Stantec

Memo

To:	Shingle Creek Watershed Management Commission	From:	Katy Thompson, PE, CFM Rena Weis, EIT Todd Shoemaker, PE Stantec
Project/File:	227705751	Date:	August 4, 2023

Reference: Gaulke Pond Subwatershed Assessment—BMP Prioritization

The Shingle Creek Watershed Management Commission (SCWMC) requested Stantec evaluate opportunities to reduce stormwater runoff volume to the Gaulke Pond. As part of this effort, we have reviewed the available data, conducted a field reconnaissance visit, and conducted a desktop-based evaluation of potential sites within the Gaulke Pond subwatershed, that could be retrofit to include a volume-reduction best management practice (BMP). This document summarizes the project background, watershed changes, opportunity locations and BMPs considered, and preliminary results for discussion.

1 Background

The Gaulke Pond watershed is located within the cities of Crystal, New Hope, and Robbinsdale. The watershed roughly spans south to north, from 38th Avenue to 49th Avenue; and west to east, from Boone Avenue to Welcome Avenue (Figure 1). Gaulke Pond is the most downstream in a series of four ponds, including Hagemeister Pond, Brownwood Pond, and Memory Lane Pond, within the City of Crystal. Gaulke Pond collects runoff from 883 acres of residential, institutional, and commercial properties upstream and discharges via a pump system east into storm sewer, and ultimately Twin Lake.

As part of this project, we reviewed a substantial number of reports and sources regarding the Commission and cities of Crystal and New Hope's management of stormwater and floodplains. The goal was to develop a wholistic understanding of the watershed, its history, existing issues, and future work.

