CITY OF LINCOLN NEBRASKA

LINCOLN PARKS & RECREATION DEPARTMENT
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MEMORANDUM

DATE: June 26, 2023

TO: City of Lincoln Parks and Recreation Department, Lower Platte South Natural Resources District Board of Directors, Nebraska Game and Parks Commission, and Nebraska Chapter Pheasants Forever, Inc.

FROM: Tom Malmstrom
Natural Resources Coordinator/Park Planner II - Parks and Recreation Department
Saline Wetlands Conservation Partnership

RE: Saline Wetlands Conservation Partnership – 2021-2022 Progress Report

On behalf of the Saline Wetlands Conservation Partnership (SWCP) I want to make you aware of the activities, which occurred in 2021 and 2022. The SWCP was initiated in 2003 and continues efforts to conserve Nebraska's eastern saline wetlands. Efforts of the SWCP are to protect, restore, and manage the rare and unique saline wetland habitat. *Nebraska's Eastern Saline Wetlands Conservation Plan* (2018) provides conservation guidance for continued efforts to conserve saline wetlands. This plan along with other resources and partnership efforts are available on the city web site here: https://www.lincoln.ne.gov/City/Departments/Parks-and-Recreation/Parks-Facilities/Saline-Wetlands

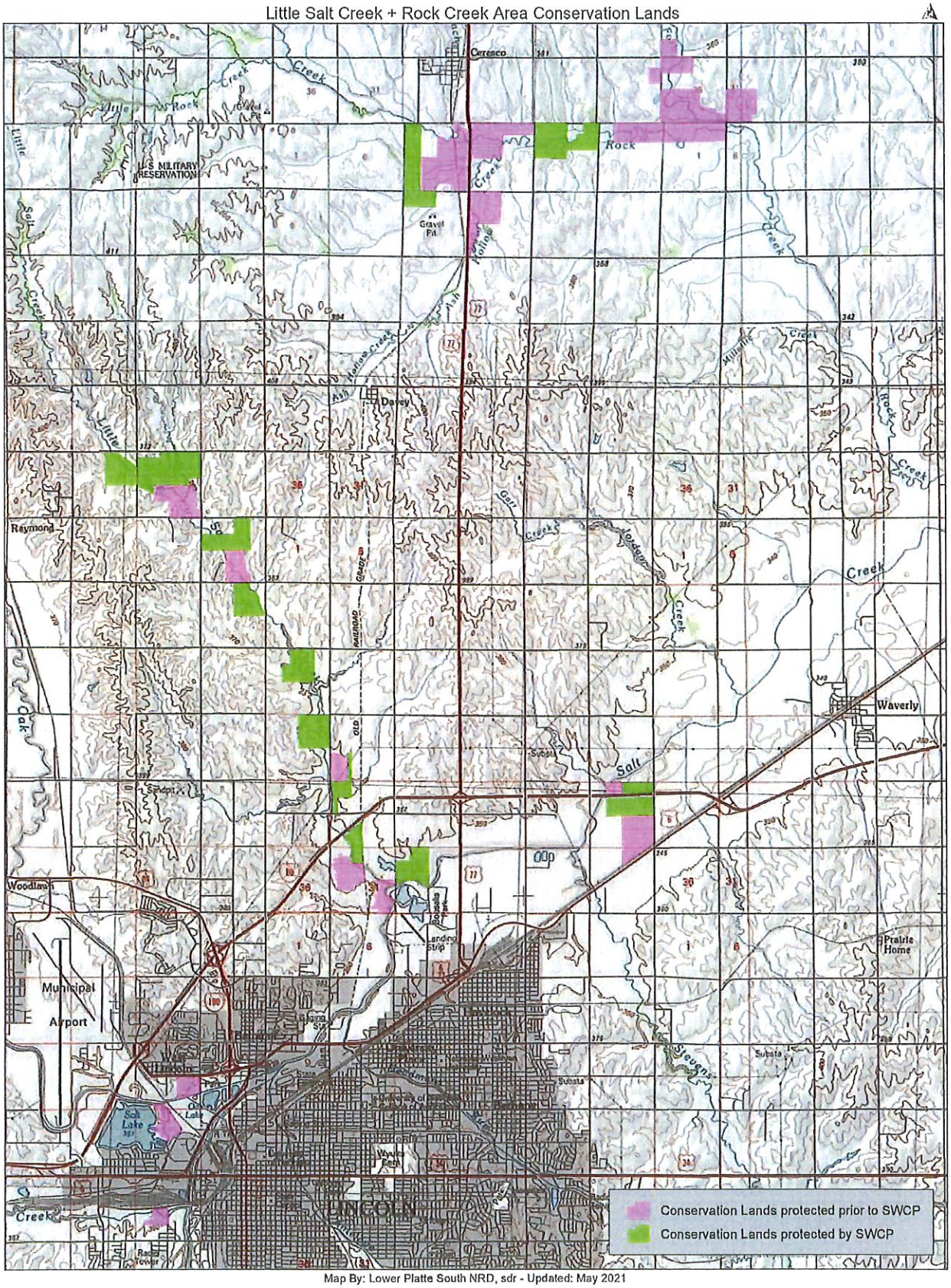
Since its inception, approximately 1,996 acres of habitat containing saline wetlands, freshwater wetlands, native prairie, and other associated upland habitat have been conserved through fee-title acquisition from willing sellers. Activities continue with education, saline wetland restoration and conservation projects, and the operation and maintenance of conservation areas.

Illustration 1 identifies saline wetland properties, which have been acquired through fee-title acquisitions from willing sellers since the 1980's.

Lincoln Parks & Recreation

Illustration 1

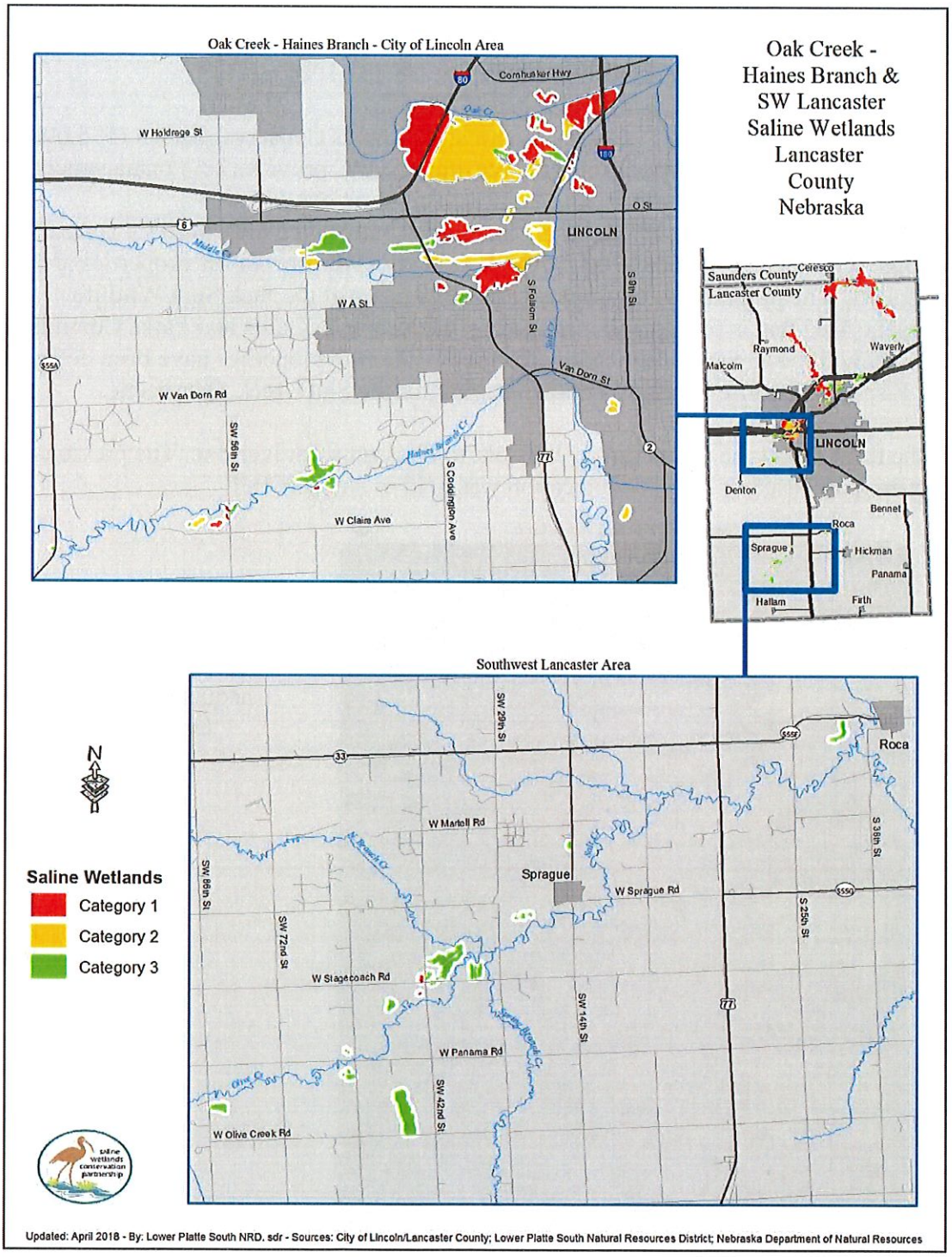
Little Salt Creek + Rock Creek Area Conservation Lands



Map By: Lower Platte South NRD, sdr - Updated: May 2021

Illustration 2 identifies saline wetland locations located in southwestern Lancaster County. Saline wetland locations in the Oak Creek- Haines Branch inset include Pioneers Park and the Capital Beach/Airport areas. A few saline wetland conservation easements are located in the Southwest Lancaster inset near Roca and along West Olive Creek Road and Southwest 42nd Street.

