80,000.00
Clearing and Grubbing	LS	1	$ 60,000.00	$ 60,000.00
Temporary Traffic Control Measures	LS	1	$ 30,000.00	$ 30,000.00
Excavation, Established Quantity	CY	15,000	$ 10.00	$ 150,000.00
Earthwork Measured in Embankment (Established Quantity)	CY	0	$ 20.00	$ -
Bridge Removal and Replacement	SF	4,500	$ 500.00	$ 2,250,000.00
48" RCP Class III	LF	0	$ 500.00	$ -
48" RCP Flared End Section	EA	0	$ 3,000.00	$ -
Concrete Headwall	EA	0	$ 7,500.00	$ -
Automatic Flap Gate	EA	0	$ 10,000.00	$ -
Double 8'x4' Box Culvert	LF	128	$ 3,000.00	$ 384,000.00
Crushed Rock Base Course	TONS	200	$ 75.00	$ 15,000.00
Gravel Surface Course	TONS	100	$ 90.00	$ 9,000.00
Rock Riprap	TONS	325	$ 110.00	$ 35,750.00
Remove Pavement	SY	0	$ 25.00	$ -
7" Concrete Pavement	SY	0	$ 100.00	$ -
Silt Fence, Low Porosity	LF	42,000	$ 4.00	$ 168,000.00
Seeding, Fertilizer and Mulch	ACRE	12	$ 10,000.00	$ 120,000.00
CONSTRUCTION SUBTOTAL				***$3,539,750.00***
CONSTRUCTION with 20% CONT				**$4,247,700.00**
Mitigation Costs				
Recreation Facilities				$0.00
Land Acquisition				
Land	ACRE	8	15,000.00	120,000.00
Home Buyout	EA	0	100,000.00	0.00
Hold	LS	0	0.00	0.00
Hold	LS	0	0.00	0.00
		Land Acquisition Subtotal		$120,000.00
		Legal Fees, Appraisals, Etc	30%	$36,000.00
			LAND ACQUISITION TOTAL	**$156,000.00**
Engineering				
Design, Geotech, & Bidding	LS	1	$ 679,700.00	$ 679,700.00
Permitting	LS	1	$ 170,000.00	$ 170,000.00
Construction Engineering & Material Testing	LS	1	$ 424,800.00	$ 424,800.00
ENGINEERING SUBTOTAL				**$1,274,500.00**
SUBTOTAL PROJECT COST				**$5,678,200.00**
Sponsor Admin and Other Fees				$212,400.00
TOTAL PROJECT COST				**$5,890,600.00**

Drainage Improvement Project - Phase 1 Payments

Date	Amount Paid	Grant	Leshara	NRD
Nov-22	10,547.85	8,765.51	891.17	891.17
Dec-22	5,067.85	4,211.51	428.17	428.17
Jan-23	0.00			
Feb-23	0.00			
Mar-23	0.00			
Apr-23	0.00			
May-23	0.00			
Jun-23	0.00			
Jul-23	0.00			
Aug-23	0.00			
Sep-23	0.00			
Total	15,615.70	12,977.02	1,319.34	1,319.34

1/11/2023

Village of Leshara, NE
Attn: Paula Wagner
210 Summit Street
Leshara, NE 68064

RE: Village of Leshara #21-PW-013 Drawdown #2

Dear Mrs. Wagner:

Enclosed is Drawdown #2 for your Public Works, street and drainage improvement project. After you have reviewed the material, please have Board Chairperson, Melvina Ruhe-Langfeldt and yourself sign the Drawdown (DD) as noted and mail the original DD form back to SENDD for processing. Please sign all documents in **"BLUE INK"** and place in File IV.

After the drawdown documents are submitted, the Village can expect an automatic transfer from the Nebraska Department of Economic Development (NDED) within 10-30 business days that will be deposited into the designated Community Development Block Grant (CDBG) account. Once received, please write the following check(s):

	TOTAL	CDBG	Match
Drawdown #2: The following #03K Street Improvements bills have not yet been paid.			
SENDD Invoice(s): Activity Code #21A General Administration	$0.00	$0.00	$0.00
Street Improvements: Activity Code #03K Street Improvements	$5,067.85	$4,211.51	$856.34
SENDD Invoice(s): Activity Code #03K Construction Management	$0.00	$0.00	$0.00
Totals:	**$5,067.85**	**$4,211.51**	**$856.34**

According to the above figures, the Village should make the following payments:

Activity Code: #03K
Amount: $5,067.85
To: Southeast Nebraska Development District
Address: 7407 O St, Lincoln, NE 68510

NOTES:

1. Upon completed processing at NDED/State, the CDBG funds will be electronically deposited in the identified City's account**. Please disburse NDED funds within five days**; otherwise, it may result in a finding during monitoring.
2. If you make a payment with local funds before the CDBG funds are electronically deposited in your City account, that will be "reimbursement" and those funds are no longer considered "federal" and may be transferred to local accounts as you wish.
3. Please remember to keep copies of the checks made as payment for CDBG activities and keep copies of the bank statements showing deposits of CDBG funds and clearance of checks distributed.

