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2024 Water System Facility Plan

Report

City of

North Liberty, IA

April 2025

STRAND ASSOCIATES®

Report for
City of North Liberty, Iowa

2024 Water System Facility Plan

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EXECUTIVE SUMMARY

BACKGROUND

The City of North Liberty, Iowa (City) is responsible for potable water service to residences, businesses, and institutions within the City. The City sources its water from the Jordan and Silurian aquifers, and is treated and distributed to the City's customers. Increased water demand in the City is primarily due to the City's growing population. As population grows, water treatment, raw water supply, and water storage capacities will need to grow to meet increasing water demands. Additionally, water main improvements are required to provide adequate service in the distribution system.

DESIGN CONDITIONS

The City's population as of 2023 was estimated to be 22,710. The population is expected to grow to approximately 34,310 by 2035 and 48,400 by 2045, based on a 3.5 percent annual growth rate. Population growth will drive the need for improvements to water treatment, water supply, water storage, and water mains in the distribution system.

Average day demands (ADD) and peak day demands (PDD) in 2023 were approximately 1.29 and 1.97 million gallons per day (MGD), respectively. This translates to 57 gallons per capita per day (gpcd) average use, and 87 gpcd peak day use. Over the past 6 years, average daily per capita use was 61 gpcd and peak day use was 111 gpcd. To provide adequate conservatism to water demand projections, average day use was estimated at 70 gpcd and peak day use was estimated at 120 gpcd in this report. At the design year of 2045, ADDs are projected to be approximately 3.39 MGD and PDDs are projected to be approximately 5.81 MGD. Improvements to water treatment, water supply, and water storage capacities will be required to meet projected 2045 water demands.

EXISTING FACILITIES

The City owns and operates a water system consisting of six active local groundwater supply wells drawing from the Jordan and Silurian aquifers, a nanofiltration (NF) membrane water treatment plant (WTP), 2.15 million gallons (MG) of finished water storage capacity, an aquifer storage and recovery (ASR) well, and a water distribution and transmission system that spans the City limits.

Raw water supply is provided by three Silurian wells (Well Nos. 3, 4, and 9) and three Jordan wells (Well Nos. 5, 6, and 8) for a total capacity of 3,400 gallons per minute (gpm) (2,300 gpm firm capacity). Well Nos. 3 and 4 have significantly lower capacity, are approximately 40 years old, and may be taken out of service or abandoned during the 20-year planning period. With Well Nos. 3 and 4 out of service, the total raw water capacity is 3,320 gpm (2,220 gpm firm capacity).

The City has operated its NF WTP located at 433 South Front Street since it finished construction in 2018. The plant was constructed for an intended design production capacity of 3.0 MGD and a design intent to provide adequate capacity for a population of approximately 28,940, as noted in the previous *2016 Facility Plan Amendment No. 1*. Actual current water treatment capacity based on normal operation (20 hours of operation, 20.5 percent bypass to achieve 100 milligrams per liter maximum hardness) is 3.17 MGD. Firm capacity (one supply well and one NF skid out of service) is 2.96 MGD.

The City's ASR well (Well No. 7) can provide up to 1.32 MGD of finished water. In recent years, use of the ASR well has not be necessary to meet peak demands and, therefore, it has not been used since 2019. The City wants to consider discontinuing use of the ASR well and converting this well into a raw water source.

Distribution storage is provided by two water towers (with volumes of 0.4 and 1.0 MG, respectively) and one 0.75-MG ground storage reservoir.

WATER SYSTEM EXPANSION ALTERNATIVES

As populations increase, water treatment capacity will need to be increased incrementally. In order to adequately feed the WTP, raw water supply will also need to increase. Phase 1 treatment capacity denotes the existing capacity of the WTP. The existing membrane skids can be expanded to have an additional 10 percent capacity. Additionally, there is space for two more full membrane skids. In Phase 1A, the existing membrane skids will be built out to their full capacities. In Phases 2 and 3, one additional skid will be added per phase.