Illustration 2



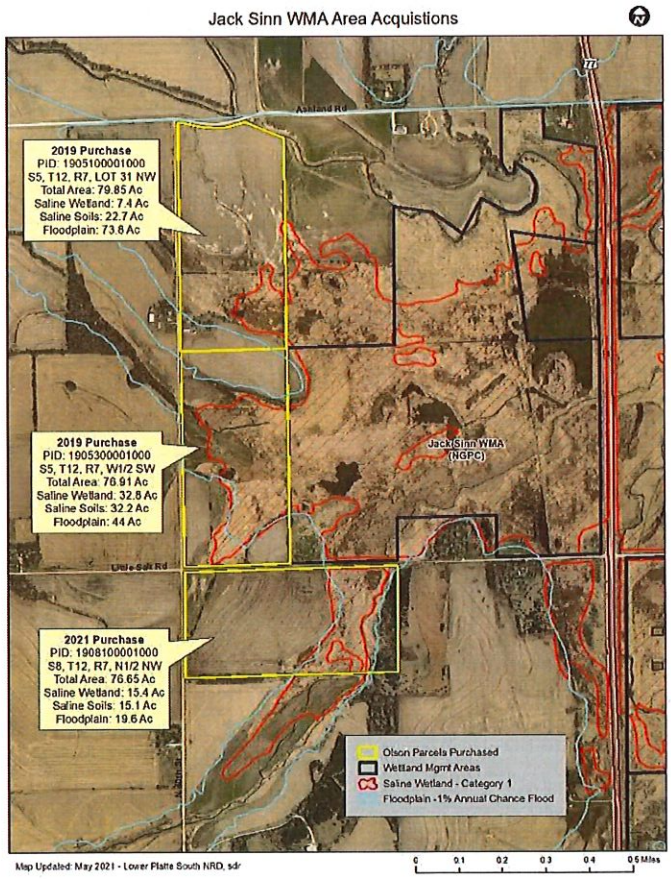
FEE TITLE ACQUISITIONS

Saline Meadows (Olson addition) – April 2021
East of 40th Street and south of Little Salt Road

Size:	76.65 acres
Purchase price and date:	$369,600 on April 12, 2021
Funding sources:	Pheasants Forever, Inc. ($ 152,100)
	Ducks Unlimited ($122,500)
	PF – North American Wetlands Conservation Act ($95,000)
Owner:	Pheasants Forever, Inc. (NGPC provides land management)

Notes – The property contains 15.4 acres of Category 1 saline wetlands and 15.1 acres of saline hydric soils. (Gilbert and Stutheit 1994). Approximately 19.6 acres of the properties are within the floodplain. The property is contiguous with 1,620 acres of the Jack Sinn Wildlife Management Area that is owned and managed by the Nebraska Game and Parks Commission. Approximately three acres saline meadow/flat area within the properties have been designated by the U.S. Fish and Wildlife Service as critical habitat for the Salt Creek tiger beetle.

This is the third parcel the Olson family has sold to Pheasants Forever, Inc. The previous two parcels were purchased in 2019. A dedication was held in August 2021.



Olson saline wetland acquisitions adjacent to Jack Sinn WMA

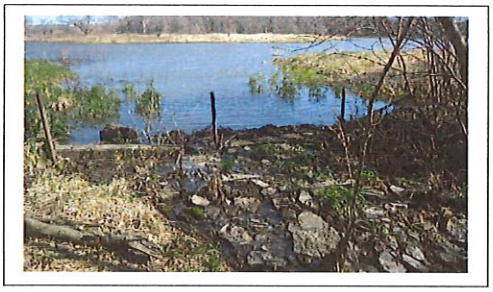
SALINE WETLAND RESTORATION

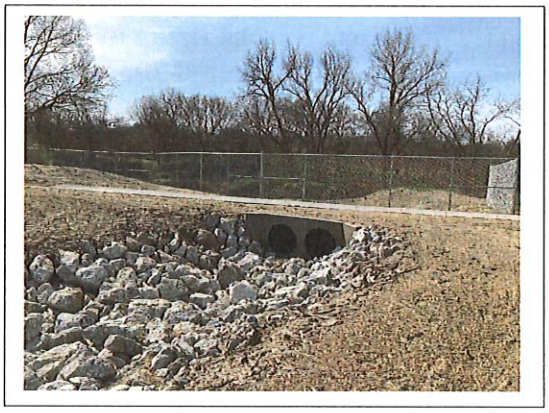
Haines Branch Tributary Stabilization Project

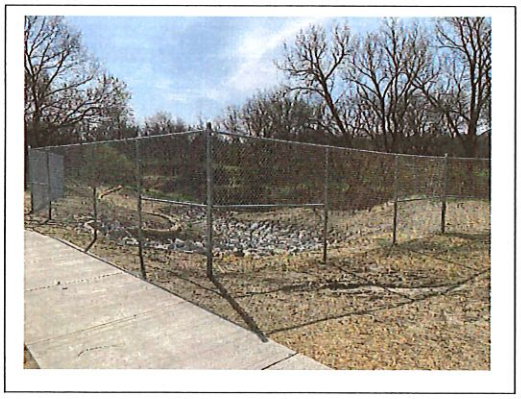
The City of Lincoln, on behalf of the Saline Wetlands Conservation Partnership (SWCP) completed an Engineering Design Plan along the Haines Branch located in the southwestern portion of Pioneers Park in 2020. The "Haines Branch Tributary Stabilization Project" was identified in the Haines Branch Watershed Master Plan (Capital Improvement Project HB-5).

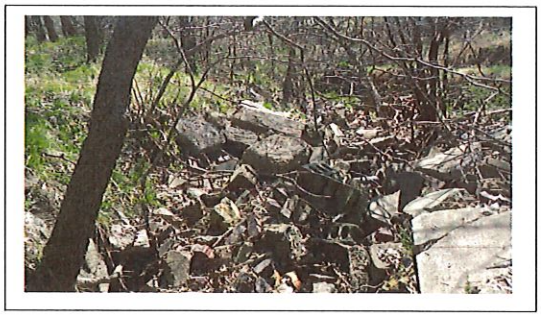
The project repaired a large head-cut which has formed over the years draining wetlands and pond depressions in Pioneers Park Nature Center to the Haines Branch. In addition, tree removal was completed, and two grade controls were constructed between the Bison pasture of the Nature Center and the Haines Branch. Head-cut repair included a new armored lined channel, pipe culverts and public access improvement above the new channel.

The construction project was bid in May of 2021 and a contractor was selected based upon a contract amount of $223,558 (adjusted amount $214,898). Construction began in August of 2021 and was completed in December 2021.









This project improves the hydrology for both freshwater and saline wetlands. Critical habitat is located along Haines Branch for the Federal and State listed endangered species, the Salt Creek tiger beetle.

Haines Branch Bank Stabilization Project Funding		
SOURCE	ENGINEERING	CONSTRUCTION
2016 NET (saline wetlands)	$46,000.00	
SWCP	$16,500.00	$75,000.00
LPSNRD		$44,949.27
City Watershed		$44,949.27
2019 NET (Prairie Corridor)		$50,000.00
TOTAL	$62,500.00	$214,898.54

Marsh Wren Berm Repair

Muskrat damage in the central berm on west side of main pond reached a point where repair was required in 2021 by a contractor to prevent failure of berm. The repair included placement of stainless steel mesh and 3" rock riprap to be placed in same permitted footprint as original project. Monitoring of repair in fall 2021 indicates success.

SALINE WETLAND RESEARCH

The SWCP has worked with partners on a variety of projects within the saline wetlands. Funding for projects has come from the Nebraska Environmental Trust, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and the Nebraska Game and Parks Commission.

ENDANGERED SPECIES

Efforts of the SWCP are to protect, restore, and manage the rare and unique saline wetland habitat and not just endangered species. The Salt Creek tiger beetle and Saltwort plants are indicator or bio species where their presence in Nebraska's eastern saline wetlands can indicate certain environmental conditions, such as soil type, pollution levels, etc. Therefore, it is imperative the SWCP helps to monitor the endangered species of these wetlands for conservation efforts, as well as monitoring other indicator species.

The Salt Creek tiger beetle (*Cicindela nevadica lincolniana* Casey) was listed as a state endangered species in 2000 and Federal endangered species on October 2005 and is endemic to the saline wetlands in Lancaster and southern Saunders counties. Saltwort (*Salicornia rubra*) is a state listed endangered species and in Nebraska only found in these saline wetlands.

The final revision to designate 1,110 acres of critical habitat for the Salt Creek tiger beetle was approved on May 5, 2014. Critical habitat is identified along four streams that contain sufficient potential habitat to support viable populations of Salt Creek tiger beetle: Little Salt Creek, Rock Creek, Oak Creek, and Haines Branch Creek. It is estimated the critical habitat can support at least six viable populations of Salt Creek tiger beetles and will ensure recovery of the species.

The critical habitat units include land under private ownership, lands owned by the Nebraska Game and Parks Commission, the City of Lincoln, the Lower Platte South Natural Resources District, and Pheasants Forever. Approximately 30 percent of the critical habitat is protected from future disturbance by conservation easements or fee title land acquisitions.

Salt Creek Tiger Beetle Research

The following research information provided by:

Shaun Dunn
Natural Heritage Zoologist
Nebraska Game and Parks Commission

2021-2022 SCTB Highlights

- Productive years for the recovery program of the Salt Creek tiger beetle
- Annual meetings in spring of each year to discuss plans for the coming year
- Continue to use and explore future needs for Section 6 grant funding
- Released 200 larvae and around 20 adults at NRD site in 2021 and 166 larvae at same location in 2022
- Since Covid, lab-reared numbers have been low but will see great improvement in this as we proceed post-covid
- In 2021-2022 there were large rainfall events followed by long periods of dry conditions which may have hampered wild populations.
- Continuing to work with many partners to keep this program moving forward:
    - Henry Doorly Zoo
    - Lincoln Children's Zoo
    - Topeka Zoo
    - University of Nebraska – Lincoln
    - City of Lincoln
    - Lower Platte South Natural Resources District
    - Nebraska Game and Parks Commission
    - U.S. Fish and Wildlife Service
    - Saline Wetlands Conservation Partnership
    - Landowners

Recent annual counts:
2019: 250
2020: 345
2021: 276
2022: 275

Nebraska Eastern Saline Wetlands Monitoring and Evaluating Salinity Status, Hydrological Interaction, and Vegetative Community

Research conducted by: Zhenghong Tang, Ph.D, University of Nebraska – Lincoln

The overall goal of this research project is to deploy a wireless based real-time sensor network to monitor and evaluate salinity status, hydrogeological interaction, and vegetation of Nebraska's eastern saline wetlands

The wireless sensors were successfully installed in six selected sites in the Little Salt Creek Watershed within Lancaster County, Nebraska during April 12-15, 2021. Each site has one HYDRO 21 sensor to measure the water depth, temperature, and electrical conductivity; and one HYDRO 21 sensor to measure the volumetric water content, temperature and bulk electrical conductivity (ECb).