Reference: Gaulke Pond Subwatershed Assessment—BMP Prioritization

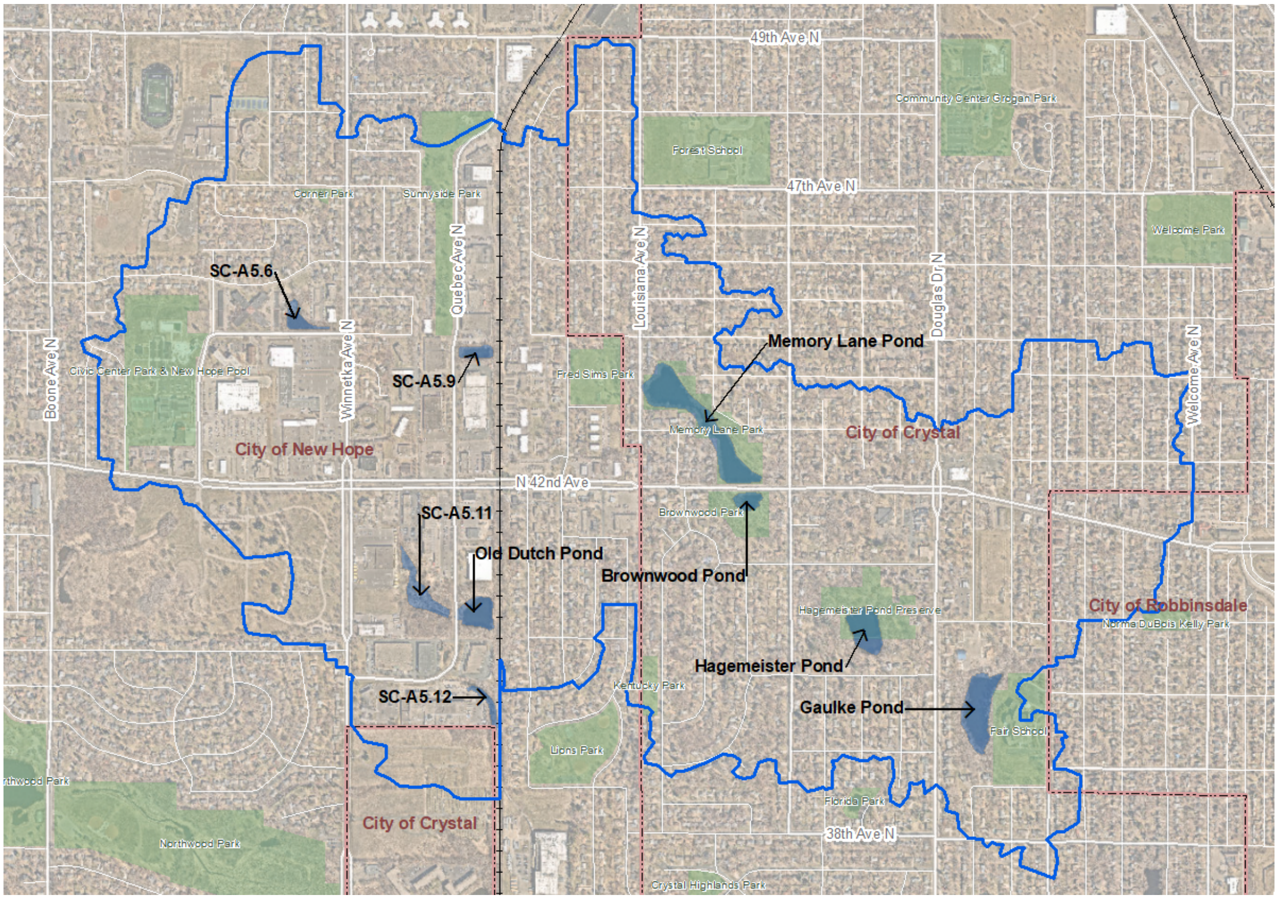

Figure 1. Gaulke Pond watershed and major features location map.

1.1 Watershed and Land Use Changes

Prior to European settlement, the Gaulke Pond watershed native vegetation consisted primarily of Oak Openings and Barrens and Prairie (Minnesota Department