Additional raw water supply will primarily come from the drilling of additional wells in the Silurian aquifer. Two alternatives were considered for water supply expansion, which can be summarized as:

1. Alternative No. 1–The ASR well remains in service.
2. Alternative No. 2–The ASR well is converted into a raw water supply well.

In Alternative No. 1, the ASR well remains in service as an ASR well, and is able to provide additional peak day finished water capacity. In this case, only Phase 1A and Phase 2 WTP expansions will be required through the design year (2045).

In Alternative No. 2, the ASR well is converted into a raw water supply well, which could provide up to 1,100 gpm of additional raw water capacity, contingent on the appropriate aquifer modeling and permits. In this case, construction of additional Silurian wells could be delayed by approximately 1 year, but WTP expansions will be required sooner. Phase 1A, Phase 2, and Phase 3 WTP expansions will be required through the design year (2045).

Distribution system and storage improvements will be required to provide adequate storage and service through 2045, regardless of which alternative is chosen. Storage volume will need to be increased by 1.25 MG to provide adequate storage through 2045. Additionally, several water main improvements are recommended to increase system looping, mitigate water service disruptions, and provide additional redundancy through 2045.

Table ES-1 presents a summary opinion of probable costs (OPC) for supply, treatment, and storage improvements for Alternative No. 1 in 2024 dollars.

Project Description	Estimated Year Completed	OPC
Phase 1A		
Two New Silurian Wells	2028	$6,610,000
Membrane Replacement and Buildout	2028	$1,270,000
Phase 2		
1.25-MG Water Tower	2031	$8,393,000
Five New Silurian Wells	2037	$11,815,000
Added Membrane Skid and Phase 2 Treatment Improvements	2037	$3,457,000
Total OPC		**$31,545,000**

Table ES-1 Alternative No. 1 Water Supply, Treatment, and Storage OPC Summary

Table ES-2 presents a summary OPC for supply, treatment, and storage improvements for Alternative No. 2 in 2024 dollars.

Project Description	Estimated Year Completed	OPC
Phase 1A		
Well No. 7 Conversion	2028	$1,010,000
Membrane Replacement and Buildout	2028	$1,270,000
Phase 2		
Two New Silurian Wells	2028	$6,610,000
Added Membrane Skid and Phase 2 Treatment Improvements	2028	$3,457,000
1.25-MG Water Tower	2031	$8,393,000
Phase 3		
Five New Silurian Wells	2038	$11,815,000
Add Membrane Skid and Phase 3 Treatment Improvements	2038	$2,325,000
Total OPC		**$34,880,000**

Table ES-2 Alternative No. 2 Water Supply, Treatment, and Storage OPC Summary

The total OPC for improvements through 2045 for Alternative No. 1 is approximately 10 percent less than Alternative No. 2. At the study phase of alternative evaluation, a 10 percent difference is considered approximately equivalent. In addition to the monetary evaluation, a nonmonetary evaluation between alternatives is valuable. Table ES-3 summarizes the results of the comparison of each alternative considering several nonmonetary factors.

Criteria	Description	Alternative No. 1	Alternative No. 2
1	Operational Complexity	0	1
2	Reliability	0	1
3	Operational Flexibility	0	1
4	Expandability	1	1
5	Implementation	1	0
6	Maintenance Requirements	0	1
7	Ability to Meet Future Regulation	0	1
8	Social Impacts	1	0
	Composite Score	**3**	**6**

Table ES-3 Evaluation of Alternatives by Nonmonetary Criteria

Water main improvements are needed on the basis of population growth, and timing is determined by timing and location of development in the City, criticality of the deficiency being addressed, water main age, the City's preference, and other factors. Table ES-4 presents a summary of the OPC for recommended water main improvements through 2045.