Project Deliverables:

Task 1: Deploy wireless-based real-time sensor networks to monitor the salinity status

- A wireless-based monitoring system deployed in conserved saline wetlands

Task 2: Analyze wetland salinity dynamics and hydrological interaction

- A technical report to evaluate the status of saline wetland ecosystems, salinity status, hydrological dynamics, vegetation conditions

Task 3: Evaluate wetland community conditions and existing conservation practices for best management practices

- A geodatabase to document the conditions of salinity status

Project Cost: $150,000 from EPA

Period: 3-year period (by 09-30-2023)

Project team at Arbor Lake Complex project sensor installation in April 2021

See Appendix for January 2023 research project summary presented to the Partnership.

SALINE WETLAND LAND MANAGEMENT

Land management of the saline wetland areas include many ongoing tasks completed by land managers. These include noxious weed and tree removal, fencing construction and repair, prescribed burning when allowed, monitoring of water control structures, parking lot and grounds maintenance, public access development and maintenance, and helping site visitors.

Little Salt Creek saline wetland management areas

Contributors: Drew Ratkovic and Trent Henry of LPSNRD, Kirk Hansen of NGPC, and SWCP

Marsh Wren – Salt Creek tiger beetle releases were conducted on the site in both 2021 and 2022. A driveway leading to the parking lot was reconstructed in 2021and an underground leak in the west distribution system was fixed in 2021. Muskrats damaged the berm between the two wetland cells, and it was repaired.

Little Salt Creek saline wetland management areas	Hay	Graze
2021	109 acres	497 acres
2022	136 acres	497 acres

Source: SWCP, 2023

Rock Creek saline wetland management areas

Contributors: Travis Kopf of NGPC, Kelsi Wehrman of Pheasants Forever, and SWCP

Saline Meadows – Approximately 40 acres of cropland was reseeded back to native grasses and wildflowers to provide wildlife habitat in May 2022. Tree removal included 20 acres of scattered eastern red cedar, mulberry, cottonwoods, and other undesirable trees. All structures have been removed and concrete bases are in the process of being removed to restore the area. Three parking lots are currently being built.

Jack Sinn WMA	Hay	Graze	Tree/brush control
2021	41 acres	346 acres	25 acres
2022	79 acres	150 acres	40 acres
Saline Meadows	**Hay**	**Graze**	**Tree/brush control**
2021	17 acres	0 acres	10 acres
2022	17 acres	0 acres	20 acres

Source: Travis Kopf, NGPC, 2023

Four seasonal employees in 2021 and six in 2022 were hired by the Lower Platte South NRD to provide land management on the saline wetland areas. Members of the SWCP establish management activities to be addressed within the saline wetlands complex. These employees primarily worked on noxious weed and woody vegetation removal, structure maintenance, and access. Approximately 1,720 hours were worked by the seasonal employees in 2021 and 1,492 hours in 2022 on saline wetland management activities. Funding for these positions is provided by the LPSNRD. The LPSNRD provided nearly $48,260 to fund the salaries of the seasonal employees in 2021 and 2022. The Coordinator and LPSNRD provide supervision of employees.

2022 Prescribed Burn
Little Salt Fork Marsh Preserve

Pre-burn

Burn

Post-burn

The LPSNRD has one full-time Maintenance Technician who assists the seasonal employees with work performed on the saline wetlands. The coordinator also holds an annual meeting of the land managers of the saline wetland management areas to share and discuss issues and methods of land management in these areas.

SALINE WETLAND OUTREACH AND EDUCATION

- Saline Wetlands Digital Imaging Collection – This collection documents the history of the saline wetlands in Eastern Nebraska, including channel improvements of Salt Creek and Dead Man's Run, flooding and high water on Salt Creek in the 1950s and 1960s, the early days of the Salt Valley Watershed District and the Salt-Wahoo Watershed Association, current efforts to conserve and restore saline wetland areas, and historical collections from NEBRASKAland magazine and Nebraska Game and Parks Commission. The original dates covered were from 1940 through 2018, with most materials from the 1980s-2000s. Periodically new material is entered into the collection.

- Lower Platte South NRD – provides opportunities for local schools to visit the saline wetlands to learn about saline wetland soils, vegetation, and hydrology. Students also examine invertebrate health within the wetlands and in streams to indicate stream health. In the spring, summer and fall of 2021-2022, the NRD hosted field trips with 5th grade students and summer Day Camps at the Lincoln Saline Wetlands Nature Center. Around 75 students enjoyed netting insects at the site, learning about the vegetation and potential wildlife and netting for macroinvertebrates in the water!

  - Between 2021-2022, NRD staff conducted Nebraska wetland presentations at various elementary schools for over 300 students
  - LPSNRD highlighted saline wetlands topics three times in the district newsletter, numerous times on social media, and in newspaper advertisements
  - The LPSNRD developed an educational video on Marsh Wren Saline Wetland, focusing on the renovation of the property and the wetland habitat

- Saline Wetlands Conservation Partnership – Partnership representatives provide numerous presentations to students, conservation and service clubs, local organizations and residents, and professionals and agencies involved with projects and the conservation of Nebraska's eastern saline wetlands. Pheasants Forever along with the Partnership held a Dedication ceremony for Saline meadows in August of 2021.

- Saline Wetlands web site - The Saline Wetlands Conservation Partnership web site was developed in 2005 and is updated on an annual basis. It is accessed through the City of Lincoln/Parks and Recreation Department web page. This website provides information related to the Partnership, a description of saline wetlands and where they are located, provides information and photographs of publicly owned saline wetland areas, which are accessible for the public, and descriptions and photos of the unique flora and fauna of saline wetlands. Links are also provided to a variety of publications documenting the conservation of the saline wetlands.

- Wetlands of Nebraska Outreach and Education Project – The NGPC partnered with the Platte Basin Timelapse to develop wetland resources showcasing the importance and dynamics of Nebraska's wetlands including an in-depth look at Nebraska's regional wetland complexes. These new wetland resources include website content, documentaries of five wetland complexes including the saline wetlands, links to personal stories, photo galleries and more. The project was initiated in 2020 and completed in 2023.

SALINE WETLAND MANAGEMENT AREA PROTECTION (2001-present)

In order to preserve and restore these wetlands, an Implementation Plan for the Conservation of Nebraska's Eastern Saline Wetlands was completed in 2003. In 2018, this plan was updated with Nebraska's Eastern Saline Wetlands Conservation Plan. The Implementation Plan update addresses the preservation and restoration of Nebraska's eastern saline wetlands. The Plan Goal, Comprehensive strategies, and Landscape objectives are established for future conservation of the wetlands. A summary of wetland acres conserved through fee-title acquisition and conservation easements since 2001 through the efforts of the Partnership is provided below. This summary is based on targets identified within Landscape objectives 1–4.

Summary of wetland acres conserved through fee-title acquisition

IMPLEMENTATION OF LANDSCAPE OBJECTIVES	TOTAL ACRES PER OBJECTIVE*	ACRES OF WETLAND PROTECTED OR RESTORED 2002-2017
1 – Permanently protect 100% (148 acres) of intact Category 1 saline wetlands and their associated conservation zones to ensure that the wetlands and their functions are sustained	148	47
2 – Restore and Protect 80% (1,412 acres) of unprotected degraded Category 1 saline wetlands and their associated conservation zones to ensure that the wetlands and their functions are sustained	1,412	503
3 – Restore (to intact Category 1 wetlands) and protect 50% (167 acres) of unprotected Category 3 saline wetlands and their associated conservation zones to ensure that the wetlands and their functions are sustained as intact Category 1 wetlands	167	99
4 – Restore (to intact Category 1 wetlands) and protect 50% (2,360 acres) of unprotected current non-wetland areas on saline hydric soils so that they become intact and sustained Category 1 saline wetlands	2,360	550
TOTAL	**4,087**	**1,199**

*Acres identified in 2003 Implementation Plan

Source: Ted LaGrange and Rachel Simpson of the NGPC, June 2018 and SWCP, 2023

Well Distribution.

The following Table provides a summary of the well distribution throughout the saline wetland management areas. Information gathered from the wells assists with the understanding of saline wetland hydrogeology of Nebraska's eastern saline wetlands.

Saline Wetland Management Area	Wells # (depths)			
	15-40 feet	41-90 feet	90 feet +	Other
Frank Shoemaker Marsh	3 (20', 25', 25')	3 (72.5, 75', 87.5')		1 (unknown depth)
Dakota Springs	3 (15', 25', 30')	2 (88', 79')	1 (98')	
Little Salt Creek WMA	2 (15', 15')	3 (77.5', 78', 83.5')	1 (182')	
Little Salt Fork Marsh Preserve	4 (9', 12', 25', 33')		2 (155', 201')	
Arbor Lake Complex	3 (14', 25', 28')	1 (41')	4 (113', 100', 120', 180')	
Little Salt Springs				1 (livestock)
Marsh Wren			2 6" (E. 216' and W. 155')	
Lincoln Saline Wetland Nature Center				1 (unknown depth)
Whitehead Saline Wetland	5 (15', 22', 23', 29'(?), 40')	1 (78')	2 (113', 188')	1 (unknown depth) 1 (Dial easement 30')
Jack Sinn WMA	1 (34.5')	4 (43', 45', 45', 63')	4 (93', 143', 143', 191')	2 (unknown depth)
Warner Wetlands		1 (60')		

Covid SWCP site visit with landowner, April 2021

FUNDING RESOURCES

The following provides a summary of recent awards. It does not include all the grant awards received since the inception of the SWCP in 2002.

