UPPER BIG BLUE NATURAL RESOURCES DISTRICT

REQUEST FOR PROPOSALS (RFP 2024-0002)

BRUCE L. ANDERSON RECREATION AREA

GRANT / FUNDING OPPORTUNITIES

Contents

1. INTRODUCTION

This Request for Proposal (RFP) is issued by the Upper Big Blue Natural Resources District, CONTRACTOR; to solicit proposals for researching all funding programs and opportunities for measures to improve water quality at Recharge Lake, located west of York, Nebraska.

In March of 2020, through an agreement with the Nebraska Department of Environment and Energy, and the guidance of JEO Consulting Groupe, the Upper Big Blue Natural Resources District completed a District Wide Water Quality Management Plan (WQMP). The Recharge Lake watershed was named as a priority area in the WQMP with implementation efforts to address sediment, nutrients, bacteria, and atrazine. While initial efforts were focused on best management practices (BMPs) in the watershed about Recharge Lake, adoption of these BMPs has been slow.

In June of 2024, through a contract with the Upper Big Blue Natural Resources District, The Flatwater Group completed the Recharge Lake Water Quality Improvement Study (Study). The Study resulted in the recommendation of 2 alternatives. Alternative 1 is labeled the Water Quality Management Plan Concept and Alternative 2 is labeled The Flatwater Group Alternative. Each alternative lists a number of recommended Best Management Practices to be implemented.

2. EXAMINATION OF REQUEST FOR PROPOSAL DOCUMENTS AND EXPLANATION TO OFFEROR

Should the OFFEROR find discrepancies in, or omissions from the RFP, or should the intent or meaning appear unclear or ambiguous, or should any other questions arise relative to the RFP, the OFFEROR shall notify CONTRACTOR as listed below. The OFFEROR making such a request solely will be responsible for its timely receipt by the CONTRACTOR. Replies to such notices will be addressed within 48 hours of receipt by the CONTRACTOR. If the request(s) require changes to the original RFP, then an amendment to the RFP will be issued to all prospective OFFERORs and shared via https://www.upperbigblue.org/about/bid-proposals . As reviewed by the CONTRACTOR, if a request(s) is deemed significant, the CONTRACTOR at their discretion may extend the closing date of the RFP.

For discrepancies, omissions, or general questions concerning the RFP, OFFERORs should contact

Jack Wergin
402-362-6601
jwergin@upperbigblue.org

or

Marie Krausnick
402-362-6601
mebel@upperbigblue.org

3. EXHIBITS INCLUDED IN RFP 2024-0002

Exhibit A – Schedule of Events
Exhibit B – Project Background, Objectives, Scope of Work
Exhibit C – Recharge Lake – Location

Exhibit D – Recharge Lake Water Quality Improvement Study – Table 5, BMP Alternatives Evaluation
Exhibit E – Recharge Lake Water Quality Improvement Study
Exhibit F – Recreation Enhancement Opportunities
Exhibit G – Recharge Study - Links

4. AMENDMENTS TO REQUEST FOR PROPOSAL

If this RFP is amended, all terms and conditions that are not modified remain unchanged. The term "RFP" includes all exhibits and amendments provided by the OFFEROR as part of this RFP.

5. PREPARATION COST

The preparation of the proposal shall be by, and at the expense of, the OFFEROR.

6. PRICE CONDITIONS

The quoted price must include all costs to the CONTRACTOR for all supervision, labor, tools, supplies, materials, equipment, transportation, testing, and any other miscellaneous for full and complete performance of the work as set forth herein.

Pricing will be guaranteed for 90 days from submission of proposal. All pricing information requested in this RFP must be provided. Costing/Pricing by details must be broken down by labor, materials, etc. CONTRACTOR reserves the right to require the OFFEROR to furnish an accounting breakdown of all contract prices.

7. PAYMENT TERMS

CONTRACTOR payment terms are net 30 days upon receipt of invoice, subject to approval by the Upper Big Blue Natural Resources District Board of Directors.

8. RIGHT OF ACCEPTANCE

CONTRACTOR reserves the right to:

- Accept or reject any proposal in whole or in part.
- Reject all proposals, with or without, notice or reason.
- Enter into discussions or negotiations with OFFEROR prior to award. Negotiations do not constitute an acceptance of the proposal, nor rejection of the proposal, nor a counteroffer by the CONTRACTOR.
- Abandon the work or have the work performed in such a manner as CONTRACTOR may elect, if no proposal is accepted.

9. PROPOSAL EVALUATION CRITERIA

While the CONTRACTOR intends to engage in the purchase of services, this event shall not guarantee that the participating OFFEROR will be awarded a Subcontract.

Any award resulting from this request will be made to the OFFEROR whose proposal provides the best value to the CONTRACTOR. The best value determination will be at the sole discretion of CONTRACTOR and could result in an award to someone other than the

lowest price proposal. Any resulting purchase award will be set forth in writing between the CONTRACTOR and the successful OFFEROR at some date after the close of the request. CONTRACTOR reserves the option to cancel this RFP process at a time and/or to elect not to engage in a Subcontract.

The OFFEROR must provide all data required in order to be considered an acceptable OFFEROR. All data must be executed completely, correctly, and accurately by the OFFEROR. Should the OFFEROR not complete all forms and documents, the OFFEROR will be deemed non-responsive.

This RFP will be evaluated based on the following criteria. OFFERORs are reminded the Subcontract will be awarded for best value with technical ability having the highest weighted percentage.

Criteria	Weighted Percentage (%)
Technical Ability (Experience, Project Plan, Schedule)	60%
Cost	40%
Total	**100%**

10. SUBMITTAL OF PROPOSAL

OFFEROR's proposal must be submitted with

- Past project experience,
- Project Team, including Project Lead
- Detailed project plan,
- Schedule,
- Detailed cost estimate: Please break down pricing for supervision, labor, tools, supplies, materials, equipment, transportation, testing, and any other miscellaneous for full and complete performance of the work as set forth herein.
- Listing of Subcontractors if applicable.
- Specific documentation requested by CONTRACTOR must be submitted within the time specified and unless otherwise specified by CONTRACTOR, at no expense to CONTRACTOR.
- Proposals should be submitted via hand delivery, USPS, or E-mail to:

  Upper Big Blue Natural Resources District
  Attn: Jack Wergin
  319 East 25th Street
  York, NE 68467

  Or jwergin@uppebigblue.org

- **Proposals must be received by close of business (5:00 CST) on Friday, December 27, 2024.**

11. AWARD OF SUBCONTRACT

CONTRACTOR contemplates award of a Subcontract in accordance with the requirements and conditions set forth or incorporated by reference in this RFP.

Proposals for other than the total work defined may be rejected. The Award may not be made to any OFFEROR who has not responded to all instructions and representations indicated in the RFP.

CONTRACTOR may reject any or all proposals if such action is in the best interest of CONTRACTOR and their PARTNERS and/or waive informalities and minor irregularities in offers received.

CONTRACTOR and their PARTNERS may evaluate proposals and the CONTRACTOR award a Subcontract without discussions with OFFEROR. Therefore, each initial proposal should contain the OFFEROR's best terms.

CONTRACTOR reserves the right to conduct discussions, if later determined to be necessary by CONTRACTOR's Subcontract Administrator and Project Lead.

12. NOTICE TO SUCCESSFUL OFFEROR – W-9 Verification, Certificated of Liability Insurance

CONTRACTOR will require any successful OFFEROR to supply a W-9 Request for Taxpayer Number and Certification and a Certificate of Liability Insurance if applicable.

13. NOTICE OF UNSUCCESSFUL OFFEROR

The OFFEROR will be informed whether the proposal was successful using a method deemed adequate by the CONTRACTOR.

Exhibit A
SCHEDULE OF EVENTS

Event	Date
Opening Date	December 11, 2024
Omissions and/or Questions	December 16, 2024
Closing Date	December 27, 2024
Evaluation Period	December 30, 2024 - January 16, 2025
Anticipated Subcontract Award	January 16, 2025
Project Completion, Final Report	March 20, 2025

Exhibit B
BACKGROUND & SCOPE OF WORK

Project Background

Recharge Lake was constructed in 1990 as part of a groundwater recharge study. The lake has a drainage area of 8,549 acres and a normal pool surface area of 44 acres. The lake is now used extensively by the public for recreational activities.

In March of 2020, through an agreement with the Nebraska Department of Environment and Energy, and the guidance of JEO Consulting Groupe, the Upper Big Blue Natural Resources District completed a District Wide Water Quality Management Plan (WQMP). The Recharge Lake watershed was named as a priority area in the WQMP with implementation efforts to address sediment, nutrients, bacteria, and atrazine. While initial efforts were focused on best management practices (BMPs) in the watershed about Recharge Lake, adoption of these BMPs has been slow.

In June of 2024, through a contract with the Upper Big Blue Natural Resources District, The Flatwater Group completed the Recharge Lake Water Quality Improvement Study. as listed in the Recharge Lake Waer Quality Improvement Study. The Study resulted the recommendation of 2 alternatives. Alternative 1 is labeled the Water Quality Management Plan Concept and Alternative 2 is labeled The Flatwater Group Alternative. Each alternative lists a number of recommended Best Management Practices to be implemented

Evaluation of watershed BMPs should focus on the high risk and very high risk areas as identified by the Agricultural Conservation Planning Framework model runs as shown in Exhibit E.

Objectives

This Grant/Funding Opportunities Study has the following objectives:

Objective 1. Review both the Upper Big Blue District-Wide Water Quality Management Plan and the Recharge Lake Water Quality Improvement Study.

Objective 2. Evaluate assistance programs, available funding sources, and potential partners for both alternatives (WQMP Concept and the TFG Concept) listed in the Recharge Lake Water Quality Improvement Study (Exhibit F and Exhibit G).

Objective 3. Evaluate assistance programs, available funding sources, and potential partners for individual and/or grouped BMP Components of both alternatives (WQMP Concept and the TFG Concept) as listed in the Recharge Lake Water Quality Improvement Study (Exhibit D and Exhibit E).