of Natural Resources, 2022), based the General Land Office (GLO) records from 1856, which show that the watershed was low-lying swamp, with pockets of prairie in the northeast portion of the watershed (Figure 2 (Minnesota Geospatial Information Office, 2011)).

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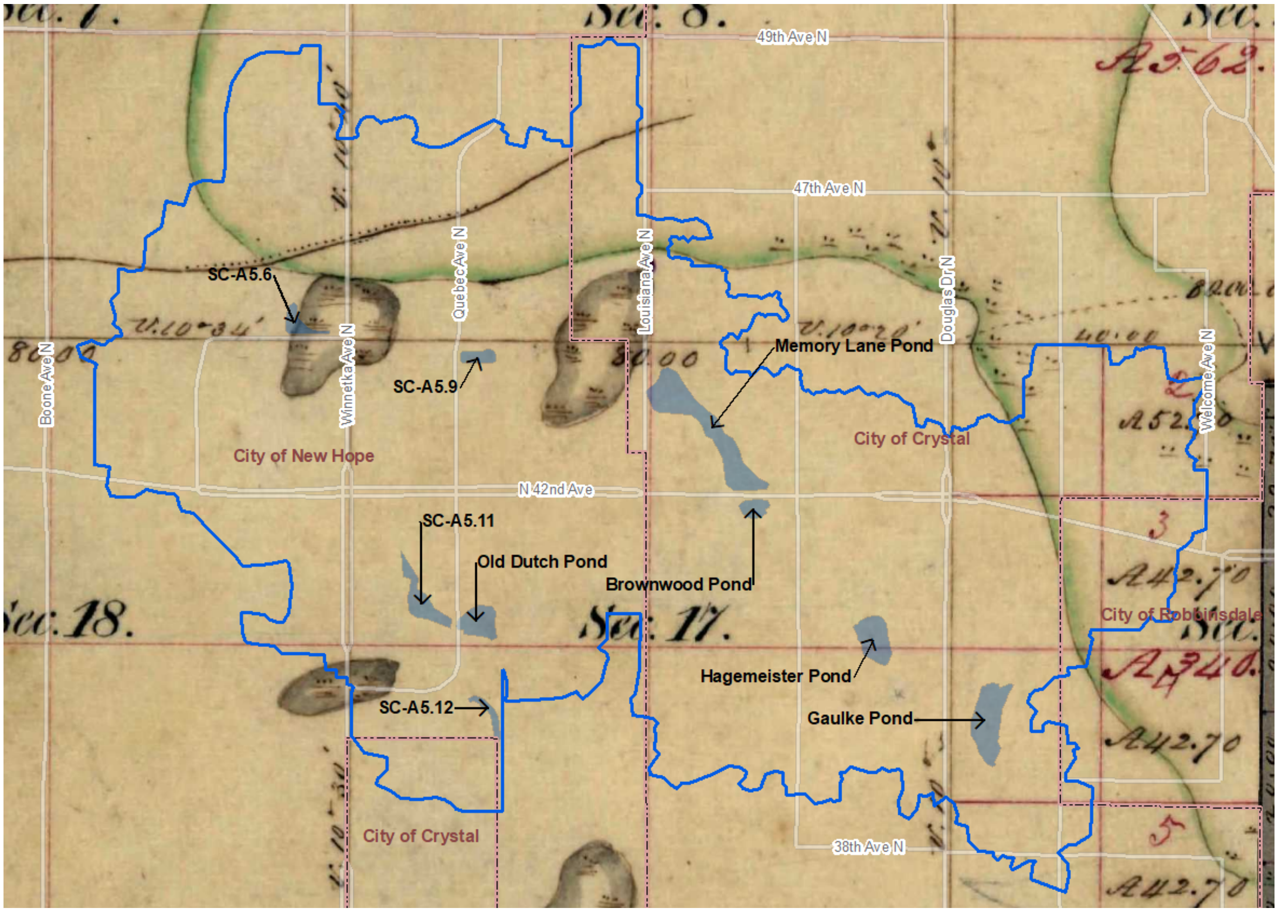