- Federal Section 6 Land Recovery Acquisition grants – In 2013, the NGPC through the U.S. Fish and Wildlife Service was awarded $190,300 for the acquisition of a property containing saline wetlands. The funding was used for the acquisition of Saline Meadows in 2019.

  In 2016, the NGPC through the U.S. Fish and Wildlife Service was awarded $206,536 for the acquisition of a property containing saline wetlands. The funding was used for the acquisition of Saline Meadows in 2019.

  In 2020, the NGPC through the U.S. Fish and Wildlife Service was awarded $357,806 for the acquisition of a property containing saline wetlands. The funding is pending for land acquisition of saline wetlands.

- A grant was submitted to the Nebraska Environmental Trust in 2015 for the "Eastern Saline Wetlands Project – 2016." The grant was approved in the amount of $795,000 over three years primarily for wetland restoration/engineering/management and planning activities. A one-year extension of the grant was approved through June 2020. A final report was submitted in 2020.

- NAWCA – This proposal funded the protection and restoration of two unique wetland landscapes in Nebraska – the Sandhills and Saline wetlands. The Saline Wetlands provide habitat to a large variety of wildlife, particularly shorebirds and waterfowl during migration and the endangered Salt Creek tiger beetle, which is only located in this landscape. The grant was approved in 2020 in the amount of $1,000,000 of which $475,020 is designated for the saline wetlands landscape.

- Small NAWCA – Pheasants Forever, Inc received a Small NAWCA grant in 2019. The grant was awarded for approximately $100,000. Nearly $80,000 was used for the acquisition of the south Olson tract in 2021.

- Section 319 – The City of Lincoln made a request to the NDEE for Section 319 grant funds in the amount of $80,000 pursuant to the Federal Clean Water Act and the Nebraska Nonpoint Source Management Program. The proposal was in regard to The Shoemaker Marsh project to increase the Eastern saline wetland habitat for rare, threatened and endangered species and other aquatic life, reduce erosion and sedimentation, and improve stream stability. This project will also address elements identified as priority by the Nebraska Nonpoint Source State Management Plan. The grant in the amount of $80,000 was approved in 2022.

SUMMARY OF OTHER COORDINATOR ACTIVITIES

- Attended meetings regarding City and County projects regarding construction activities scheduled near or on saline wetland areas

- Attended and participated in City of Lincoln Parks and Recreation Department meetings regarding greenways, Wilderness Park, and the Prairie Corridor

- Participated in Woods Park Place safety meeting, Microsoft teams training, NRCS ACEP workshop, and Trust for Public Lands Park quality natural resource workshops

- Toured saline wetland management areas with Platte Basin time-lapse team, NRCS PL566 team, Solidago, and Prairie Plains Resource Institute

- Worked with USFWS and NGPC on endangered species monitoring efforts, re-introduction site locations, and participated in release of endangered species

- Worked with City legal counsel in development of Waiver, Release, and Access Agreements for grazing and haying of City owned land; executed agreements with cooperators and monitor work per agreement

- Assisted UNL student on master's degree project using cameras to capture saline wetland images for future educational project using a mobile application method

- Participant of Prairie Corridor technical advisory committee, U.S. Corps of Engineers Nebraska inter-agency wetland group meetings, bi-annual Parks, City Watershed, and LPSNRD coordination meetings, SCTB re-introduction coordination meetings, PL566 planning team, and Parks Department annual 10-year planning review

- Work with landowners and representatives, fund administrators and agencies regarding the acquisition of land

- Assisted City Parks liaison on positions of certain legislative bills

- Assisted NGPC Zoologist with agreements for Spotted skunk camera trap locations

- Assisted LPSNRD General Manager with job description, review of applicants, and interviews of individuals for vacated Resource Coordinator position

- Presentations and information sharing on saline wetlands and the partnership – LPSNRD Recreation, Forestry, and Wildlife sub-committee, Nebraska Natural Legacy conference, NDEE and EPA field trip, NRCS Biologist on national conference field trip, local Cub Scout troop, UNL Career Day, and several UNL classes

- Land management – Participated in interviews of potential seasonal employees, worked with USFWS on prescribed burning of on designated critical habitat for endangered species, supervision of seasonal employees, annual saline wetland discussion with agency land managers, and noxious weed and woody vegetation control and coordination of GPS location identification at saline wetland sites, and observed vertical tillage demonstration

- Haines Branch Stabilization Project – Completed construction administration agreement, assisted consultant with bid packet, attended and assisted pre-bid and pre-construction meetings, met with consultant and selected contractor, monitor and document construction project, review and submit invoices, assist and participate in substantial completion walk-through, post -construction site visit (one year) and discussion with consultant and contractor

- Greenways Building – Met with engineering consultant on building scenarios, attended and assisted with pre-bid meeting, coordinated project; designed pole shed and ordered structure, selected unit price contractor, scheduled and monitored construction, tracked down missing building parts and monitored deliveries from building supply company, communicated with contractor throughout construction, and completed building project

- *Guide to Nebraska's Wetlands* and their conservation needs (2022) – Several meetings and field visits, and in-field filming with PBT representatives, office and in-field interviews with PBT, and review initial write-ups and video related to saline wetland portions of project

- City Greenways and Prairie Corridor on Haines Branch – Greenways monthly land management and administration meetings, provided direction to Greenways Supervisor, assisted administration team on future Northwest park siting, Wilderness Park working group meetings, continual meetings with Solidago and team to discuss land acquisitions throughout the Prairie Corridor, participated in Prairie Corridor site visits, assisted with grazing and haying agreements, Greenways mapping identification meeting, and participated in Parks Department discussion on conservation easements

- Conferences – Wildlife Society (virtual 2021 and 2022) and Nebraska Natural Legacy (virtual 2021, in-person 2022)

- Grant Administration – Miscellaneous grant administration, provided grant application and identification of grant funding opportunities assistance to City Parks staff and other conservation agencies regarding wetland and prairie conservation projects. Identified and coordinated activities with funding sources on potential land acquisitions and habitat restoration projects and provided technical review of NET grant applications. Drafted and submitted NET applications each year.

    - NET 2016 – Completed, submitted and received approval on final report.
    - Developed and submitted NET grants in 2020, 2021, and 2022; none approved
    - Federal Section 319 – Developed and submitted application; approved for Frank Shoemaker Marsh project
    - Federal Section 6 – assisted NGPC with application; 2021 approved
    - NRCS PL566 – assisted LPSNRD and consultants with application development; approved 2020-2021
    - NAWCA – initial discussions with City legal counsel and LPSNRD on agreement with Ducks Unlimited, coordinated activities for City Council approval, and assisted Pheasant Forever with small NAWCA application; both NAWCA grants have been approved

SALINE WETLAND PROPERTIES

- **Frank Shoemaker Marsh** – 27th Street and Bluff Road

Size:	160 acres
Purchase price and date:	$472,000 on June 12, 2003
Funding sources:	2001 State Wildlife Grant through the USFWS ($222,000) 2002 NET grant ($250,000)
Owner:	City of Lincoln

Activity summary – Noxious weed removal and cedar removal concentrated around wetland cells and west of Little Salt Creek. Prescribed haying.

- **Dakota Springs** – South of Arbor Road and East of 27th Street

Size:	68.7 acres
Purchase price and date:	$204,700 in January 2004
Funding sources:	Federal Section 6 ($153,525) 2002 NET grant ($51,175)
Owner:	City of Lincoln

Dakota Springs Extension Purchase (Dial Realty, 7.45 acres)

Purchase price and date:	$48,500 on December 31, 2008
Funding source:	Federal Section 6

Activity summary – Noxious weed and wood vegetation removal. Hayed in 2021 and 2022. Access gate installed by Lower Platte South NRD

- **Warner Saline Wetlands** - 98th Street and Interstate 80

Size:	140 acres
Purchase price and date:	$298,580 on December 7, 2004
Funding sources:	Federal Section 319 ($179,148) LPSNRD ($43,043.20) SWCP ($76,388.80)
Owner:	LPSNRD

Activity summary – A well was constructed and solar pump installed, which was re-purposed from Arbor Lake. Noxious weed and wood vegetation removal.

- **Little Salt Creek Wildlife Management Area** – 1st Street and Raymond Road

Total Size:	256.5 acres
Purchase price and date:	$476,000 in June 2004 (original 156 acres)
Funding sources:	Federal Section 6 ($276,000)
	2004 NET grant through NGPC ($200,000)
Owner:	Nebraska Game and Parks Commission

Noble Tract Extension (100.5 acres) - Along Little Salt Creek, between Mill Road and the southern boundary of the original Little Salt Creek Wildlife Management Area.

Activity summary – Prescribed grazing and haying of upland was conducted. Cedar removal and noxious weed control. Platte Basin time lapse camera location.

- **Little Salt Creek West Wildlife Management Area** – South of Branched Oak Road between NW 12th and 1st Streets

Total Size:	220.0 acres
Purchase price and date:	$979,000 on October 9, 2009
Funding sources:	Federal Section 6 ($560,000)
	2005 NET Grant ($42,838.58)
	2008 NET Grant ($366,250.42)
	Ducks Unlimited ($10,000)
Owner:	Nebraska Game and Parks Commission

Activity summary – Prescribed grazing and haying was conducted. Cedar removal and noxious weed control. Boundary fence installation.