Please feel free to give me a call at (402) 475-2560 if you have any questions.

Sincerely,

Ceylon J. Herath

Ceylon J. Herath
Community Development Specialist

Request for Funds (Drawdown/Payment Request)
Community Development Block Grant Program
Nebraska Department of Economic Development

Name of Subrecipient (Local Unit of Government)			Mailing Address		City		State	ZIP
Village of Leshara			210 Summit Street		Leshara		NE	68064
CDBG Agreement Number	Federal Identification Number	DUNS Number	UEI Number	SAM Expiration Date	Number sequence order of funds	Final Drawdown	DED Program Representative	
#21-PW-013	470663927	118125358	ZAF7F9TRL5K2	10/07/2023	2		Aaron Boucher	

Part I – STATUS OF FUNDS

1. CDBG Funds Received to Date	$8,765.52
2. Add: Program Income Received to Date (exclude RLF)	$0.00
3. Subtotal	$8,765.52
4. Less: Federal Funds Disbursed To Date (Must Agree To Total Of Part II, Line 3)	$8,765.52
5. Total: Federal Funds On Hand (Must Agree To Part II, Line 6)	

Part II – CASH REQUIREMENTS (Identify all activities listed in the CDBG Agreement, even if funds are not being requested.)

Activity/Budget Category	21A GA	03K CM	03K SI				TOTAL
1. Total Cash Requirements To Date	$0.00	$0.00	$15,615.70				$15,615.70
2. Less: Local Funds Disbursed (includes RLF) (exclude Program Income)	$0.00	$0.00	$2,638.68				$2,638.68
3. Less: Federal Funds Disbursed (include Program Income) Total Must Agree To Part I, Line 4 (exclude RLF)			$8,765.52				$8,765.52
4. Total Current Cash Requirements			$4,211.50				$4,211.50
5. Less: Unpaid Previous Request.							
6. Less: Federal Funds On Hand (Must Agree To Part I, Line 5)							
7. Net Amount of Federal Funds Requested							$4,211.50

By signing this report, I certify to the best of my knowledge and belief that the report is true, complete, and accurate, and the expenditures, disbursements and cash receipts are for the purposes and objectives set forth in the terms and conditions of the Federal award, I am aware that any false, fictitious, or fraudulent information, or the omission of any material fact, may subject me to criminal, civil or administrative penalties for fraud, false statements, false claims or otherwise. (U.S. Code Title 18, Section 1001 and Title 31, Sections 3729-3730 and 3801-3812). I also certify that the amount of the request for federal funds is not in excess of current needs.

Signature of Authorized Official (Mayor/Board Chairman)	Typed Name of Authorized Official		Date
	Melvina Ruhe-Langfeldt, Board Chairperson		
Signature of Authorized Official (Clerk/Treasurer)	Typed Name of Authorized Official		Date
	Paula Wagner, Village Clerk		
Person Preparing Request for CDBG Funds Form Name:	Organization:	Telephone Number:	Email:
Ceylon Herath	SENDD	402-475-2560	cherath@sendd.org

PLEASE REFER TO INSTRUCTIONS FOR ADDITIONAL GUIDANCE. INCOMPLETE OR INCORRECT FORMS WILL NOT BE PROCESSED
***To update calculations, either tab two (2) fields or click on a different field with your mouse.*

Village of Leshara Street and Drainage Improvements (#21-PW-013) Contract Obligation Spreadsheet

Recipient Village of Leshara	Elected Official	Melvina Ruhe-Langfel	Clerk/City Admin. Paula Wagner	SENDD Admin	Ceylon J. Herath	Approval
CDBG Grant # 21-PW-013	DED Program Rep.	Aaron Boucher	Clerk/Admin Email thevillageofleshara@gmail.com	SENDD Admin Email	cherath@sendd.org	

Mailing Address	210 Summit Street
Fed. ID #	470663927
DUNS	118125358
UEI	ZAF7F9TRL5K2
Release of Funds	6/18/2022
Program Income	No
Sam.gov Expiry	10/7/2023
Amendment #	
Contract End Date	4/17/2024
USDA/Other Reporting	No