Figure 2. Gaulke Pond watershed and major waterbodies overlaid on the 1856 GLO land survey map. Green boundary indicates prairie, while the gray represents swamps; none of the present-day Gaulke Pond features were mapped.

The United States Geological Survey (USGS) conducted the first topographic survey of the area in 1905, which shows construction of roadways, including the current 42nd Avenue, Winnetka Ave, and Douglas Drive (Figure 3). The swamp areas identified in 1856 no longer appear, but Brownwood Pond and Gaulke Pond are now clearly mapped, though much larger than their present-day footprints.

Using the 1902 quadrangle contours, the undeveloped watershed was roughly 735 acres versus 884 acres today. In addition, Gaulke Pond is mapped with a normal water elevation of approximately El. 890 and an overflow to the northeast, likely over a low point in 42nd Avenue, east of Douglas Road, around El. 895.

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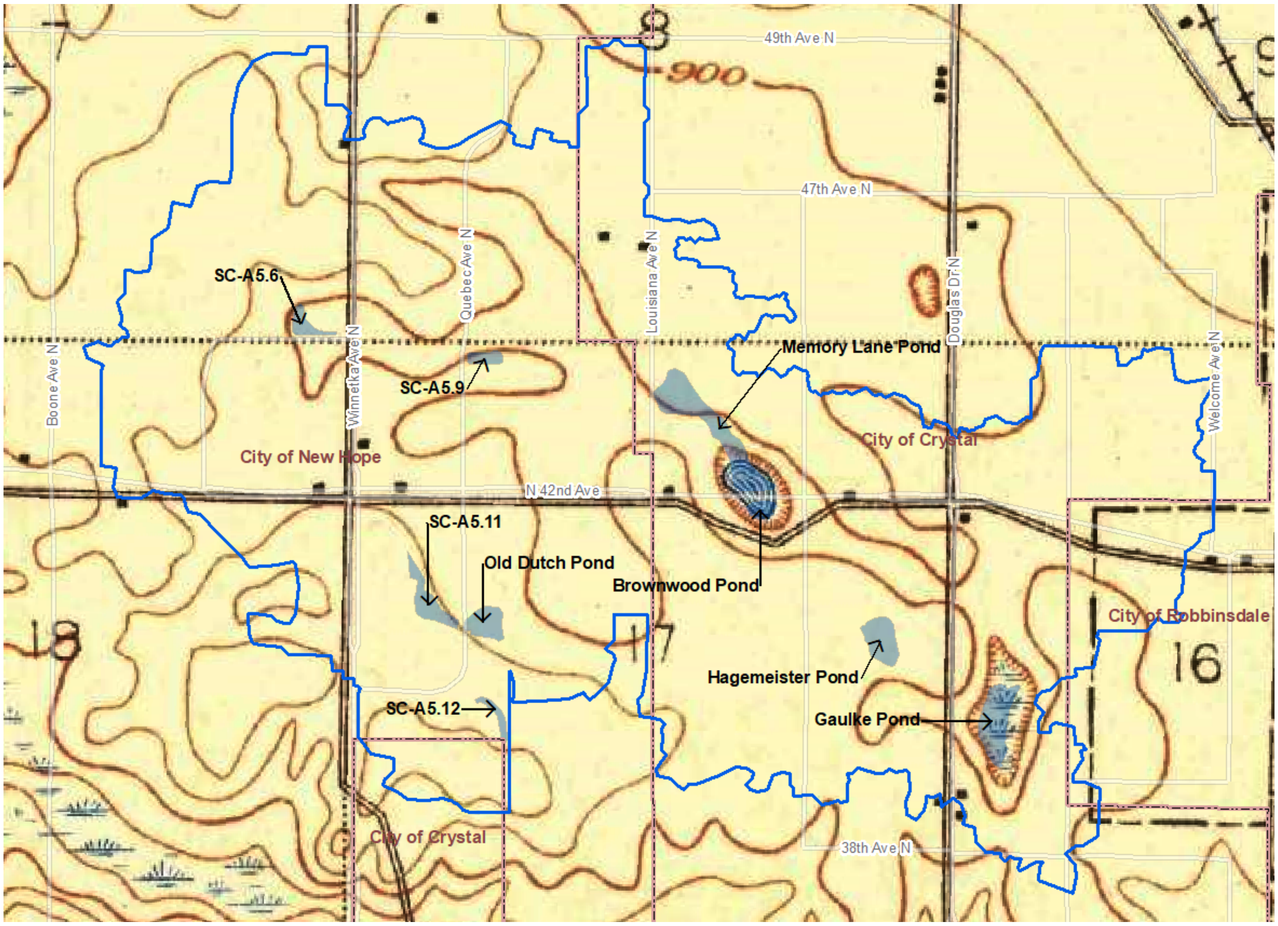