- **Arbor Lake Complex** – North of Arbor Road and east of 27th Street.
  Total Size: 132.5 acres
  Owner: City of Lincoln

  Arbor Lake Extension Purchase (Anderson Property, 69.2 acres)
  Purchase price and date: $361,710.67 on September 1, 2004
  Funding source: 2002 NET grant through City of Lincoln

  Activity summary – Noxious weed and wood vegetation removal. Prescribed haying.

- **Marsh Wren** – Between 40th and 56th Streets and north of Salt Creek
  Total Size: 80.0 acres
  Purchase price and date: $320,000 on May 27, 2009
  Funding sources: Lower Platte South NRD ($25,000)
  SWCP ($25,000)
  City of Lincoln floodplain acquisition funds ($178,000 ($89,250 each from the City of Lincoln and the LPSNRD)
  2005 NET Grant ($91,500)
  Owner: Lower Platte South Natural Resources District

  Marsh Wren addition – East of 40th Street and immediately north of Salt Creek

  Size: 49.4 acres
  Purchase price and date: $270,000 on June 19, 2012
  Funding sources: Federal Section 6 ($135,000)
  2008 NET Grant ($130,000)
  SWCP ($5,000)
  Owner: Lower Platte South NRD

  Activity summary – Noxious weed and wood vegetation removal. The driveway was resurfaced, and berm repaired between hemi marsh and open water. The saline water distribution system is monitored for water release and any necessary modifications; repaired west distribution system leak. Viewing scope replaced on overlook. SCTB releases in 2021 and 2022.

- **Little Salt Fork Marsh Preserve addition (Allen property)** – Between Branched Oak Road and Raymond Road and west of 1st Street
  Size: 66.6 acres
  Purchase price and date: $304,000 on February 17, 2010
  Funding sources: Lower Platte South NRD ($76,000)
  SWCP ($75,000)
  2008 NET Grant ($153,000)
  Owner: Lower Platte South NRD

  Activity summary – Noxious weed and wood vegetation removal. Monitor 2017 native seeding.

- **Little Salt Springs** – NW 12th Street and Branched Oak Road

Size:	123 acres
Purchase price and date:	$472,188 on July 31, 2007
Funding sources:	Lower Platte South NRD ($187,960.35)
	2005 NET grant ($227,227.95)
	Partnership Funds ($57,000)
Owner:	Lower Platte South NRD

Little Salt Springs Addition – West Branched Oak Road between NW 12th and NW 27th streets

Size:	13.3 acres
Purchase price and date:	$175,000 on October 15, 2015
Funding sources:	Lower Platte South NRD ($43,201.17)
	2012 NET Grant ($131,798.83)
Owner:	Lower Platte South NRD

Activity summary – Solar pump re-purposed from Arbor Lake was installed at existing well. Continue noxious weeds and wood vegetation removal with considerable efforts to remove young cottonwoods along native planted areas along creek.

- **Helmuth Marsh** – South of Mill Road and west of 14th Street

Size:	119.0 acres
Purchase price and date:	$630,000 on November 23, 2010
Funding sources:	Federal Section 6 ($275,000)
	2001 State Wildlife Grant through the
	U.S. Fish and Wildlife Service ($131,666.50)
	NGPC ($23,333.50)
	Donation from Helmuth family ($200,000)
Owner:	Pheasants Forever, Inc.

Activity summary – Noxious weed and wood vegetation removal. Prescribed grazing and haying of upland was conducted.

- **Jack Sinn Wildlife Management Area (Kreitman addition)** – Between North 70th and North 84th streets and south of Ashland Road

Size:	183.5 acres
Purchase price and date:	$375,000 on June 4, 2014
Funding sources:	Nebraska Game and Parks Commission ($225,000) 2012 NET Grant ($150,000)
Owner:	Nebraska Game and Parks Commission

Activity summary – Noxious weed and wood vegetation removal. Fencing plan developed to allow for prescribed grazing

- **Jack Sinn Wildlife Management Area Addition (Laurel Nelson property) – On West Branched Oak Road between NW 12th and NW 27th streets**

Size:	79.8 acres
Purchase price and date:	$378,000 on December 29, 2017
Funding sources:	Pittman-Robertson funds through the Nebraska Game and Parks Commission
Owner:	Nebraska Game and Parks Commission

Activity summary – Noxious weed and wood vegetation removal. Fencing plan developed to allow for prescribed grazing and parking lot being planned for access

- **Saline Meadows – Between Little Salt and Ashland roads along North 40th Street**

Size:	156.76 acres
Purchase price and date:	$713,500 on July 29, 2019
Funding sources:	Nebraska Game and Parks Commission – Section 6 and
Habitat	cash funds ($281,900) Pheasants Forever, Inc. ($351,600) 2016 City of Lincoln NET Grant ($60,000) Saline Wetlands Conservation Partnership ($20,000)
Owner:	Pheasants Forever, Inc. (NGPC provides land management)

Activity summary – The property is contiguous with 1,620 acres of the Jack Sinn Wildlife Management Area that is owned and managed by the Nebraska Game and Parks Commission. Noxious weed and wood vegetation removal. A dedication was held in August 2021.

All structures have been removed and concrete bases are in the process of being removed to restore area. Boundary fencing is continuing, and three parking lots and signage have been planned and installation has begun.

- **Glacial Hill** – Between North 14th and North 27th streets and south of Waverly Road

Size:	139.7 acres
Purchase price and date:	$807,700 (Norder tract 9/2014 ($457,000) and Christensen tract 12/2018 ($350,700)
Funding sources:	Federal Section 6 ($270,000) 2012 NET Grant ($187,000) 2016 NET Grant ($275,000) City of Lincoln ($75,000) Saline Wetlands Conservation Partnership ($700)
Owner:	City of Lincoln

Activity summary – Noxious weed and wood vegetation removal. Boundary fencing repair and replacement. Prescribed grazing and haying. Driveway access off Waverly Road completed.

The following saline wetland properties were acquired prior to the inception of the SWCP in 2002. The properties are supported through the activities identified in "Nebraska's Eastern Saline Wetlands Conservation Plan (2018)."

- **Seacrest Range** (43 acres) – Located west of Folsom Street along both the north and south sides of Rosa Parks Way. The area is owned by the City of Lincoln. Efforts continued to remove wood vegetation and to control noxious weeds (Leafy spurge).

- **Lincoln Saline Wetlands Nature Center** (92.7 acres) – Located near Capitol Beach in Lincoln. The area is owned by the LPSNRD. Management activities included noxious weed control and woody vegetation removal and prescribed haying.

- **Schleich Wetlands** (50.2 acres) – Located southwest of Little Salt Creek near where it empties into Salt Creek and east of the Northridge subdivision in Lincoln. Owned by the LPSNRD. Management activities include noxious weeds and wood vegetation removal.

- **Whitehead Wetlands** (98.8 acres) – It is located east of 27th street and a short distance south of Interstate 80. The area is owned by the LPSNRD. Management activities include noxious weed control and removal of wood vegetation.

- **Little Salt Fork Marsh Preserve** (174.2 acres) – Located northwest of north 1st Street and Raymond Road and owned by the Lower Platte South NRD. Management activities include control of noxious weeds. Prescribed burn in 2022 and boundary fence installation along Raymond Road.

- **City of Lincoln Mitigation Bank** (183 acres) – South of Warner Wetlands it is located along 98th Street and north of Highway 6 the property is managed by the Lower Platte South NRD. Management activities include control of noxious weeds. Fence repairs and installation were completed along 98th Street in proximity to the parking area.

- **Jack Sinn Wildlife Management Area** (1,620 acres) – Located south of Ceresco in Saunders and Lancaster counties. The area is owned by the NGPC. Management activities include control of noxious weed and wood vegetation and grazing and haying.

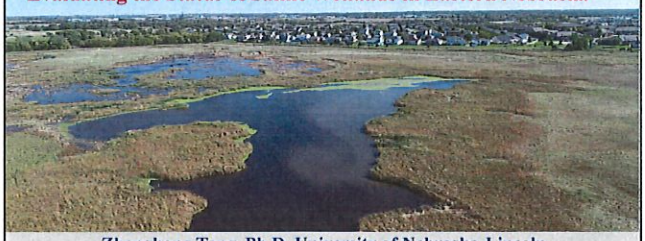
This program has been very successful and continues to accomplish many of the goals of Nebraska's Eastern Saline Wetlands Conservation Plan (2018). Your continued support for the conservation of these natural areas is appreciated. If you have any questions, please contact me at 402-441-7063 or tmalmstrom@lincoln.ne.gov at the City Parks and Recreation Department or 402-476-2729 or tmalmstrom@lpsnrd.org at the NRD.

You can visit the saline wetland website at: https://www.lincoln.ne.gov/City/Departments/Parks-and-Recreation/Parks-Facilities/Saline-Wetlands

APPENDIX

Nebraska Eastern Saline Wetlands Monitoring and Evaluating Salinity Status, Hydrological Interaction, and Vegetative Community

Deploying Wireless Sensor Network for Monitoring and Evaluating the Status of Saline Wetlands in Eastern Nebraska



Zhenghong Tang, Ph.D University of Nebraska-Lincoln

01-31-2023

Saline Wetlands Conservation Partnership Meeting

1

Project introduction

Project cost: $150,000 from EPA

Period: 3-year period (by 09-30-2023)

Students: Qiao Hu, Ligang Zhang, Jason Cyboron, Jahangeer Jahangeer

Overall goal: To deploy wireless-based real-time sensor networks to monitor and evaluate salinity status, hydrological interaction, and vegetation community of saline wetlands.