Objective 4. Evaluate assistance programs, available funding opportunities, and potential partners for recreation enhancements at Recharge Lake (Exhibit F).

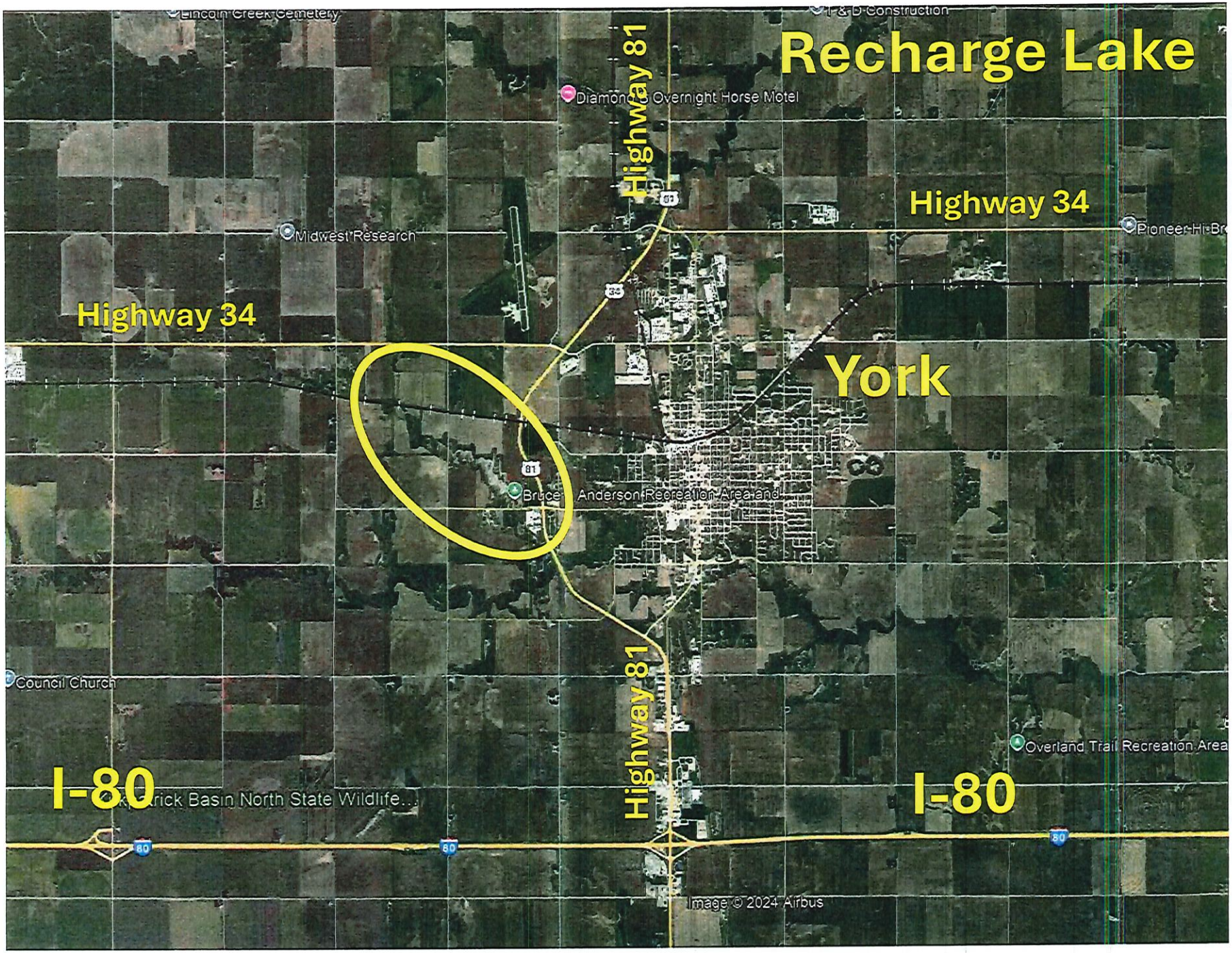
The suggested scope of work is below, and prospective consultants should suggest any proposed alterations to this scope of work.

Scope of Work

This Grant/Funding Research Study will identify assistance programs, available funding sources, and potential partners for alternatives, individual concepts, and/or grouping of concepts of recreational enhancements as presented in the District Wide Water Quality Management Plan (WQMP) and in the Recharge Lake Water Quality Improvement Study.

The tasks and specific steps for this study include the following:

1. Review previously completed studies
    a. Recharge Lake Water Quality Improvement Plan
    b. District Wide Water Quality Management Plan
2. Evaluate the benefits, available funding sources, and potential partners of the two plans identified in the Recharge Lake Water Quality Improvement Plan
    a. Water Quality Management Plan Concept
    b. The Flatwater Group Alternative
3. Evaluate the benefits, available funding sources, and potential partners of individual concepts of each alternative separately
4. Evaluate the benefits, available funding sources, and potential partners of various combinations of concepts listed in both alternatives
5. Evaluate assistance programs, available funding opportunities, and potential partners for recreation facilities at Recharge Lake
6. Provide timelines for each grant opportunity identified
7. Project meetings and management
    a. Provide NRD Staff with monthly updates throughout the project
8. Incorporate NRD comments into a final report
9. Present a report of findings and recommendations to the Upper Big Blue Natural Resources District Projects and Programs Committee and/or Board of Directors.


Recharge Lake
Highway 81
Highway 34
Highway 34
York
Highway 81
I-80
I-80
Lincoln Creek Cemetery
T & D Construction
Diamond D Overnight Horse Motel
Midwest Research
Pioneer Hi-Br
Bruce Anderson Recreation Area and...
Council Church
Overland Trail Recreation Area
Image © 2024 Airbus

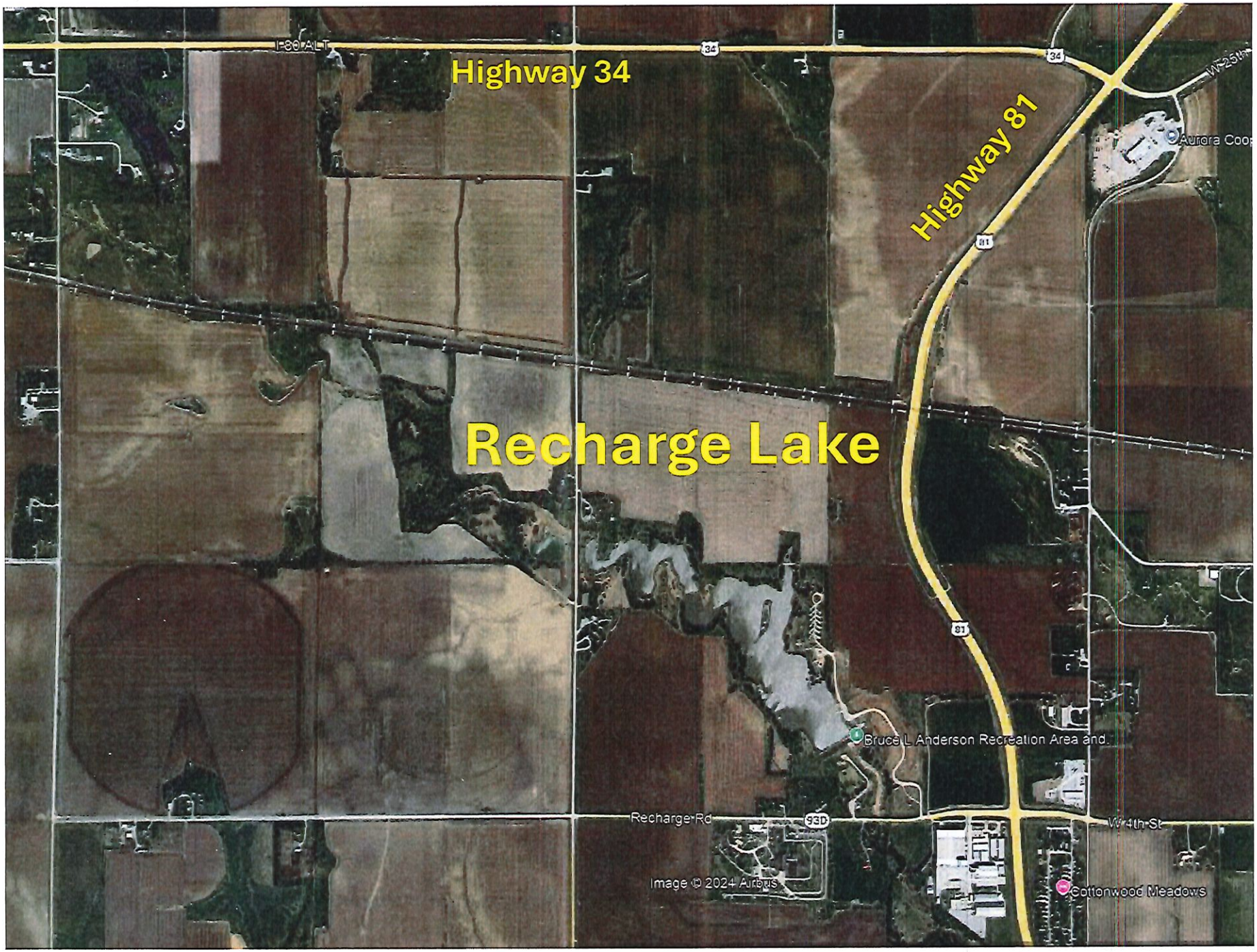

Highway 34
Highway 81
Recharge Lake
I-80 ALT
34
34
81
81
W 25th
Aurora Coop
Bruce L Anderson Recreation Area and...
Recharge Rd
93D
W 4th St
Cottonwood Meadows
Image © 2024 Airbus

Table 5. Relative Cost Comparison of BMP implementation for Alternatives 1 and 2. Total phosphorus (TP), nitrogen (TN), and sediment treatment reductions for BMPs are included.