Figure 3. Gaulke Pond watershed and major waterbodies overlaid on the 1902 Anoka USGS quadrangle. Note the construction of present-day 42nd Avenue though the center of the watershed, as well as definition around Brownwood and Gaulke Ponds.

The first aerial photos were collected in 1937 and show the encroachment of urban development from the east, agricultural field across the majority of the watershed, and pockets of undisturbed oak woodlands, the largest remnant located to the southwest of Hagemeister Pond (Figure 4). Hagemeister Pond first appears in these photos, indicating that it is a constructed pond. The 1937 aerial photos also faintly show the agricultural ditches providing drainage for the present day Old Dutch Pond and northwest of Memory Lane Pond.

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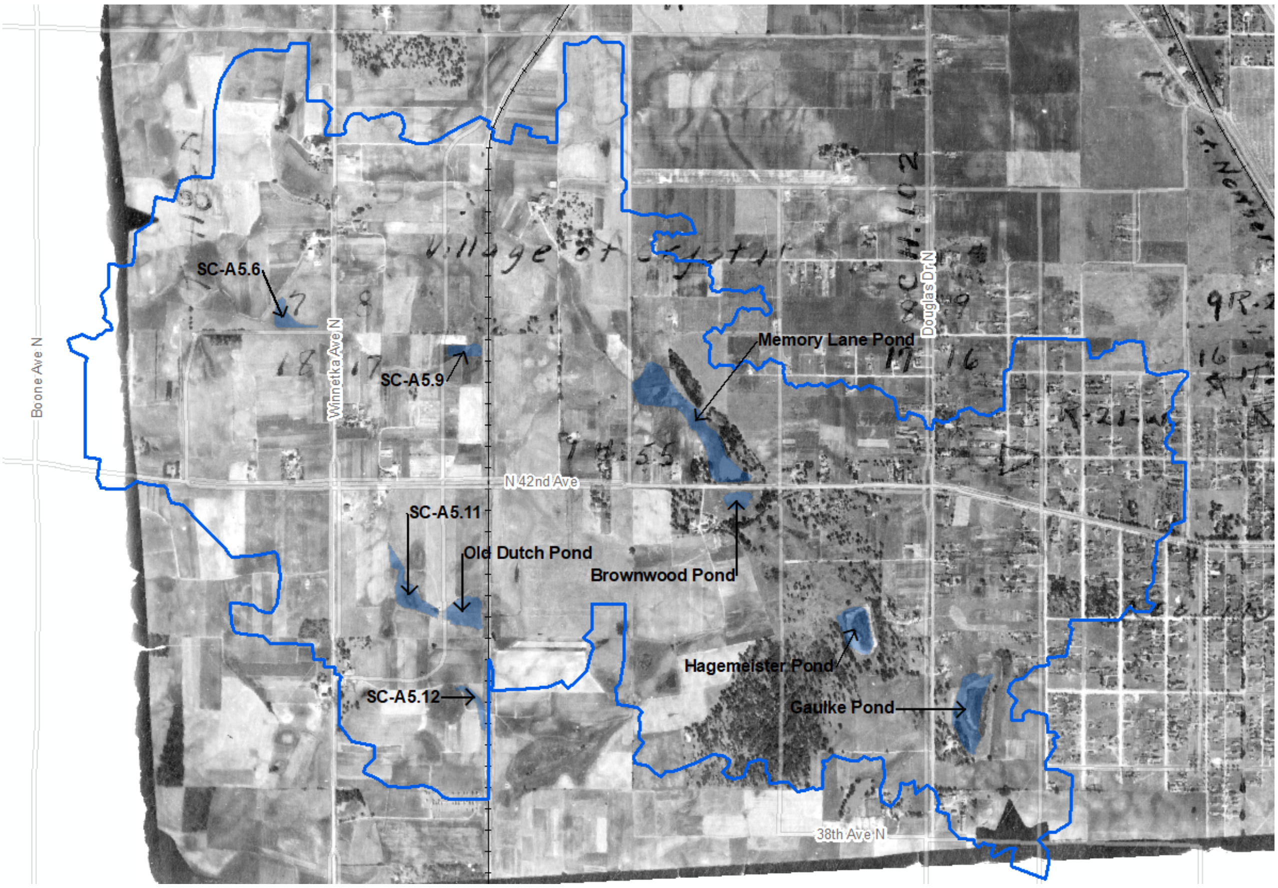

Figure 4. 1937 aerial photo of Gaulke Pond watershed and key waterbodies.

Nearly twenty years later, by 1956 (Figure 5), the east half of the watershed is intensively urban, development is encroaching on the remaining agricultural lands, and none of the native oak woodlands remain. Old Dutch Pond first appears in the aerial photos in 1952 and is clearly shown on both sides of the Canadian Pacific Railroad crossing by 1956, with a much larger footprint than today's pond. Construction of the Fair School to the east of Gaulke Pond shows the waterbody taking on its current location and shape. The USGS quadrangles from the early 1950s (Figure 6) highlight the hydraulic connections creating the Gaulke Pond chain, as well as a number of pocket wetlands in the west half of the watershed, indicating that the native soils in the New Hope area are poorly draining or the area is subject to high groundwater.