2

Three Tasks and deliverables

Task 1: Deploy wireless-based real-time sensor networks to monitor the salinity status

- A wireless-based monitoring system deployed

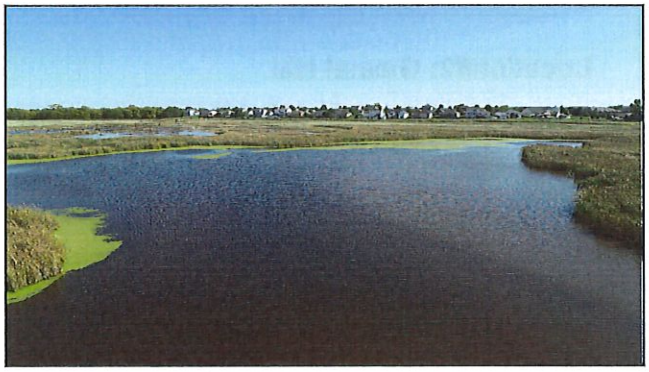
Task 2: Analyze wetland salinity dynamics and hydrological interaction

- A technical report to evaluate the status of saline wetland ecosystems

Task 3: Evaluate wetland community conditions and existing conservation practices for best management practices

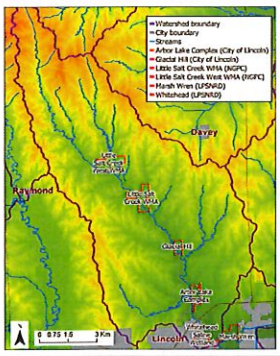
- A geodatabase to document the conditions of salinity status

3



4

Site Selection Process



Site selection criteria

1) Wetland soils
2) Inundation areas
3) Vegetation coverage
4) Endangered species
5) Hydrology condition
6) Site representativeness
7) Site accessibility
8) Land ownership
9) Wireless signal strength
10) Conservation activities

Selected six sites

Site name	Owner name
Arbor Lake Complex	City of Lincoln
Glacial Hill	City of Lincoln
Little Salt Creek WMA	Nebraska Game and Parks Commission
Little Salt Creek West WMA	Nebraska Game and Parks Commission
Marsh Wren	Lower Platte South Natural Resources District
Whitehead Saline Wetland	Lower Platte South Natural Resources District

5

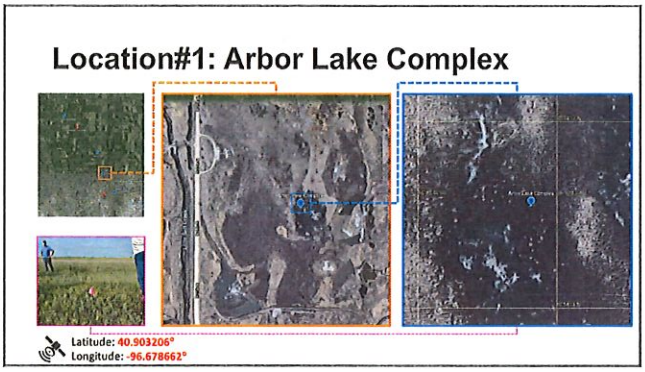
Sensors

- **Hydro 21 Sensor System (6 sets)**
  - Sensor: $491
  - ZL6: $650
  - Zentra Cloud Service Fee: $540

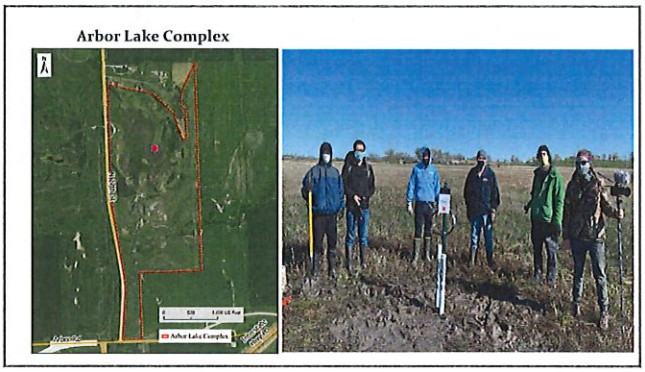
- **Teros 12 Sensor System (6 sets)**
  - Sensor: $300
  - ZL6: $650
  - Zentra Cloud Service Fee: $540

HYDRO 21 sensor	TEROS 12 sensor
(Deploy at surface water in saline wetlands)	(Deploy at 20 cm of salty soils)
• **Water depth:** 0-10 m	• **Volumetric water content (VWC):** 0.00–0.70 m^3/m^3
• **Temperature:** -11-49 °C	• **Temperature:** −40 to 60 ° C
• **Electrical conductivity:** 0 to 120 dS/m	• **Bulk electrical conductivity (EC_b):** 0 to 20 dS/m (bulk)

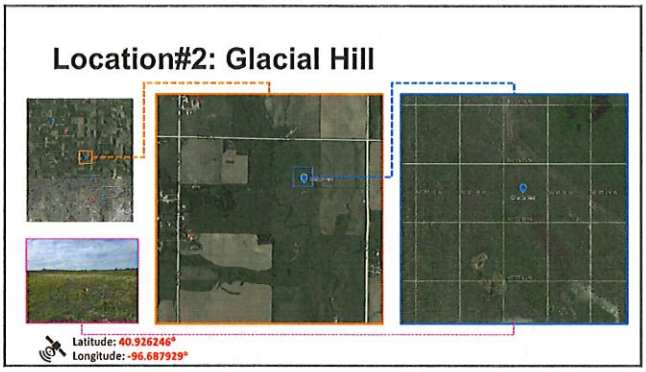
6


Location#1: Arbor Lake Complex
Latitude: 40.903206°
Longitude: -96.678662°

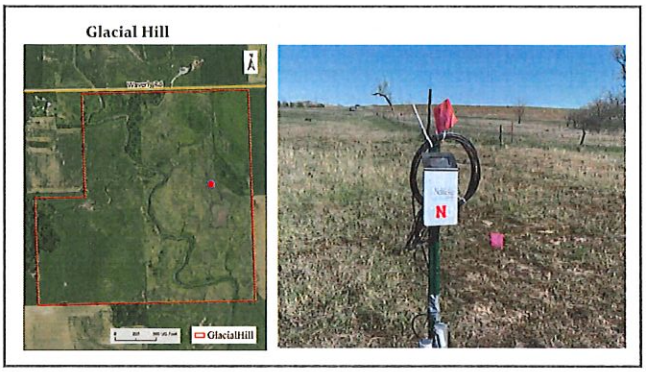
7


Arbor Lake Complex

8


Location#2: Glacial Hill
Latitude: 40.926246°
Longitude: -96.687929°

9


Glacial Hill
GlacialHill
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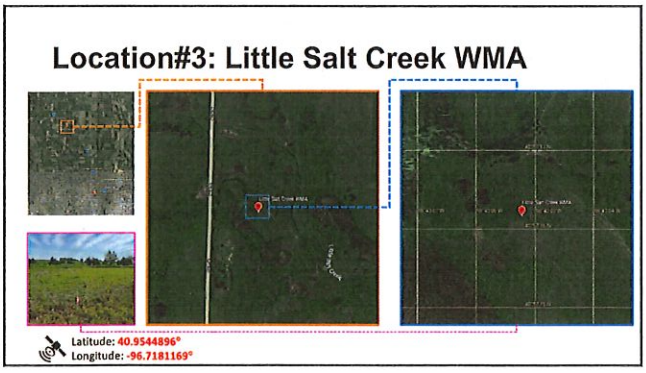
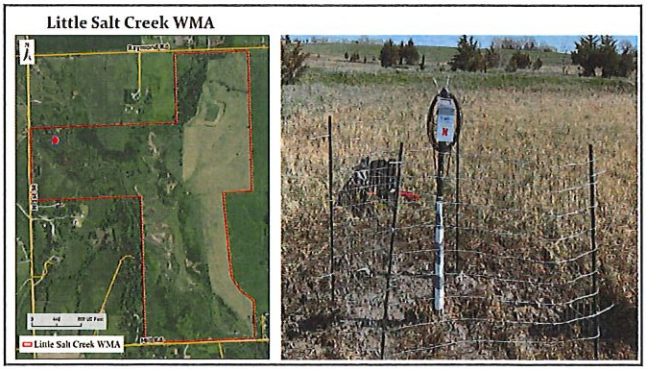
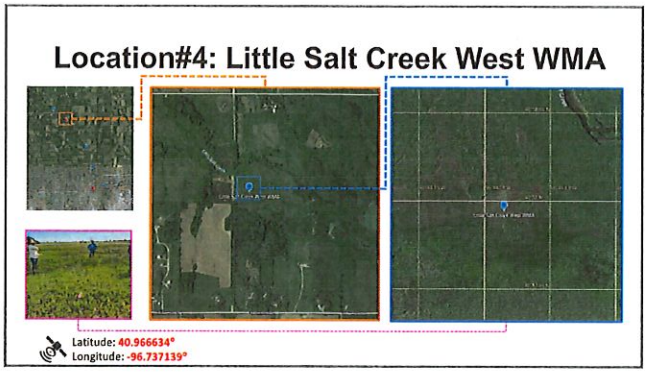

Location#3: Little Salt Creek WMA
Latitude: 40.9544896°
Longitude: -96.7181169°

11


Little Salt Creek WMA
Little Salt Creek WMA

12



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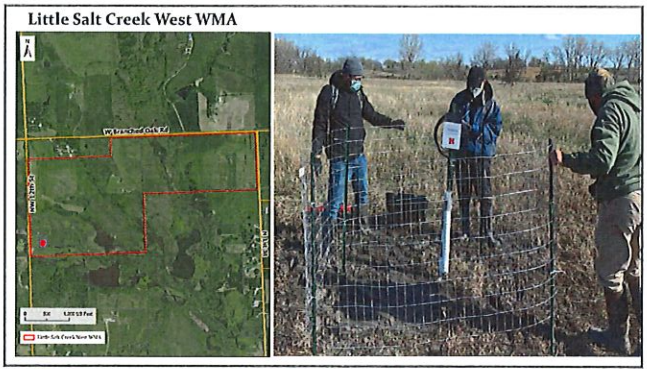