BMP Component	Alternative 1 WQMP Concept				Alternative 2 TFG Concept			
	Cost	TP lbs/yr	TN lbs/yr	Sediment tons/yr	Cost	TP lbs/yr	TN lbs/yr	Sediment tons/yr
Near Lake Detention Ponds	$869,000	(15,491)	(10,062)	(3,321)	$1,079,000	(17,549)	(13,128)	(3,762)
Floating Treatment Wetlands	-	-	-	-	$244,000	(585)	(1,950)	-
In-Lake Wetlands	$309,000	(4,042)	(8,748)	(656)	$309,000	(4,468)	(14,055)	(584)
Reservoir Deepening	$2,053,000	(3,248)	-	-	$1,821,000	(3,248)	-	-
Island Restoration[1]	$149,000				$149,000			
Shore-line Protection[2]	-				$648,000			
Aquatic Habitat Structures[3]	-				$65,000			
General Costs[4]	$338,000				$432,000			
Construction Cost Total 30% Contingency Total + Contingency[5]	$3,718,000 $1,115,000 $4,833,000	(22,781)	(18,810)	(88,746)	$4,747,000 $1,424,000 $6,171,000	(25,266)	(27,184)	(79,544)

1) *Island Restoration line-item cost is limited to shore-line protection only. Earthwork and seeding costs are accounted for under near lake detention ponds and reservoir deepening line items.*
2) *Shore-line Protection line item includes jetties and rock riprap shore-line armoring with a chip trail for angler access.*
3) *Aquatic Habitat Structure line item based on gravel / rock beds. Log structures and rubble piles generally use waste materials and have lower associated costs.*
4) *General Construction Costs include mobilization, erosion and sediment control, general site work, and haul road construction.*
5) *Typical engineering design cost is 10-12% and construction administration/observation is 5-7%.*

BMP Alternatives Evaluation

The BMPs identified by the WQMP and through this study were evaluated for their effectiveness to improve water quality in Recharge Lake. Two Alternatives were considered for this analysis. Alternative 1 utilizes the general BMPs and areas from the WQMP, as shown in Figure 2. Alternative 2, as shown in attached Exhibit 4, was developed for this study to meet water quality goals stated in the WQMP and through this study.

Alternative 2 represents the high-end cost estimate to achieve water quality goals, improve aquatic habitat, and enhance angler access. To meet project budgets based on available funding, this alternative can be scaled back. Table 5 is intended to help guide project budget planning by showing each BMPs impact on nutrient reductions. Below are additional planning considerations:

- Cost for reservoir deepening is scalable based on volume of sediment removed.
    - o Excavation volume is 62 ac-ft for Alternative 1 and 55 ac-ft for Alternative 2.
- The design life of the near lake detention ponds before maintenance was estimated based on sediment accumulation versus available capacity.
    - o Available capacity is 12 ac-ft for Alternative 1 and 16 ac-ft for Alternative 2.
    - o The amount of time anticipated before first maintenance was estimated as 10 years for Alternative 1 and 18 years for Alternative 2, which accounts for accumulation in both the detention ponds and in-lake wetlands.
    - o Subsequent maintenance periods are every 7 years for Alternative 1 and 12 years for Alternative 2.
    - o Sediment accumulation amounts will fluctuate from year to year. Years with more precipitation will accumulate more sediment, while dry years will have less

Planning Level Cost Estimates

Opinions of construction cost were developed for Alternatives 1 and 2 for planning purposes. Table 5 provides a summary of the costs for each BMP component. For comparison, the total phosphorus, nitrogen and sediment reductions are included to evaluate the potential benefits of each BMP.

THE FLATWATER GROUP INC.

8200 Cody Drive, Suite A Lincoln, NE 68512-9550
Phone: 402.435.5441
Fax: 402.435.7108
www.flatwatergroup.com

To: Jack Wergin, UBBNRD
Marie Krausnick, UBBNRD

From: The Flatwater Group, Inc. (TFG)

Date: Draft-Final – 9 May 2024

Re: Recharge Lake Water Quality Improvement Study

Introduction/Overview

In January 2024, TFG contracted with the Upper Big Blue NRD (UBBNRD) to conduct a water quality improvement study for the Bruce A. Anderson Recreation Area (Recharge Lake) near York, Nebraska. The major components of TFG's Scope of Work included project management, data collection and site assessment, nutrient loading assessment and fisheries evaluation, Best Management Practices (BMP) alternatives evaluation and report documentation and concept map preparation.

Recharge Lake was constructed in 1990 as part of a 5-year groundwater recharge study. The lake is 44 acres in surface area and is open to the public for passive and active recreational use. The proximity to the City of York enables widespread public use.

Study Purpose

The purpose of this study is to further evaluate BMPs identified in the UBBNRD's 2020 Water Quality Management Plan (WQMP) and provide a concept level construction cost opinion for implementation. Due to a lack of landowner participation in watershed BMP alternatives, in-lake treatment options outlined in the WQMP were evaluated in greater detail to address nutrient loading and sedimentation impairments. The in-lake treatments identified in the WQMP include:

- Near-Lake Wet Detention Pond
- In-Lake Wetlands
- Reservoir Deepening
- Island Stabilization

Additional in-lake BMPs were identified by TFG upon consultation with UBBNRD staff. These BMPs were considered to help replace the watershed BMPs and to enhance aquatic habitat, the fishery and angler access.

- Floating Treatment Wetlands
- Jetties and Shoreline Stabilization
- Underwater Aquatic Habitat Structures
- North Tributary Sediment Basin

Background Data

TFG coordinated with UBBNRD staff to collect, compile, and evaluate existing data sets to determine supplemental information needs. Available documents included:

- UBBNRD Water Quality Management Plan (WQMP) and associated GIS data
- 2018 NRCS Bathymetric Survey
- As-built construction plans for Recharge Lake

Past studies completed for Recharge Lake are summarized in the WQMP, which includes a baseline for existing water quality conditions and nutrient loading into Recharge Lake. The key WQMP data included water quality sampling data and average annual loading estimates developed for phosphorus, nitrogen, and sediment.

To work toward required pollutant load reductions, the WQMP outlined a "Treatment Train" approach that would implement multiple complimentary BMPs in series to treat various non-point pollutants with increased efficiency. The UBBNRD engaged stakeholders and discussed various non-structural and avoidance practices as well as in-field, near field and riparian practices as part of the "Treatment Train" approach. However, stakeholders did not choose to participate in the proposed voluntary implementation strategy.

Field Data Collection

On 12 March 2024, TFG team members conducted a bathymetric survey of Recharge Lake using a boat with attached sonar capable bathymetric equipment to map the lake bottom. Survey equipment was also used to measure soft sediment depth from the boat. Additionally, a canoe was used to collect bathymetric data in the sediment basin west of Road K. The water level was 3.4ft below the dam overflow at the time of survey. Secchi disk measurements ranged from 3 to 6-inches. These low readings are likely related to shallow water levels and to seasonal and wind driven lake turnover.

TFG staff also performed drone flights to inventory lake shoreline conditions to complement observations made by team members in the boat (Figure 1). This data was used to develop a shoreline inventory map of the entire lake. See attached Exhibits 1 and 2.

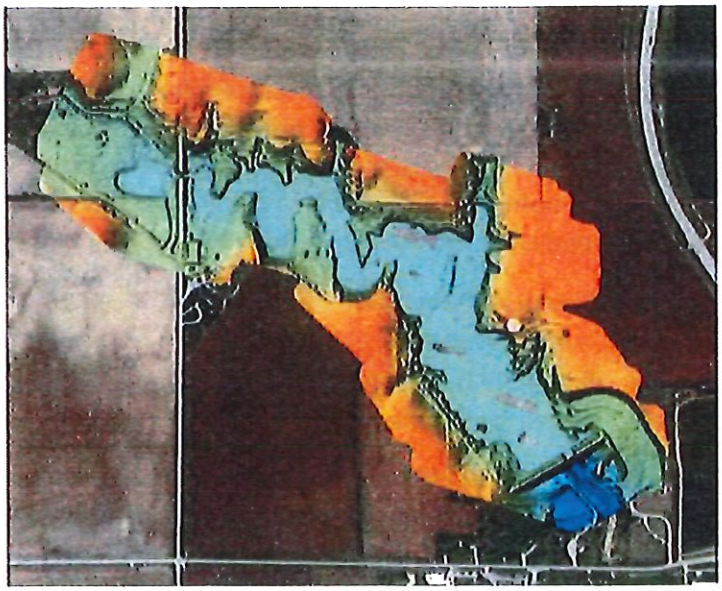


Figure 1.
Digital Elevation Model (DEM) 3D topographical surface generated from TFG LiDAR drone flight over Recharge Lake.

Sediment and Nutrient Loading Assessment

The ability of BMP alternatives to enhance water quality in Recharge Lake was evaluated through a sediment and nutrient loading assessment. This assessment took watershed based average annual loading rates reported in the WQMP study and applied them on a daily time interval. By routing daily estimates of sediment and nutrient laden runoff through individual BMP structures, a better understanding of site-specific trapping capabilities can be gained. Factors such as BMP size, hydraulic loading rates, detention and retention times, and sediment particle size can have a major impact on BMP effectiveness.

WQMP Data Summary

Annual watershed estimates for precipitation-based runoff, sediment yield, and nutrient loading were calculated in the WQMP. A district wide evaluation of runoff potential based on land cover, soil type and slope class estimated an average annual yield of 1.61-inches for the Recharge Lake watershed. Average annual runoff loads of sediment, phosphorus and nitrogen were estimated using the EPA's Spreadsheet Tool for Estimating Pollutant Loads (STEPL). The 8,540 acre watershed is comprised of 88% cropland, 6% urban, 5% grassland, and 1% forested. As a result, cropland drives the sediment and nutrient loading characteristics for the watershed. Average annual loadings were estimated at 6,050 tons of sediment, 18,635 lbs of phosphorus, and 53,682 lbs of nitrogen. Internal phosphorus loads from waterfowl, resuspension, and bottom sediment release was estimated at 13,600lbs, for a total annual load of 32,235lbs.