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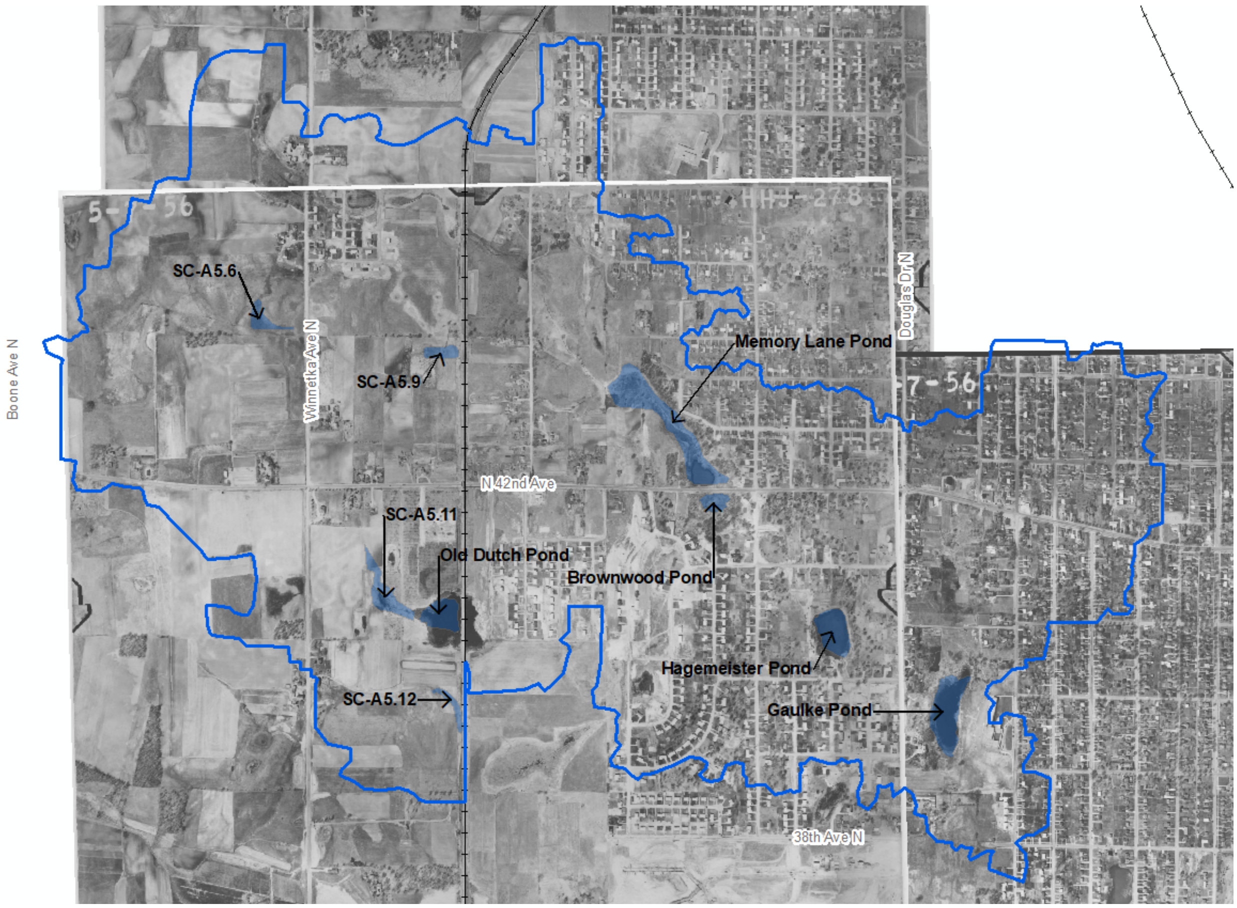

Figure 5. 1956 aerial photo of Gaulke Pond watershed and key waterbodies.