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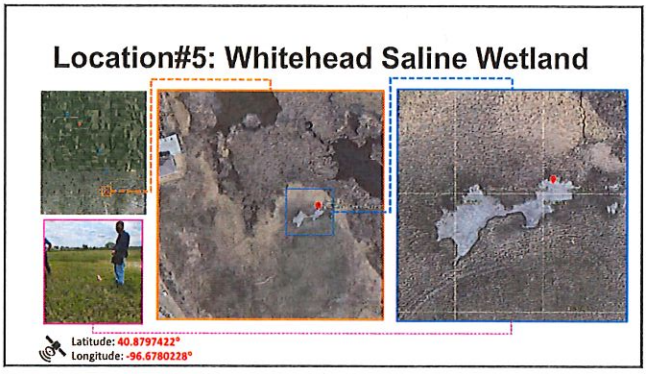

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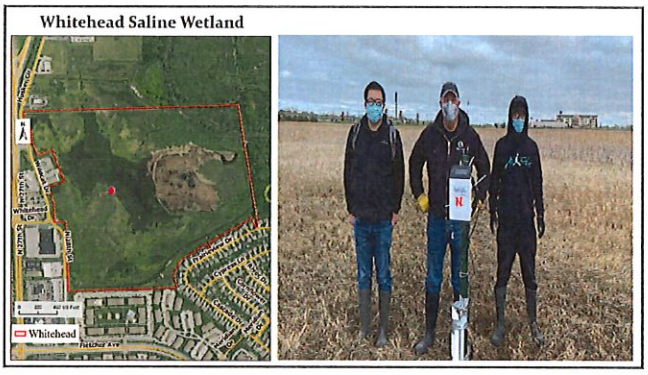

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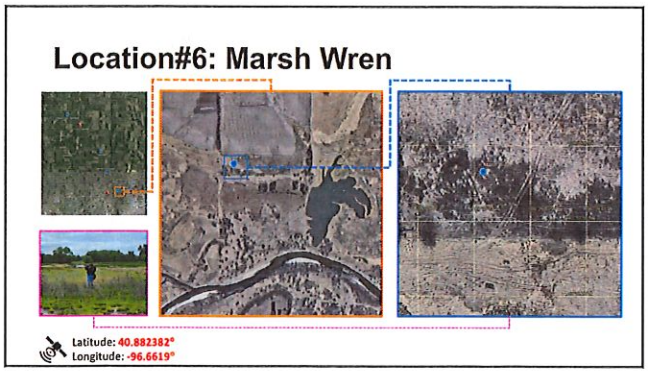

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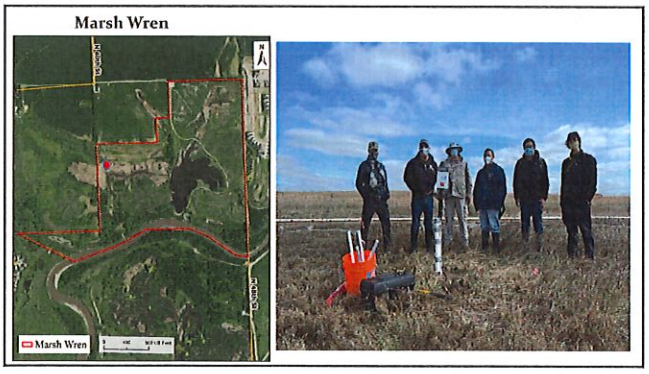


18

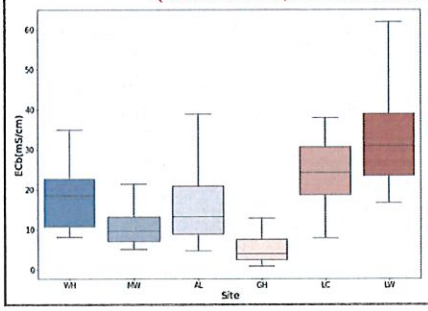
Research questions

The HYDRO 21 sensors and TEROS 12 sensors were deployed to measure the conductivity of surface water and topsoil on the six selected saline wetlands in eastern Nebraska, USA during 2021-2022.

- (1) What are the spatial and temporal patterns of the salinity dynamics in these saline wetlands?
- (2) How are the salinity patterns correlated to contextual factors?

19

Soil salinity conditions during April 2021- April 2022 in six sites (Based on 210,240 data observations)



Relatively high levels of topsoil salinity in five wetlands were found among these six sites.

Excellent soil salinity conditions exist in five of the six sites, particularly the two upper stream sites.

Statistically significant variations of soil salinity conditions among these six sites.

20

Soil salinity conditions in 2021-2022 in six sites

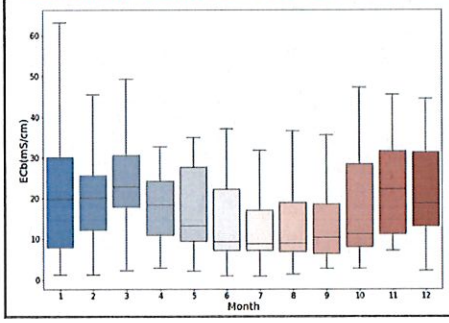
Type of statistics	Whitehead (WH)	Marsh Wren (MW)	Arbor Lake (AL)	Glacial Hill (GH)	Little Salt Creek (LC)	Little Salt Creek West (LW)	All six sites
Min	8.13	5.05	4.69	0.85	7.94	16.64	0.85
Max	34.89	28.49	57.93	12.78	37.83	68.32	68.32
Mean	17.98	10.65	17.65	4.94	22.97	31.61	17.63
Median	18.44	9.64	13.23	3.92	24.20	30.81	14.20
Std.Dev	7.70	4.13	11.99	2.99	8.15	8.64	11.58

The mean bulk electrical conductivity (ECb) on the topsoil of all six sites reached at **17.63 mS/cm**.

The upstream wetland in the **Salt Creek West Wildlife Management Area (WMA)** had the highest soil salinity level with ECb at **31.61 mS/cm**.

21

Soil salinity conditions in each month in six sites



The summer months (June, July, and August) **have the lowest EC_b** during the whole year

The non-growing months (November, December, January, February, March) **have high levels of soil salinity**.

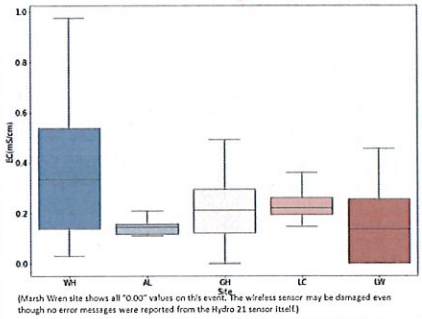
22

Pearson correlation coefficients for soil salinity (ECb) and soil moisture (water content), soil temperature (Soil temperature)

Pearson correlation coefficients	EC_b at Whitehead (WH)	EC_b at Marsh Wren (MW)	EC_b at Arbor Lake (AL)	EC_b at Glacial Hill (GH)	EC_b at Little Salt Creek (LC)	EC_b at Little Salt Creek West (LW)	EC_b for total
Water content	0.563	0.404	0.317	0.333	-0.055	-0.278	**0.596**
Soil temperature	-0.731	-0.617	-0.299	-0.294	-0.635	-0.676	**-0.339**

23

Surface water salinity conditions on 10/27/2021



(Marsh Wren site shows all "0.00" values on this event. The wireless sensor may be damaged even though no error messages were reported from the Hydro 21 sensor itself.)

Electrical conductivity (EC) for the surface water during a major inundation event in 2021 reached **0.22 mS/cm** with a standard deviation of 0.18 mS/cm.

24

Surface water salinity conditions in six sites

	Whitehead (WH)	Marsh Wren (MW)*	Arbor Lake (AL)	Glacial Hill (GH)	Little Salt Creek (LC)	Little Salt Creek West (LW)	All for five sites with inundation conditions
Min	0.03	-	0.11	0.00	0.15	0.00	0.00
Max	0.98	-	0.37	1.29	0.38	0.46	1.29
Mean	0.36	-	0.16	0.23	0.23	0.13	0.22
Median	0.34	-	0.15	0.21	0.22	0.14	0.19
Std.Dev	0.25	-	0.07	0.22	0.06	0.13	0.18

The highest mean value of EC is observed in Whitehead site at 0.36 mS/cm.

The highest EC in the Whitehead site reaches 0.98 mS/cm.

25

Summary of key findings

- This research provides **solid scientific evidence** of the **salinity status of topsoil and inundated water** in these inland saline wetlands.
- The findings confirmed that **the salinity status on topsoil maintains at effective salty level**. Five of the six sites had the mean salinity level above 10 mS/cm, indicating **relatively high salinity conditions**.
- The research findings support conservation effectiveness in these conserved wetlands. The **current conservation practices have effectively maintained salinity on topsoil** in these studying sites.

26

Summary of key findings

- For the water salinity monitoring results, we found that **surface water stays at lower level of salinity** even though variations exist in these six sites.
- The **surface water salinity level was diluted by the excess freshwater runoff** from the increasing paved watershed due to commercial, residential, and road development at watershed level.
- **Many factors may jointly affect** the salinity levels on topsoil and surface water of saline wetlands.

27

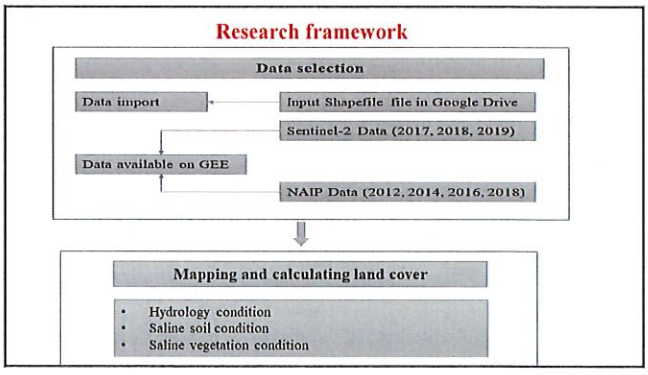
Environ Monit Assess (2022) 194:193
https://doi.org/10.1007/s10661-022-09850-8

Assessing the contemporary status of Nebraska's eastern saline wetlands by using a machine learning algorithm on the Google Earth Engine cloud computing platform

Zhang L, Hu Q, Tang Z. Assessing the Contemporary Status of Nebraska's Eastern Saline Wetlands by Using a Machine Learning Algorithm on the Google Earth Engine Cloud Computing Platform. Environmental Monitoring and Assessment. 2022 February 16; 194(3):193. DOI: doi: 10.1007/s10661-022-09850-8.