SOURCES	21A General Admin.	03K Construction Management	03K Streets/Bridges		TOTAL
CDBG	$ 25,000.00	$ 10,000.00	$ 300,000.00		$ 335,000.00
OTHER City Match	$ -		$ 61,000.00		$ 61,000.00
TOTAL	$ 25,000.00	$ 10,000.00	$ 361,000.00		$ 396,000.00
% CDBG	100.00%	100.0000%	83.10%		
% Other Business			16.90%		
1.Total Cash Requirements to Date	$ -	$ -	$ 15,615.70	$ 15,615.70	Current Fund Request 2
2.Local Funds Disbursed	$ -	$ -	$ 2,638.68	$ 2,638.68	7. Net Fund Request $ 4,211.51
3.Federal Funds Disbursed		$ -	$ 8,765.52	$ 8,765.52	Fed Funds Disbursed $ 8,765.52
4.Total Cash Required to Date	$ -	$ -	$ 4,211.51	$ 4,211.51	Local Funds Disbursed $ 2,638.68
5. Total Funds Remaining	$ 25,000.00	$ 10,000.00	$ 345,384.29	$ 380,384.29	Funds Remaining $ 380,384.29

Previous Fund Requests	Submit Date	Net Amount of Fed. Fund Request	21A General Admin. CDBG	03K Const. Mgmnt CDBG	03K Streets/Bridges INVOICE TOTAL	03K Streets/Bridges CDBG	03K Streets/Bridges LOCAL	Disbursement Date
1	12/7/2022	$ 10,547.85	$ -	$ -	$ 10,547.85	$ 8,765.52	$ 1,782.34	
2	1/11/2023	$ 4,211.51	$ -	$ -	$ 5,067.85	$ 4,211.51	$ 856.34	
			$ -	$ -				

Fund Request Details

Drawdown 2

Contractor	Description	Invoice Date	Invoice #	CDBG 21A Gen. Admin	CDBG 03K Const Mgmt.	Invoice Total	CDBG 03K	Match 03K	Check #
JEO Consulting Group		12/16/2022	137909			$ 5,067.85	$ 4,211.51	$ 856.34	

Engineering | Architecture | Surveying | Planning

JEO CONSULTING GROUP

Invoice

December 16, 2022
Project No: R210551.00
Invoice No: 137909
Invoice Amount: 5,067.85

Village of Leshara
210 Summit Street
Leshara, NE 68064

Project Manager Nathan Boone

Project R210551.00 Leshara CDBG Phase I Drainage Improvements

Professional Services through December 9, 2022

- Phase 2, the study phase, is ongoing and nearing completion. The project will soon move into preliminary design with an anticipated bid period late Winter 2022/2023.

	Contract Amount	Percent Complete	Billed-to-Date	Previous Billing	Current Billing
Lump Sum Phase(s)					
Funding Assistance	$2,955.00	18 %	$531.90	$502.35	$29.55
Topographic Survey	$7,400.00	28 %	$2,072.00	$2,072.00	0.00
Urban Drainage Study	$23,255.00	39 %	$9,069.45	$4,883.55	$4,185.90
Design	$10,655.00	37 %	$3,942.35	$3,089.95	$852.40
Permitting	$3,270.00	0 %	0.00	0.00	0.00
Bidding and Negotiation	$2,925.00	0 %	0.00	0.00	0.00
Construction Administration	$7,620.00	0 %	0.00	0.00	0.00
Construction Observation	$25,920.00	0 %	0.00	0.00	0.00
Total	**$84,000.00**		**$15,615.70**	**$10,547.85**	**$5,067.85**

Total Amount Due Upon Receipt : **$5,067.85**

Email Invoice to: thevillageofleshara@gmail.com

Village of Lindsay

121 Pine St. - P.O. Box 66   Lindsay, NE 68644   (402) 428-4010

Village of Lindsay
PO Box 66
121 Pine Street
Lindsay, NE 68644
402-428-4010; clerk@villageoflindsay.com

January 19, 2023

Mr. Eric Gottschalk
General Manager
Lower Platte North NRD
511 Commercial Park Road
Wahoo, NE 68066

RE: Cost-share, Financial Assistance for Pond Rehabilitation Project

Dear Mr. Gottschalk:

The Village of Lindsay would like to formally request cost-share assistance from the Lower Platte North NRD for a pond rehabilitation project that arose after the spring 2019 flooding. The flooding overtopped the banks of the pond in town depositing a considerable amount of sediment. The project consists of removal of approximately 5,700 cubic yards of sediment, installation of shoreline protection using an articulated concrete block matting system, installation of a crushed rock trail and access points, and installation of an ADA accessible parking pad. The Village submitted a successful NET grant application that will be awarded during the funding cycle beginning in 2023, they are to receive 60% of the total project costs from NET. The NRD provided a letter of support that was included with the NET grant application.