Water quality was sampled by the Nebraska Department of Environment and Energy (NDEE) over the period of 2002 to 2010. Both total phosphorus and nitrogen were found to exceed water quality standards for all samples collected. Average total phosphorus samples measured 495 ug/L, which is 10 times the standard of 50ug/L. Average total nitrogen samples measured 2,180ug/L, which is over 2 times the standard of 1,000 ug/L. Conversely, algae production as indicated by chlorophyll-a samples were below the water quality standard 10 mg/m^3. This is likely due to high turbidity as indicated by Secchi disk measurements that averaged 14-inches, with many readings of less than 10-inches.

Sediment Depth Analysis

The NRCS performed a bathymetric survey of Recharge Lake in 2018. The WQMP recommended the collection of additional bathymetric data to facilitate the evaluation of sediment loading. As described in the Field Data Collection section, TFG performed a bathymetric and sediment depth survey in March of 2024. Sediment depths of 0.2 to 2.3 ft were measured in the upper limits of the reservoir and in the sediment basin upstream of Road K. Comparisons of the 2024 and 2018 surveys estimated roughly 21,400 cy of accumulation over 6 years, which equates to 4,200 tons/yr of sediment loading.

To estimate the volume of sediment accumulated in the reservoir since construction in 1990, as-built plans were consulted for pre-project topography data. The reservoir site plan (as-built sheet 3) included 4-ft interval contour data. These contours were digitized and georeferenced using fence locations. Surface comparison between this map and current bathymetry found that roughly

134,000cy of sediment has accumulated over 34 years. This equates to approximately 4,650 tons/yr. See attached Exhibit 3 for locations of sediment accumulation.

It should be noted that annual loading estimates are approximate, and the accuracy of the sediment depth analysis is limited due to resolution of as-built contours and differences in collection methods used between the NRCS and TFG bathymetric surveys. TFG's estimated annual load of 4,650 tons/yr is within 25% of the WQMP estimate of 6,040 tons/yr, which indicates that these values are reasonably appropriate for planning purposes.

Daily Sediment and Nutrient Loading Analysis

To evaluate BMP alternative sediment and nutrient trapping efficiency at Recharge Lake, TFG estimated daily loading rates from historic rainfall data. This spreadsheet-based analysis applied daily watershed curve number and Universal Soil Loss Equation (USLE) erosion estimation procedures to estimate storm-based runoff and sediment yield, respectively. Rainfall data was acquired for the period of 1990 to 2023. Watershed input parameters were calibrated to match average annual values reported in the WQMP described above. Total phosphorus and nitrogen loading rates were distributed based on daily sediment and excess precipitation yield, respectively. The ten-year period from 1999 to 2008 was considered for BMP evaluation as it reflects a range of rainfall conditions over a typical span of time between potential maintenance operations. Annual summaries are provided to demonstrate the variability in daily rainfall from year to year, and its impact on sediment and nutrient runoff (Table 1).

Table 1. Annual Results of Daily Sediment and Nutrient Loading Analysis

Year	Precip	Runoff	Avg Inflow	Peak Daily Inflow	Sediment Inflow	Sediment Inflow	Nitrogen Inflow	Phos Inflow
-	in	in	cfs	cfs	tons	cy	(lbs)	(lbs)
Period Average	26.5	1.54	51	268	5,824	4,936	51,780	30,183
1999	27.9	1.92	44	248	7,253	6,147	64,661	37,592
2000	20.3	0.58	33	142	2,034	1,724	19,370	10,540
2001	24.9	1.49	52	251	5,555	4,708	50,128	28,792
2002	22.8	0.58	29	84	1,935	1,640	19,462	10,028
2003	22.7	0.81	47	160	2,899	2,457	27,224	15,025
2004	22.9	0.54	62	155	1,962	1,663	18,104	10,167
2005	26.5	2.16	75	543	8,815	7,471	72,677	45,687
2006	27.6	1.67	64	399	6,526	5,531	56,068	33,824
2007	33.6	2.71	55	381	10,284	8,716	91,021	53,302
2008	35.5	2.95	54	314	10,974	9,301	99,087	56,878

Procedures used in this analysis are generally limited to ephemeral streams. This allows for conservatively high estimates of event-based sediment and nutrient loading. Nutrient loading derived from intermittent baseflow conditions are not considered.

BMP Alternatives Evaluation

The BMPs identified by the WQMP and through this study were evaluated for their effectiveness to improve water quality in Recharge Lake. Two Alternatives were considered for this analysis. Alternative 1 utilizes the general BMPs and areas from the WQMP, as shown in Figure 2. Alternative 2, as shown in attached Exhibit 4, was developed for this study to meet water quality goals stated in the WQMP and through this study.

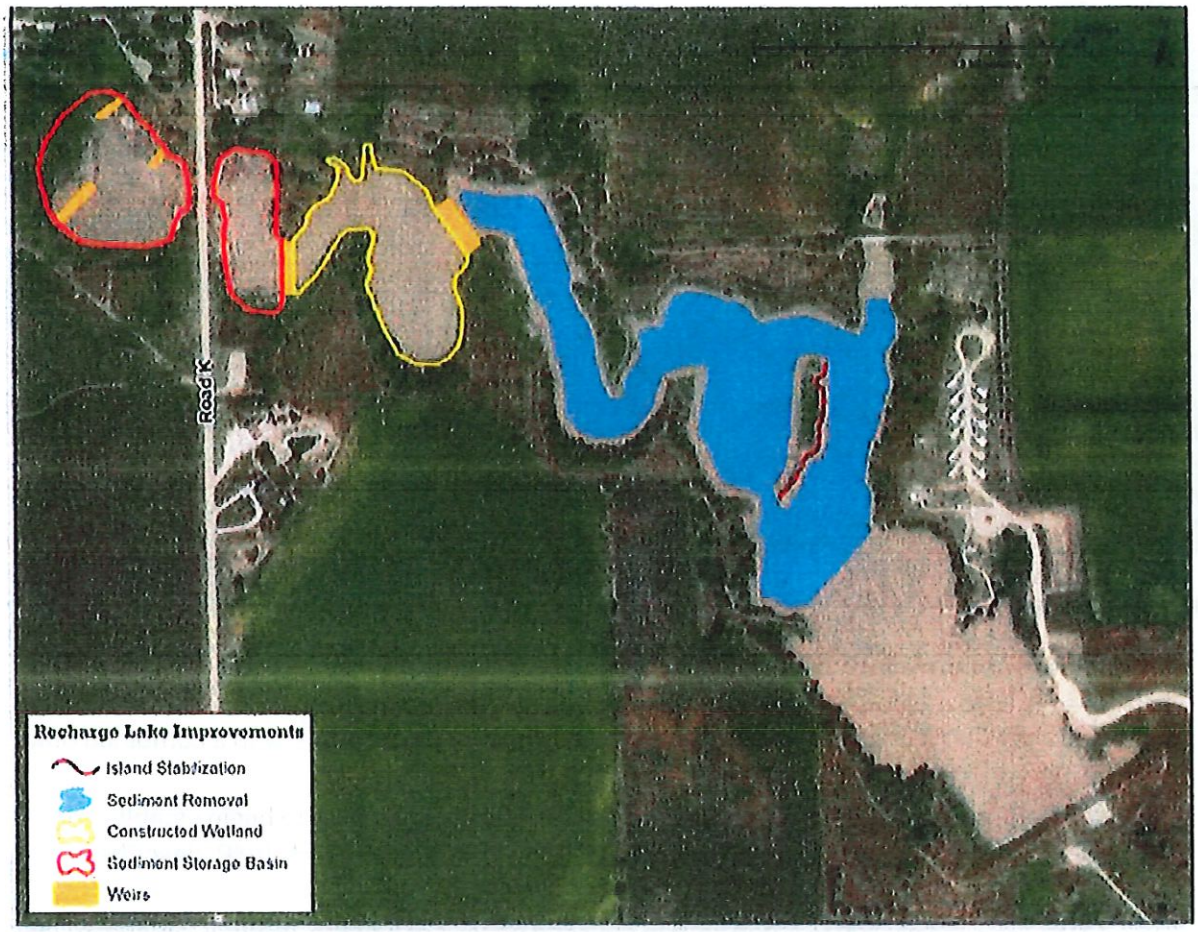


Figure 2. Conceptual In-Lake BMPs (Source: UBBNRD 2020 WQMP)

Near-Lake Wet Detention Pond – Step 1 of the Water Quality "Treatment Train"

- A wet pond removes sediment and nutrients through particle settling, and nutrient uptake can occur through biological activity (Figure 3). The WQMP BMPs propose the construction of a wet pond in the upper limits of Recharge Lake, upstream and downstream of Road K. The basic footprint already exists but would need to be enhanced to provide water quality benefits.
- The WQMP, Alternative 1, identified a constructed wet pond basin with 6 acres dedicated for primary sediment storage. Alternative 2 increased this complex to 8 acres based on site conditions, optimal placement of the overflow weir, and water quality improvement goals.

- Targeted excavation areas (4ft deep) to facilitate future maintenance. This excavation increases the operating depth to 0 to 8 ft.
- Earthen baffle structures forces water to flow over a long distance, which improves trapping performance.
- Weir overflow structure constructed of rock riprap and/or articulated concrete block matting.
- Targeted excavation areas to facilitate future maintenance.