28

29



30

Geospatial data sources

Data sources	Bands	Resolution	Date
Sentinel-2	B2, B3, B4, B8	10 m	March 2017-November 2017 March 2018-November 2018 March 2019-November 2019
Sentinel-2	B5, B6, B7, B8, B8a, B11, B12	20 m	March 2017-November 2017 March 2018-November 2018 March 2019-November 2019
NAIP	R, G, B, NIR	1 m	2012-06-26 2014-08-19 2016-07-20 2018-07-02 2018-07-03

31

Mean water cover rate in each year

	Mean water cover rate (%)		
	2017	2018	2019
Little Salt Creek West WMA	16.7	17.1	14.1
Little Salt Creek WMA	15.3	14.7	23.7
Glacial Hill	13.4	8.1	13.0
Arbor Lake Complex	19.8	29.6	31.9
Whitehead Saline Wetland	27.2	34.6	31.9
Marsh Wren	15.9	32.4	34.3
Total	18.0	22.7	24.8

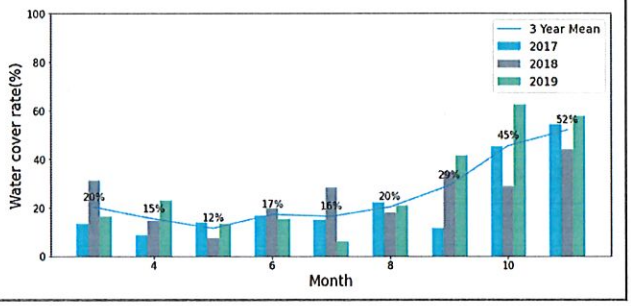
32

Visible salt flat percentage in each wetland in different years (%)

Year	Arbor Lake	Whitehead	LSC WMA	LSC West	Marsh Wren	Glacial Hill	Total
2012	8.53	11.64	1.11	0.23	2.78	1.06	25.34
2014	3.76	6.56	7.47	5.32	1.25	3.20	27.56
2016	1.89	1.74	0.91	8.81	13.75	1.70	28.81
2018	0.64	0.83	0.77	0.28	1.82	0.06	4.40
Mean	3.70	5.19	2.57	3.66	4.90	1.51	21.53

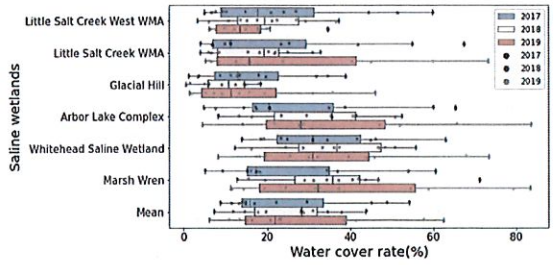
33

Temporal patterns of the mean water cover rate for all six wetlands



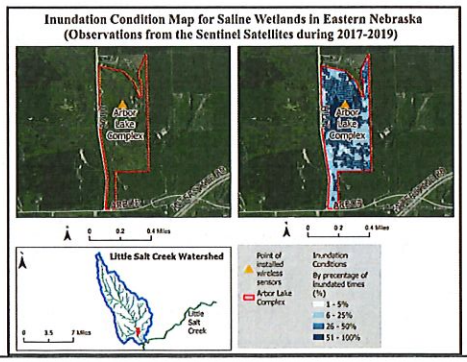
34

Water cover rate each month in each of the six sites



The dots in this figure represent the mean water cover rate for each month at each site.
The boxes represent the percentile distribution of each site each year.

35



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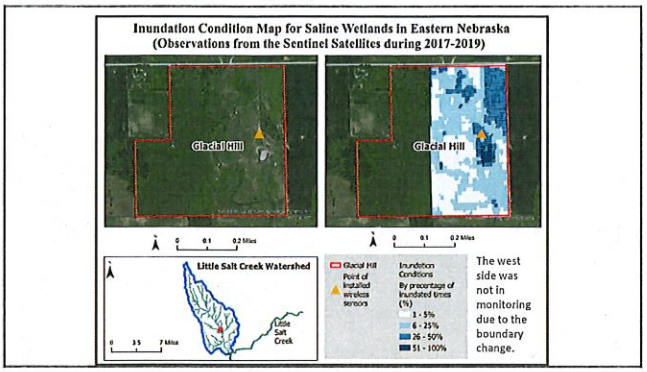

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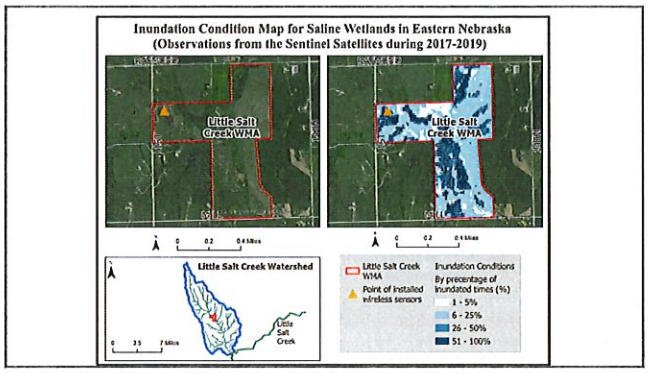

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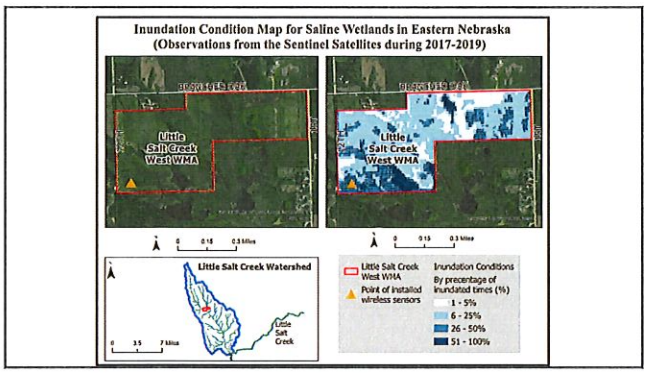

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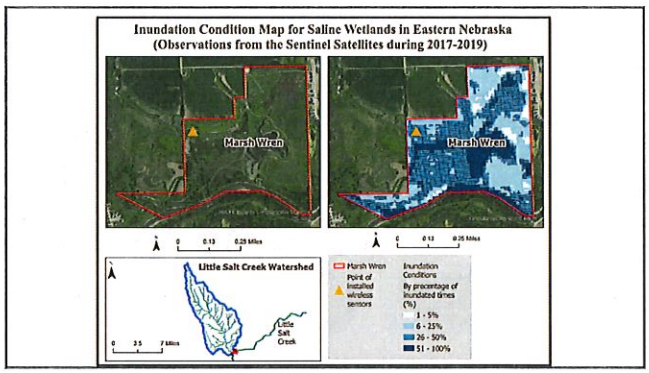

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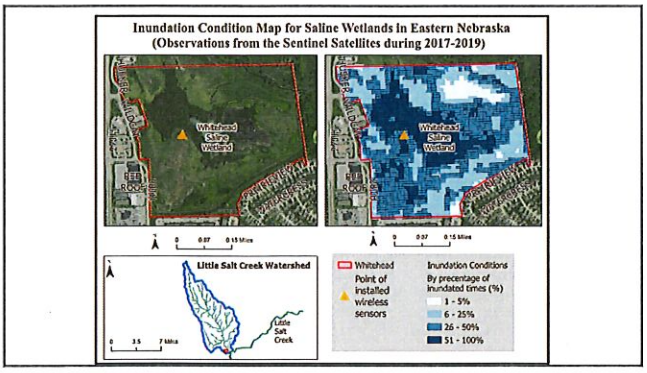

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Summary of the findings

- The **water cover rate** shows a robust contrastive pattern with **high values in the fall** and low values in the summer.
- The saline soil classification shows that **the saline soil area is highly variable in response to changes in the water and vegetation conditions**.
- **Restore hydrologic function at the watershed scale** and **increase inundation frequency and ponded area (with salty water) during the growing season**.
- **Excess surface water runoffs may dilute** salty soils and affect salty vegetation in these saline wetlands.

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Take home messages for conservation decision making

- Overall, **conservation practices contribute to effective inundation conditions and soil salinity conditions** in saline wetlands in Eastern Nebraska.
- The two upper stream wetlands (Little Salt Creek WMA and Little Salt Creek West WMA) performed best. Arbor Lake site and Whitehead sites also keep soil salinity in a relatively higher levels. **Two wetland sites (Marsh Wren and Glacial Hill) need more conservation attentions.**
- **Groundwater pumping**, particularly in the **summer season**, will be helpful to maintain the soil salinity in a good condition.
- **Managing surface water runoffs** into saline wetlands are necessary to maintain soil and water salinity at the site levels.

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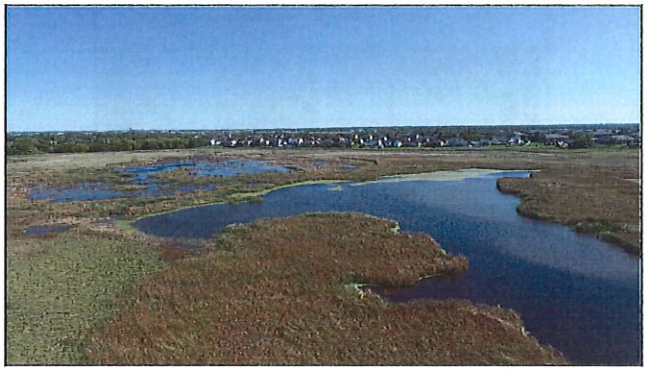

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