The Village would also like to formally request the NRD provide cost-share assistance for the pond rehabilitation project described above, up to $50,000. The cost share could be provided over the course of multiple years, starting in 2023.

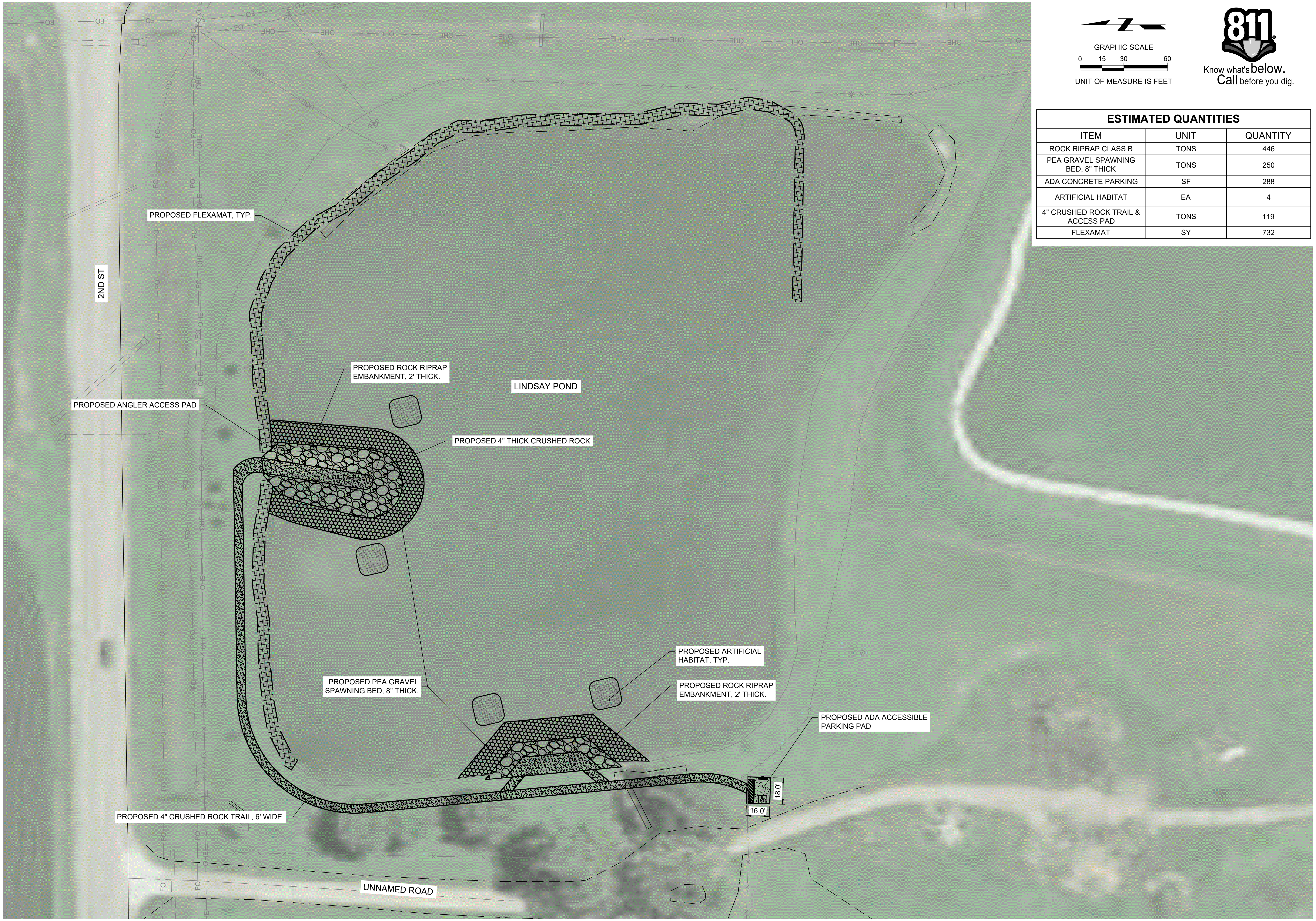
We appreciate the NRD's support and assistance with this important project. Feel free to call me at (402) 428-4010 or email me at clerk@villageoflindsay.com if you have any questions. We look forward to hearing your feedback to this request for assistance.