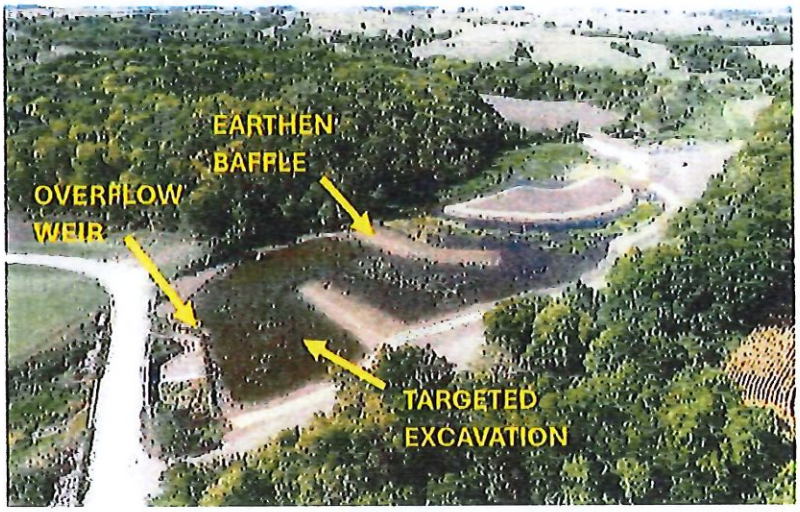


Figure 3.
Near-Lake Wet Detention Pond at Summit Lake near Tekamah NE

Floating Treatment Wetlands – Step 2 of the Water Quality Treatment Train

- Floating treatment wetlands (FTW) could be implemented as an intermediate strategy to reduce nutrient loading and provide aquatic habitat for fish and insects.
- This BMP was not identified in the WQMP. Alternative 2 shows FTWs with a combined area of 13,000 sq-ft.
- FTWs could be employed immediately after the restoration project to begin establishing emergent vegetation, and then discontinued as the In-Lake Wetlands BMP (described below) becomes established.
- FTWs are typically 400 to 1,000 sq-ft in area and consist of a frame, matting material to hold plants, and about 1,000 plants (Figure 4). Plant roots are suspended in the water column below the FTW and absorb nutrients from the water body. The suspension allows FTWs to adapt to fluctuating water body depths.

Figure 4.
UNL Students assembling a floating treatment wetland at Cooper YMCA in Lincoln NE

In-Lake Treatment Wetlands – Step 3 of the Water Quality "Treatment Train"

- The proposed In-Lake Wetland would be created downstream of the Near-Lake Detention Wet Pond. Emergent wetland vegetation would provide aquatic habitat and filter sediment and nutrient runoff (Figure 5).
- The WQMP, Alternative 1 identified an In-Lake Wetland complex of 4.5 acres. Alternative 2 increased this complex to 8 acres based on site conditions, optimal placement of the overflow weir, and water quality improvement goals.
- Weir overflow structure constructed of rock riprap and/or articulated concrete block matting.
- Designed to trap sediment becoming shallower over time to promote establishment of emergent wetland vegetation - no excavation is planned for this area. Operating depths are 0 to 4 ft.
- Underwater baffles with native wetland vegetation plantings increase hydraulic retention times and promote recruitment of desired species to other areas as conditions allow.

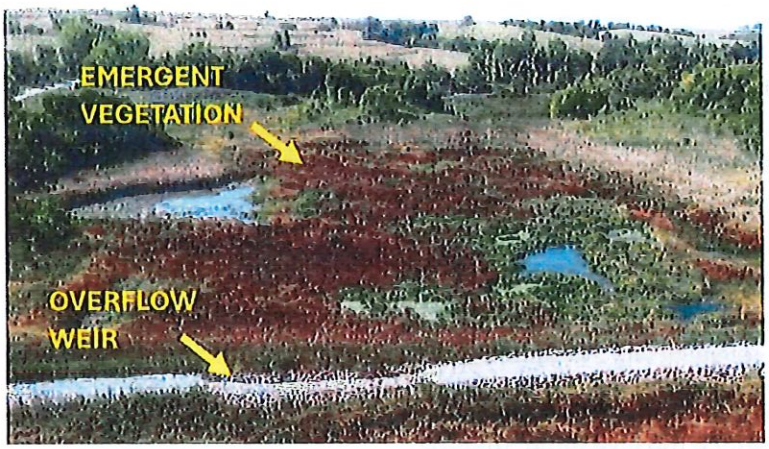


Figure 5.
In-Lake Treatment Wetland
at Summit Lake near Tekamah NE

Reservoir Deepening – Step 4 of the Water Quality "Treatment Train"

- As stated in the WQMP, sediment removal from Recharge Lake will reduce re-suspension, revive the lake's capacity to attenuate nutrients, and reduce in-lake phosphorus that is attached to sediment particles. Excavation to increase the storage capacity by 20%. This goal was identified in UBBNRDs 2018 plan for the recreation area.
- The WQMP, Alternative 1 identified an excavation volume of 62 ac-ft to achieve the 20% goal. Alternative 2 reduced this volume to 55 ac-ft to meet the 20% goal by increasing the footprint of upstream BMPs and reducing the overall surface area of Recharge Lake 5.5 acres.
- Target excavation to achieve an over-wintering depth of 12ft or greater over 25% of the reservoir to improve the fishery and water quality.
- Deep water excavation areas (6ft) are targeted in areas with highest sediment thickness.
- Shallow water excavation areas (4ft) target sediment accumulation in the upper reservoir.

- Draining of the reservoir with dry-land excavation, as compared to dredging, is recommended for cost considerations. This approach provides the added benefit of removing undesirable fish species such as carp, which are known to increase turbidity, resuspend phosphorous, and decrease native submerged aquatic vegetation while increasing algae. Additionally, the approach facilitates removal of invasive plant species.

Island Restoration

- Over time, the primary island within Recharge Lake has eroded away. The WQMP estimated that 60% of the island surface area has been lost to erosion. Shoreline protection measures associated with this BMP are described further below.
- The WQMP, Alternative 1 identified shoreline protection along the east side of the Island to protect against prevailing southeast summer and fall winds. Alternative 2 extends this protection around the island to facilitate placement of spoil material from the Reservoir Deepening BMP.
- While this BMP was not evaluated for nutrient load reductions, it does provide a sediment reduction benefit.

Shoreline Protection Measures

- Using a combination of drone flight imagery and in-lake boat reconnaissance, TFG developed a shoreline inventory (Exhibit 1). Shoreline reaches were categorized as having either active erosion, marginal erosion with some vegetation, shallow vegetated stable slope or existing rock riprap protection.
- Alternative 2 shows recommended locations for shoreline protection measures. A wind rose analysis (Figure 6) was performed by TFG to calculate prevailing wind direction and identify locations for shoreline armoring and jetties (Figure 7). Jetties can be employed to reduce the lake fetch, thereby reducing erosion causing wave run-up.

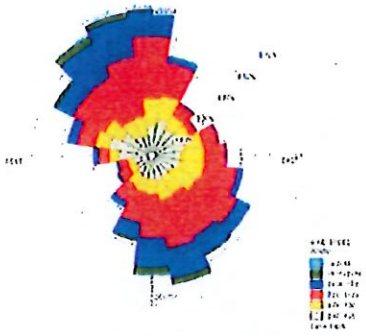


Figure 6. Wind Rose diagram for York AWDN Station (March to May)

- Protection measures include hard armoring with rock, block retaining wall and sheet-pile seawall. Softer measures include bio-stabilization through native planting revetments, which create living shorelines for aquatic habitat.
- Shoreline protection offers the opportunity to improve angler access to the lake. In many cases, these angler access improvements were located in proximity to selective reservoir deepening.

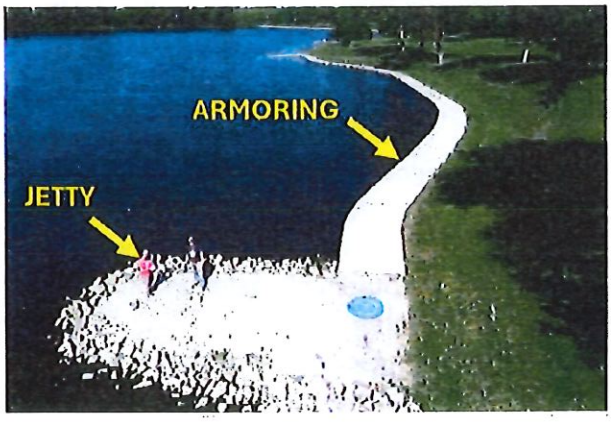


Figure 7. Shoreline Protection Measures at Conestoga Reservoir near Denton NE

Aquatic Habitat Structures

- Potential underwater aquatic habitat structures include rock piles, gravel spawning beds (Figure 8), log cribs / root pile (Figure 9), and mussel filtration beds water quality and fishery.
- Alternative 2 shows potential locations for aquatic habitat structures.

Figure 8. Gravel Spawning Bed. A combination of small riprap (Class A) and crushed limestone are placed in lake footprint adjacent to shoreline to block aquatic vegetation and provide fish habitat (photo from Summit Lake during lake drawdown).

Figure 9. Log Crib / Root Pile. Underwater "islands" were left in place as sediment was removed from around them. The photo also shows trees anchored with weights and cables to provide fish habitat features (photo above from Conestoga Reservoir during lake drawdown).

BMP Alternative Effectiveness

Effectiveness of BMP alternatives for trapping sediment and nutrients was considered in the WQMP. Trapping efficiency was based on EPA guidance for sediment basins and treatment wetlands, which is summarized in Table 2 below. These efficiencies are intended for watershed planning purposes on an average annual basis and do not account for site specific features such as BMP surface area, treatment volume, hydraulic length, etc.

Table 2. General BMP Trapping Efficiencies for Watershed Planning

BMP	Sediment	Total Phosphorus	Total Nitrogen
Sediment Basin	86%	69%	55%
Treatment Wetland	78%	44%	20%

Source: EPA STEPL

Two methods were employed to evaluate BMP trapping efficiency. Both methods utilize engineering procedures to design particle settling structures. The first method evaluates the surface area and hydraulic length relative to depth to estimate hydraulic loading rate through the BMPs. The second method evaluates the storage volume and associated detention / retention times. Nitrogen reductions were estimated based on the hydraulic loading rate and retention time through the BMPs. Phosphorus reductions were estimated relative to sediment trapping. The difference in the approach is related to Nitrogen being very mobile in surface water, while Phosphorus is held tightly to suspended clay and organic matter particles. This evaluation results in a high to low range of trapping efficiency estimates, as shown in tables 3 and 4. For planning purposes, TFG recommends using the average result from the two methods.