Improvement No.	Description	Years Until Completed	Present Worth OPC
1	12-Inch Water Main Loop Between Harlen Street and Forevergreen Road	5 to 10	$262,000
2	8-Inch Water Main Between 230th Street and Pheasant Lane	0 to 5	$137,000
3	12-Inch Water Main Loop on North Liberty Road	0 to 5	$1,034,000
4	8-Inch Water Main Loop Between Dubuque Street and East Tartan Drive	0 to 5	$296,000
5	12-Inch Water Main Loop on Jasper Avenue	5 to 10	$1,559,000

Table ES-4 Water Main Improvement OPC Summary

IMPACT ON USER RATES

As with any capital-intensive water project, the financed portion as well and operational and maintenance expenses will need to be funded through user rates. A detailed evaluation of the potential impact of this project on user rates is beyond the scope of this study. The City should consult with a trusted financial advisor to provide guidance on which type of funding is recommended for the City, the preferred loan term, and the final impact on water user fees.

SUMMARY AND RECOMMENDATIONS

Alternative Nos. 1 and 2 were evaluated based on monetary and nonmonetary criteria. While Alternative No. 1 has a lower OPC, Alternative No. 2 had a higher rating based on the nonmonetary criteria. Alternative No. 2 will help reduce the stress on the Jordan aquifer by distributing pumping over more wells and a larger area. It also improves reliability and flexibility of the raw water supply by having another high capacity well. Given these benefits, Alternative No. 2 is recommended, which includes completing Phases 1A and 2 for supply and treatment by year 2028.

Based on the evaluations presented in this *2024 Water System Facility Plan* (Facility Plan), the following recommendations are offered:

1. Proceed with increasing the raw water supply by completing the following improvements, with an estimated completion in 2028:
   a. Construct two additional Silurian wells and associated raw water main.
   b. Convert the existing ASR to a water supply well.
2. Proceed with increasing the water treatment capacity by completing the following improvements, with an estimated completion in 2028:
   a. Expand the capacity of the existing NF skids by 10 percent by adding membranes and replace the existing membrane elements as needed.
   b. Add a fourth NF skid and other WTP improvements identified in this Facility Plan.
3. Proceed with planning and budgeting for adding a new 1.25-MG water tower, with an estimated completion of 2031.
4. Proceed with planning and budgeting for water main Improvement Nos. 2 through 4 summarized in Table ES-4, to be completed within the next 5 years.

The concepts presented in this Facility Plan should be reviewed and discussed and decisions made regarding the specific features and components to be included in the selected plan. Part of the decision process will include deciding how quickly to expand the facilities to meet the growing needs of the community. The City should concur with the concepts as presented or direct that revised analyses be made. Following acceptance by the City, the Facility Plan should be submitted to the Iowa Department of Natural Resources (IDNR) for review and approval. Following comment by the IDNR, the design phase of the selected project should be initiated, as appropriate.

Once a decision is reached, then discussions can proceed on various preliminary design aspects associated with the selected plan. Some recommendations and analyses discussed in this Facility Plan may merit more detailed examination. During the design development stage, numerous decision points will arise regarding specific features of the proposed project. It can then be decided which recommendations to include in the selected plan and which deviations to make from the concepts proposed by this analysis.

SCHEDULE

The following schedule is proposed for completing the water system improvements as outlined in this Facility Plan, presuming population growth is as projected. The City should continue to monitor population growth and adjust the schedule accordingly.

Project Milestone	Month and Year	OPC
Submit Facility Plan to IDNR	April 2025	
IDNR Facility Plan Review	April to December 2025	
Phases 1A and 2–Water Supply and Treatment		**$12,347,000**
Preliminary Design (concurrent with IDNR review)	August to December 2025	
Final Design	January to September 2026	
IDNR Review and Permitting	September to February 2026	
Bidding	February to March 2027	
Construction	April 2027 to November 2028	
Phase 2–Water Storage		**$8,393,000**
Project Design	July to June 2029	
IDNR Review and Permitting	July to December 2029	
Bidding	January to February 2030	
Construction	March 2030 to October 2031	
Water Main Improvements		**$1,467,000**
Project Design	January to October 2027	
IDNR Review and Permitting	November 2027 to February 2028	
Bidding	February to March 2028	
Construction	April 2028 to October 2029	

Table ES-5 Proposed Project Schedule