Sincerely,

Fred Hoefer

Fred Hoefer
Board Chairman

Enclosure: Conceptual Design Plan, Conceptual Cost Estimate



GRAPHIC SCALE

0 15 30 60

UNIT OF MEASURE IS FEET

811 Know what's below. Call before you dig.

JEO CONSULTING GROUP 1-800-723-8567

ESTIMATED QUANTITIES

ITEM	UNIT	QUANTITY
ROCK RIPRAP CLASS B	TONS	446
PEA GRAVEL SPAWNING BED, 8" THICK	TONS	250
ADA CONCRETE PARKING	SF	288
ARTIFICIAL HABITAT	EA	4
4" CRUSHED ROCK TRAIL & ACCESS PAD	TONS	119
FLEXAMAT	SY	732

LINDSAY POND RESTORATION
VILLAGE OF LINDSAY, NEBRASKA

PROPOSED SITE PLAN

PRELIMINARY

NOT FOR CONSTRUCTION

0%

DATE: 8/4/2022

PROJECT NO.	PROJECT NO.
DATE	8/4/2022
DRAWN BY	DRAWN BY
FILE NAME	S-191217.00.dwg
FIELD BOOK	FIELD BOOK
FIELD CREW	FIELD CREW
SURVEY FILE NO.	SURVEY FILE #
PLAN IN HAND INITIALS DATE	PIH INI PIH DATE
70 PERCENT REVIEW INITIALS DATE	70% INI 70% DATE
95 PERCENT REVIEW INITIALS DATE	95% INI 95% DATE
REVISIONS	

C2.1

EARTHWORK QUANTITIES

	CUT (CU. YD)	FILL (CU. YD.)
POND	7,474 CY	1,828 CY
CONCRETE TRAIL (SLAB ON GRADE)	-	37

GRAPHIC SCALE
0 15 30 60
UNIT OF MEASURE IS FEET

811
Know what's below.
Call before you dig.

JEO CONSULTING GROUP
1-800-723-8567

LINDSAY POND RESTORATION
VILLAGE OF LINDSAY, NEBRASKA

PROPOSED GRADING PLAN

PRELIMINARY
NOT FOR CONSTRUCTION
0%
DATE:
8/4/2022

PROJECT NO. PROJECT NO.
DATE 8/4/2022
DRAWN BY DRAWN BY
FILE NAME S-191217.00.dwg
FIELD BOOK FIELD BOOK
FIELD CREW FIELD CREW
SURVEY FILE NO. SURVEY FILE #
PLAN IN HAND
INITIALS PIH INI
DATE PIH DATE
70 PERCENT REVIEW
INITIALS 70% INI
DATE 70% DATE
95 PERCENT REVIEW
INITIALS 95% INI
DATE 95% DATE
REVISIONS

C2.2

ENGINEER'S BUDGETARY OPINION OF PROBABLE COST					
Pond Restoration					
Lindsay, NE			*Date Prepared:*		
JEO Project No. 191217.00			*August 5, 2022*		

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
BASE BID - MINIMALIST OPTION					
1.	Mobilization	LS	1	$20,000.00	$20,000
2.	Bonding and Insurance	LS	1	$7,000.00	$7,000
3.	Excavation, Spoiled Off-Site (Established Quantity)	CY	5,646	$15.00	$84,690
4.	Earthwork Measured in Embankment, On-Site Borrow (Established Quantity)	CY	1,828	$10.00	$18,280
5.	Earthwork Measured in Embankment, Off-Site Borrow (Established Quantity)	CY	1,050	$20.00	$21,000
6.	Dewatering	LS	1	$25,000.00	$25,000
7.	ADA Compliant Concrete Parking Pad	SF	288	$12.00	$3,456
8.	Rock Riprap Type B	TON	446	$100.00	$44,600
9.	Flexamat	SY	732	$50.00	$36,600
10.	Crushed Rock Surface Course	TONS	119	$60.00	$7,140
11.	Pea Gravel Spawning Bed, 8" Thick	TON	250	$60.00	$15,000
12.	Artificial Habitat	EA	4	$750.00	$3,000
13.	Seeding, Fertilizer and Mulch	ACRE	0.8	$7,500.00	$6,000
			Construction Subtotal	Base Bid	$291,770
			Contingency	20%	$58,360
				Total Opinion of Construction Cost	**$350,130**
PROFESSIONAL SERVICES					
1.	Design Services (Engineering, Survey, Architecture)				$50,600
				Subtotal Professional Services	$50,600
				Total Opinion of Project Cost	**$400,730**