The WQMP takes a "Treatment Train" approach to estimating the effectiveness of BMPs to improving water quality. Tables 3 and 4 replicate this approach for this study to evaluate the two alternatives. The first column provides the values estimated in the WQMP report for reference purposes. TFG deviated slightly from this approach to 1) account for the lack of Watershed BMPs that are not being adopted and 2) account for internal Phosphorus loads estimated for release from bottom sediments that occur downstream of the treatment train.

Reductions in Total Phosphorus (TP) were not able to achieve the WQMP water quality standard of 50ug/L using the recommended design-based estimates for either Alternative 1 or 2 (Table 3). Alternative 2 further reduced TP concentration reductions to 129 ug/L, as compared to 173 ug/L under Alternative 1. Looking at the potential range of reduced TP concentrations of 96 to 250 ug/L, the water quality standard is still not met under Alternative 1. However, the water quality standard has the potential to be met under Alternative 2 with TP concentration estimates between 46 to 212 ug/L.

Findings for Total Nitrogen (TN) reductions were similar to TP. Alternative 1 achieved an expected TN concentration of 1,419 ug/L (range 1,011 to 1,688 ug/L), which did not meet the WQMP water quality standard of 1,000 ug/L. Alternative 2 further reduced TN concentrations to 1,080 ug/L (range of 787 to 1,282 ug/L), which does include the water quality standard.

Table 3. Total Phosphorus (TP) Treatment Train Loading Assessment

Parameter	Units	WQMP	Alternative 1 WQMP Concept			Alternative 2 TFG Concept		
		Report	Low	Design	High	Low	Design	High
Total Watershed Load (External)	lbs/yr	32,235	31,335	31,335	31,335	31,335	31,335	31,335
Measured TP Concentration	ug/L	495						
Watershed BMPs								
Reduction in TP	lbs/yr	(11,449)						
Post BMP Load	lbs/yr	20,786						
Near Lake Detention Ponds								
Capture Rate	%	69%	35%	49%	64%	40%	56%	72%
Reduction in TP	lbs/yr	(14,342)	(10,985)	(15,491)	(19,996)	(12,404)	(17,549)	(22,695)
Post BMP Load	lbs/yr	6,444	20,350	15,844	11,339	18,931	13,786	8,640
Floating Treatment Wetlands								
Capture Rate	lb/sf					0.010	0.045	0.080
Area of FTW	sf					13,000	13,000	13,000
Reduction in TP	lbs/yr					(130)	(585)	(1,040)
Post BMP Load	lbs/yr					18,801	13,201	7,600
In-Lake Wetlands								
Capture Rate	%	44%	15%	26%	44%	22%	32%	55%
Reduction in TP	lbs/yr	(2,835)	(3,112)	(4,042)	(4,973)	(4,188)	(4,466)	(4,749)
Post BMP Load	lbs/yr	3,608	17,238	11,802	6,366	14,613	8,732	2,851
Reservoir Deepening								
Reduction in TP	lbs/yr	(3,248)	(3,248)	(3,248)	(3,248)	(3,248)	(3,248)	(3,248)
Internal TP Load	lbs/yr	-	900	900	900	900	900	900
Post BMP Load	lbs/yr	360	14,890	9,454	4,018	12,265	6,384	503
Expected TP Concentration	ug/L	44	250	173	96	212	129	46

Table 4. Total Nitrogen (TN) Treatment Train Loading Assessment

Parameter	Units	WQMP	Alternative 1 WQMP Concept			Alternative 2 TFG Concept		
		Report	Low	Design	High	Low	Design	High
Total Watershed Load (External)	lbs/yr	53,682	53,682	53,682	53,682	53,682	53,682	53,682
Measured TN Concentration	ug/L	2,180						
Watershed BMPs								
Reduction in TN	lbs/yr	(30,530)						
Post BMP Load	lbs/yr	23,152						
Near Lake Detention Ponds								
Capture Rate	%	55%	7%	19%	37%	11%	24%	42%
Reduction in TN	lbs/yr	(12,734)	(3,545)	(10,062)	(19,996)	(5,804)	(13,128)	(22,695)
Post BMP Load	lbs/yr	10,418	50,137	43,620	33,686	47,878	40,554	30,987
Floating Treatment Wetlands								
Capture Rate	lb/sf					0.05	0.15	0.25
Area of FTW	sf					13,000	13,000	13,000
Reduction in TN	lbs/yr					(650)	(1,950)	(3,250)
Post BMP Load	lbs/yr					47,228	38,604	27,737
In-Lake Wetlands								
Capture Rate	%	20%	17%	20%	26%	34%	35%	38%
Reduction in TN	lbs/yr	(2,084)	(8,603)	(8,748)	(8,893)	(16,392)	(14,055)	(11,719)
Post BMP Load	lbs/yr	8,335	41,534	34,872	24,793	31,486	26,498	19,269
Expected TN Concentration	ug/L	345	1,688	1,419	1,011	1,282	1,080	787

Note: The potential range in nutrient reductions (Low to High) are shown for each alternative. The average of this range is recommended for design purposes.

Planning Level Cost Estimates

Opinions of construction cost were developed for Alternatives 1 and 2 for planning purposes. Table 5 provides a summary of the costs for each BMP component. For comparison, the total phosphorus, nitrogen and sediment reductions are included to evaluate the potential benefits of each BMP.

Table 5. Relative Cost Comparison of BMP implementation for Alternatives 1 and 2. Total phosphorus (TP), nitrogen (TN), and sediment treatment reductions for BMPs are included.

BMP Component	Alternative 1 WQMP Concept				Alternative 2 TFG Concept			
	Cost	TP lbs/yr	TN lbs/yr	Sediment tons/yr	Cost	TP lbs/yr	TN lbs/yr	Sediment tons/yr
Near Lake Detention Ponds	$869,000	(15,491)	(10,062)	(3,321)	$1,079,000	(17,549)	(13,128)	(3,762)
Floating Treatment Wetlands	-	-	-	-	$244,000	(585)	(1,950)	-
In-Lake Wetlands	$309,000	(4,042)	(8,748)	(656)	$309,000	(4,468)	(14,055)	(584)
Reservoir Deepening	$2,053,000	(3,248)	-	-	$1,821,000	(3,248)	-	-
Island Restoration[1]	$149,000				$149,000			
Shore-line Protection[2]	-				$648,000			
Aquatic Habitat Structures[3]	-				$65,000			
General Costs[4]	$338,000				$432,000			
Construction Cost Total 30% Contingency Total + Contingency[5]	$3,718,000 $1,115,000 $4,833,000	(22,781)	(18,810)	(88,746)	$4,747,000 $1,424,000 $6,171,000	(25,266)	(27,184)	(79,544)

1) *Island Restoration line-item cost is limited to shore-line protection only. Earthwork and seeding costs are accounted for under near lake detention ponds and reservoir deepening line items.*
2) *Shore-line Protection line item includes jetties and rock riprap shore-line armoring with a chip trail for angler access.*
3) *Aquatic Habitat Structure line item based on gravel / rock beds. Log structures and rubble piles generally use waste materials and have lower associated costs.*
4) *General Construction Costs include mobilization, erosion and sediment control, general site work, and haul road construction.*
5) *Typical engineering design cost is 10-12% and construction administration/observation is 5-7%.*

Alternative 2 represents the high-end cost estimate to achieve water quality goals, improve aquatic habitat, and enhance angler access. To meet project budgets based on available funding, this alternative can be scaled back. Table 5 is intended to help guide project budget planning by showing each BMPs impact on nutrient reductions. Below are additional planning considerations:

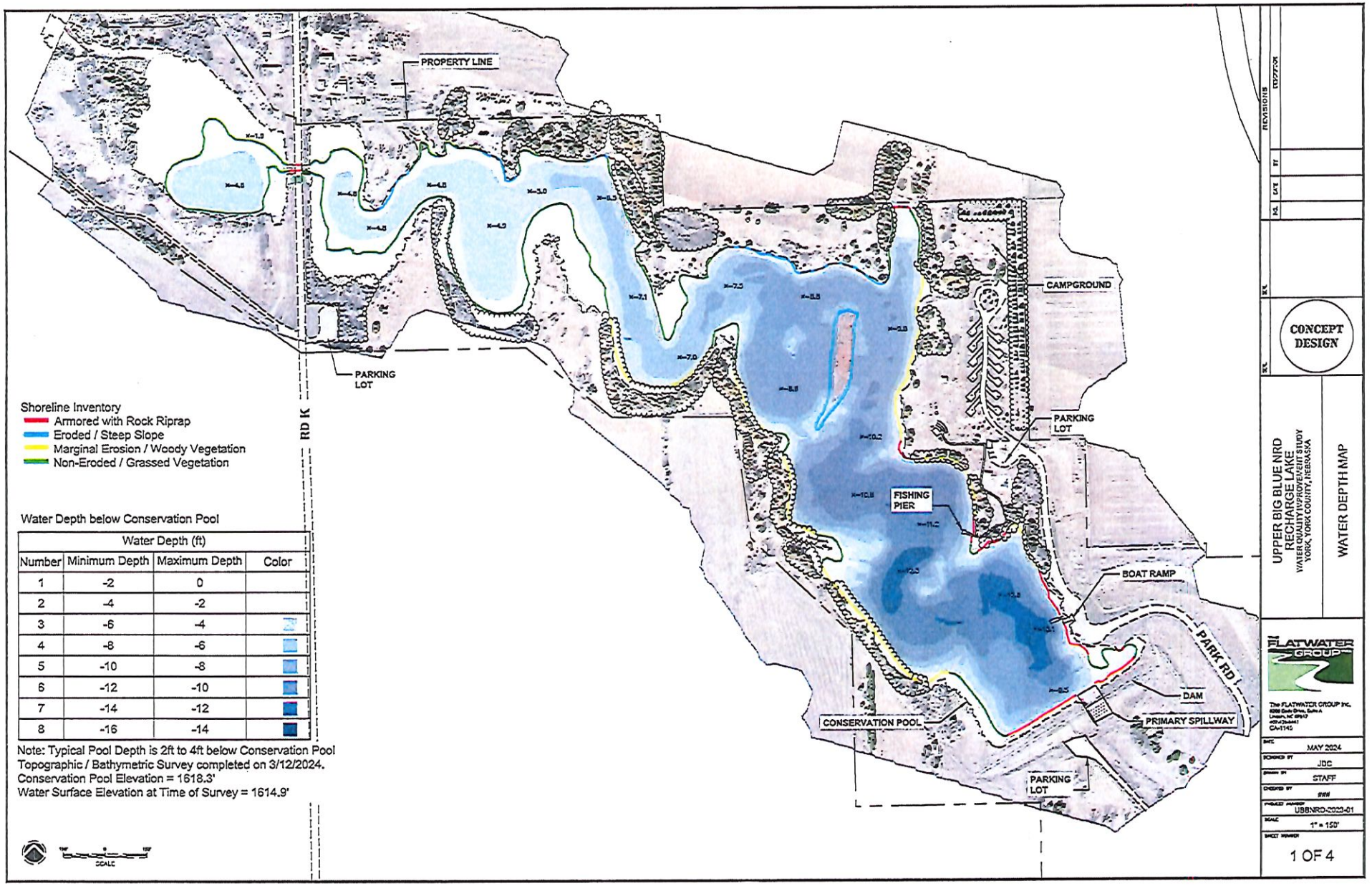
- Cost for reservoir deepening is scalable based on volume of sediment removed.
  - Excavation volume is 62 ac-ft for Alternative 1 and 55 ac-ft for Alternative 2.
- The design life of the near lake detention ponds before maintenance was estimated based on sediment accumulation versus available capacity.
  - Available capacity is 12 ac-ft for Alternative 1 and 16 ac-ft for Alternative 2.

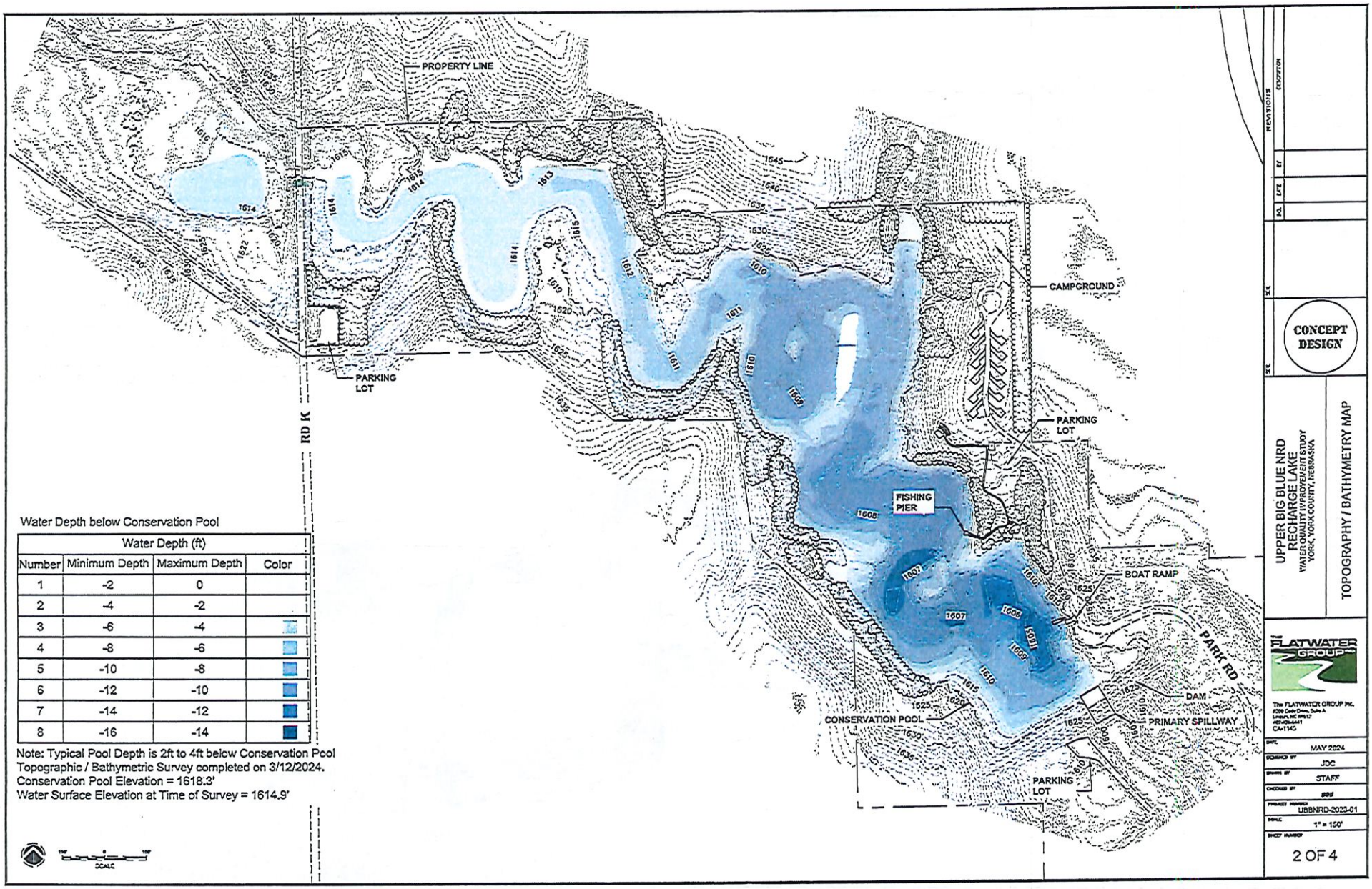
- The amount of time anticipated before first maintenance was estimated as 10 years for Alternative 1 and 18 years for Alternative 2, which accounts for accumulation in both the detention ponds and in-lake wetlands.
- Subsequent maintenance periods are every 7 years for Alternative 1 and 12 years for Alternative 2.

Water Level Management Recommendation

In discussions with UBBNRD staff, a higher quality fishery and better water clarity were observed when the reservoir conservation pool was managed at a higher elevation. Below are some potential benefits associated with groundwater pumping to maintain a higher conservation pool:

- Potential to reduce TSS and turbidity
- Added depth results in less turnover from wind
- Better aquatic habitat with deeper water

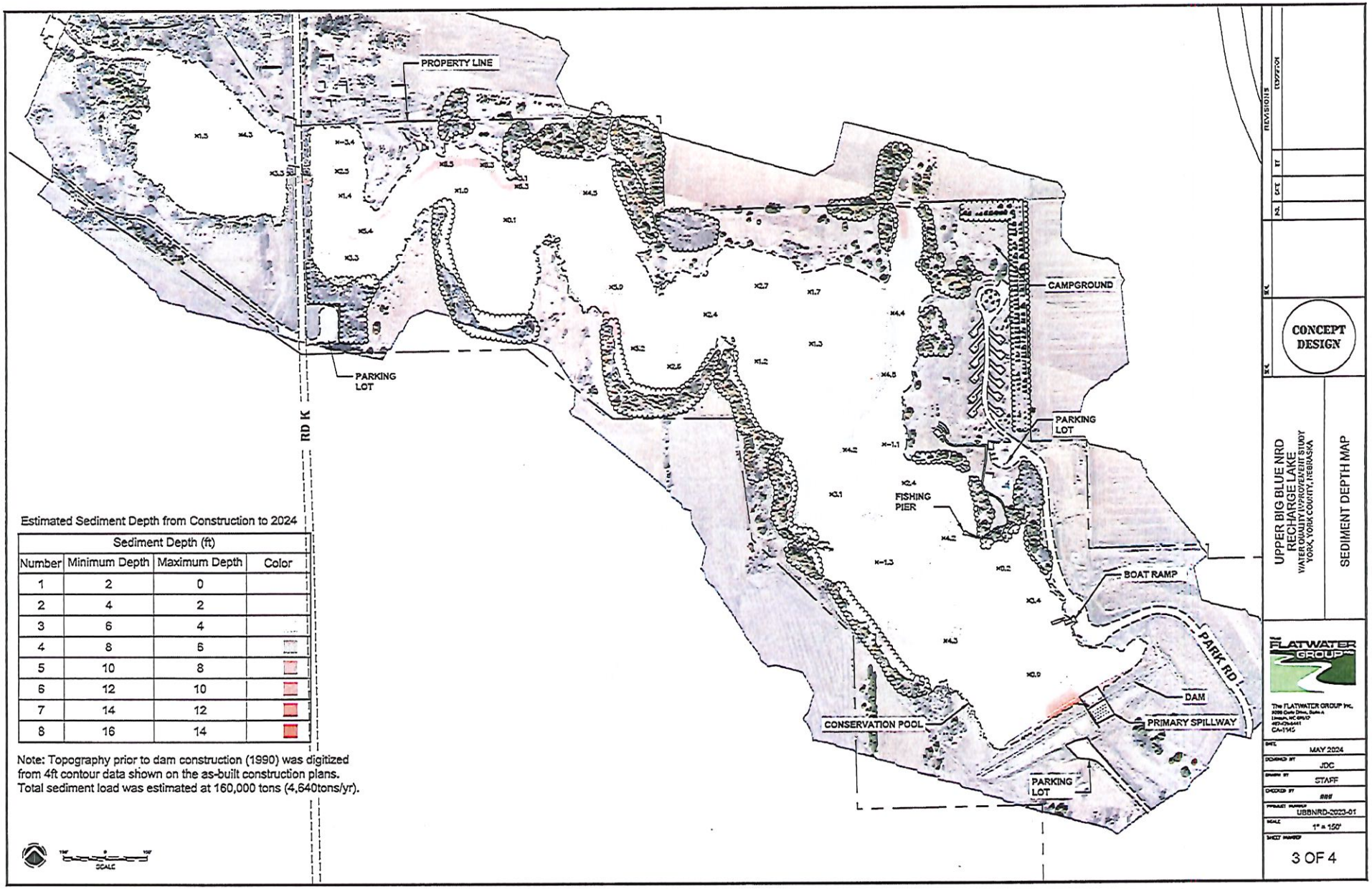

PROPERTY LINE
PARKING LOT
RD K
CAMPGROUND
PARKING LOT
FISHING PIER
BOAT RAMP
PARK RD 1
DAM
PRIMARY SPILLWAY
CONSERVATION POOL
PARKING LOT
Shoreline Inventory
Armored with Rock Riprap
Eroded / Steep Slope
Marginal Erosion / Woody Vegetation
Non-Eroded / Grassed Vegetation
Water Depth below Conservation Pool
Water Depth (ft)
Number | Minimum Depth | Maximum Depth | Color
1 | -2 | 0
2 | -4 | -2
3 | -6 | -4
4 | -8 | -6
5 | -10 | -8
6 | -12 | -10
7 | -14 | -12
8 | -16 | -14
Note: Typical Pool Depth is 2ft to 4ft below Conservation Pool
Topographic / Bathymetric Survey completed on 3/12/2024.
Conservation Pool Elevation = 1618.3'
Water Surface Elevation at Time of Survey = 1614.9'
SCALE
REVISIONS
CONCEPT DESIGN
UPPER BIG BLUE NRD
RECHARGE LAKE
WATER QUALITY IMPROVEMENT STUDY
YORK, YORK COUNTY, NEBRASKA
WATER DEPTH MAP
FLATWATER GROUP
MAY 2024
JDC
STAFF
###
USBNRD-2023-01
1" = 150'
1 OF 4



Water Depth below Conservation Pool

Water Depth (ft)			
Number	Minimum Depth	Maximum Depth	Color
1	-2	0	
2	-4	-2	
3	-6	-4	
4	-8	-6	
5	-10	-8	
6	-12	-10	
7	-14	-12	
8	-16	-14	

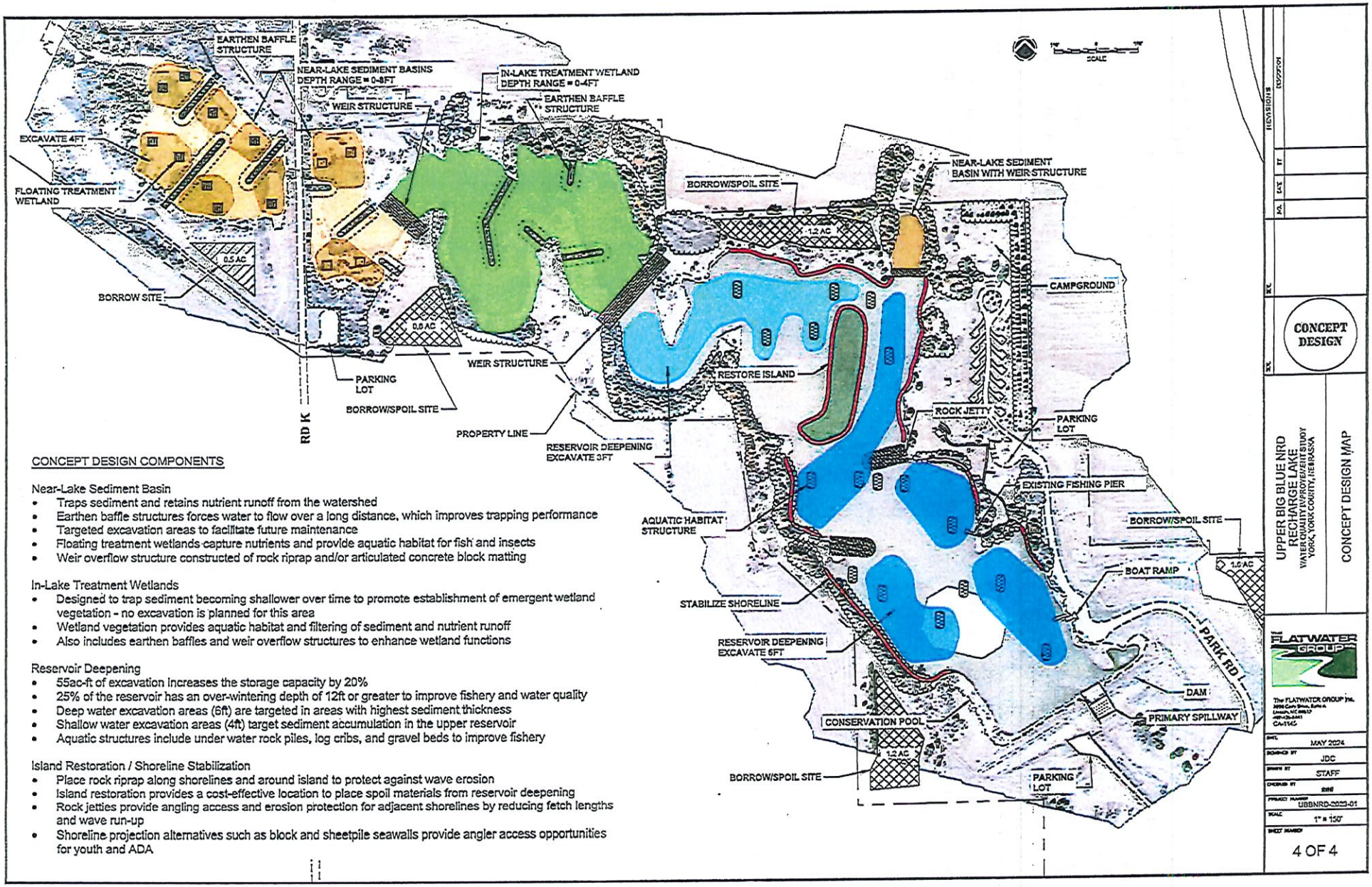
Note: Typical Pool Depth is 2ft to 4ft below Conservation Pool
Topographic / Bathymetric Survey completed on 3/12/2024.
Conservation Pool Elevation = 1618.3'
Water Surface Elevation at Time of Survey = 1614.9'



Estimated Sediment Depth from Construction to 2024

Sediment Depth (ft)			
Number	Minimum Depth	Maximum Depth	Color
1	2	0	
2	4	2	
3	6	4	
4	8	6	
5	10	8	
6	12	10	
7	14	12	
8	16	14	

Note: Topography prior to dam construction (1990) was digitized from 4ft contour data shown on the as-built construction plans. Total sediment load was estimated at 160,000 tons (4,640tons/yr).



CONCEPT DESIGN COMPONENTS

Near-Lake Sediment Basin
- Traps sediment and retains nutrient runoff from the watershed
- Earthen baffle structures forces water to flow over a long distance, which improves trapping performance
- Targeted excavation areas to facilitate future maintenance
- Floating treatment wetlands capture nutrients and provide aquatic habitat for fish and insects
- Weir overflow structure constructed of rock riprap and/or articulated concrete block matting

In-Lake Treatment Wetlands
- Designed to trap sediment becoming shallower over time to promote establishment of emergent wetland vegetation - no excavation is planned for this area
- Wetland vegetation provides aquatic habitat and filtering of sediment and nutrient runoff
- Also includes earthen baffles and weir overflow structures to enhance wetland functions

Reservoir Deepening
- 55ac-ft of excavation increases the storage capacity by 20%
- 25% of the reservoir has an over-wintering depth of 12ft or greater to improve fishery and water quality
- Deep water excavation areas (6ft) are targeted in areas with highest sediment thickness
- Shallow water excavation areas (4ft) target sediment accumulation in the upper reservoir
- Aquatic structures include under water rock piles, log cribs, and gravel beds to improve fishery

Island Restoration / Shoreline Stabilization
- Place rock riprap along shorelines and around island to protect against wave erosion
- Island restoration provides a cost-effective location to place spoil materials from reservoir deepening
- Rock jetties provide angling access and erosion protection for adjacent shorelines by reducing fetch lengths and wave run-up
- Shoreline projection alternatives such as block and sheetpile seawalls provide angler access opportunities for youth and ADA

Exhibit F
RECREATIONAL ENHANCEMENTS

Bruce L. Anderson Recreation Area has a number of recreational opportunities such as picnic shelter, playground, amphitheater, boat dock, boat ramp, ADA accessible fishing dock, RV and tent camping, vault and flush restrooms, archery range, and walking trails. The UBBNRD would like to find opportunities to enhance the recreation area with additional recreational opportunities such as fire pits with seating, horseshoes, shaded seating, bridges for trail connectivity, enhanced trail surfaces to accommodate ADA, and increased fishing access. The OFFEROR should include any available funding sources, and potential partners for recreational enhancements in the final report.

The CONTRACTOR will provide a presentation file with photos of recreational enhancement ideas collected by the CONTRACTOR. This file will be provided at the time of project award to the OFFEROR.

EXHIBIT G

Bruce L. Anderson Recreation Area

Links to Studies

District Wide Water Quality Management Plan

District Wide Water Quality Management Plan | Upper Big Blue Natural Resources District

Part 1

https://www.upperbigblue.org/sites/default/files/resource-files/wqmp_with_appendicies_compressed2_part1.pdf

Part 2

https://www.upperbigblue.org/sites/default/files/resource-files/wqmp_with_appendicies_compressed2_part2.pdf

Part 3

https://www.upperbigblue.org/sites/default/files/resource-files/wqmp_with_appendicies_compressed2_part3.pdf

Bruce L. Anderson Recreation Area
Recharge Lake
Water Quality Improvement Study

https://www.upperbigblue.org/sites/default/files/resource-files/RechargeLakeWQStudy_Final_7June2024.pdf

Recharge Lake WQ Study - Exhibits

https://www.upperbigblue.org/sites/default/files/resource-files/RechargeLakeWQStudy_FinalExhibits_9May2024.pdf