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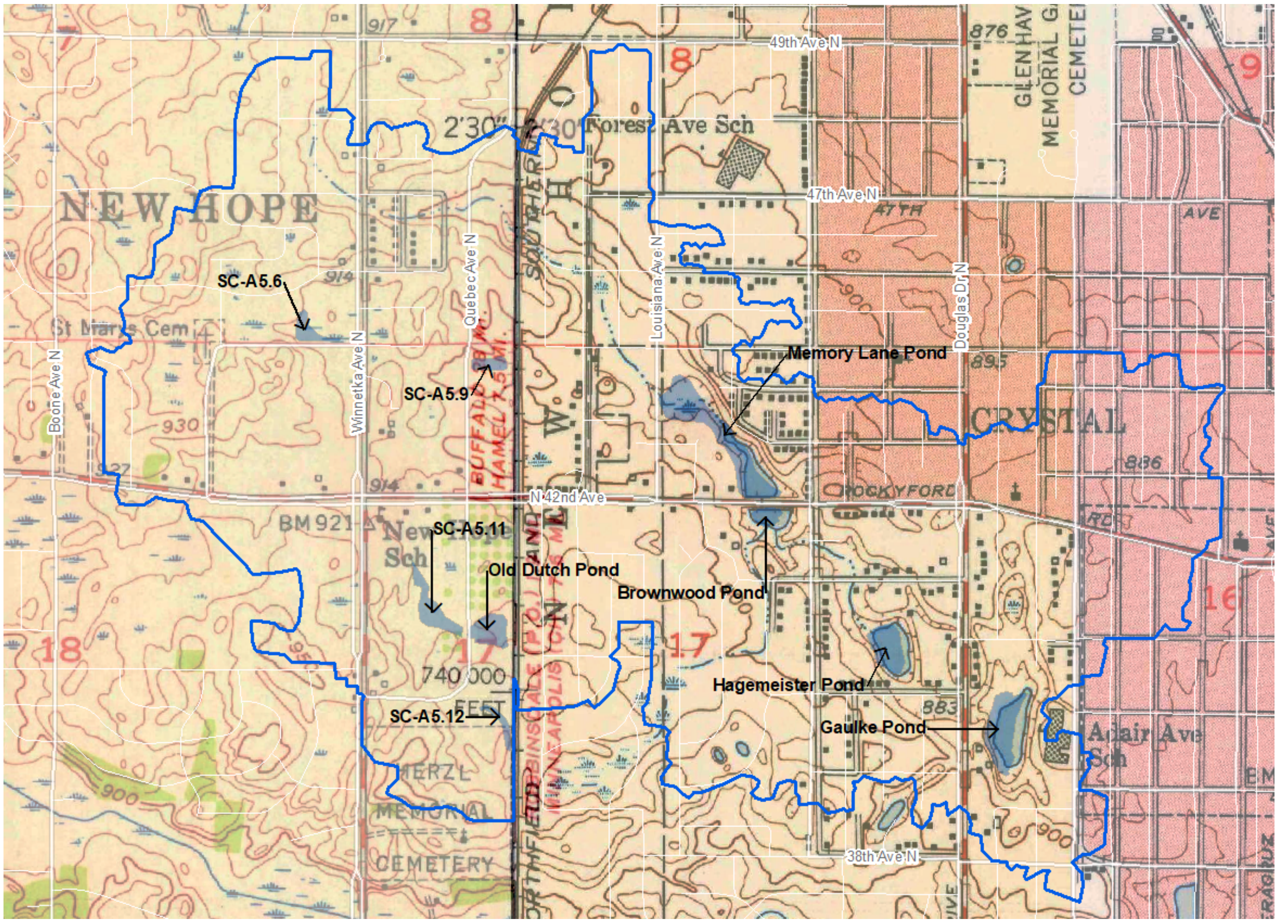

Figure 6. Gaulke Pond watershed and 1952 North Minneapolis and 1955 Osseo USGS quadrangle mapping

The USGS quadrangles also show how much urbanization and fill has occurred in the watershed, resulting in a larger watershed, with increased impervious surfaces that generate more rainfall runoff; fewer wetlands and open spaces to infiltrate rainfall; and reduced storage in the remaining ponds and wetlands to absorb the increased runoff.

1.2 Flooding

The highest recorded flood elevations in the chain occurred on April 11, 1965 from spring snowmelt. Because the system is land-locked, the long duration spring snowmelt events, such as the 1965 event, as well as intense summer rainstorms resulted in flooding (FEMA 2016). Since the extreme flooding in 1965, the City of Crystal installed a pumped outlet design at Gaulke Pond into its municipal storm sewer, which ultimately discharges into Lower Twin Lake. While this alleviated some flooding concerns, in discussions with the City of Crystal, the system can still get overloaded, especially during the 1987 “Superstorm” when flooding occurred within the City of Crystal at low points connected to the Gaulke Pond chain.

To address flood risk in the watershed and improve maintenance operations, the City of Crystal commissioned several studies, including the Gaulke Pond Discharge Rate Evaluation in 2019, the Central Core Stormwater Project expanded Gaulke Pond, installed a new pumping system, and lowered the normal water level in 2022. This project work increased the live storage within Gaulke Pond by 11.7 acre-feet (AF).

The Central Core Stormwater Project identified several potential deficiencies in the City of Crystal's storm sewer system, specifically undersized pipes that may be contributing to the surface flooding occurring in other parts of the watershed. It should be noted that this study evaluated the City of Crystal in detail but did not include the same level of detail upstream in the City of New Hope. While the focus was on the Gaulke Pond chain, it is possible that this approach did not account for the upstream storage and attenuation provided by the City of New Hope's infrastructure and existing stormwater ponds, such as Old Dutch Pond.

This study focuses on potential volume reduction practices as a way to reduce flooding in the Gaulke Pond chain. With a few exceptions, additional detention or increased pipe capacity alternatives were not considered as part of this project scope.

2 Opportunity Identification

After project kickoff, Stantec reviewed the available data and facilitated a project kickoff meeting with city staff from New Hope and Crystal to discuss the project objectives, data reviewed and needs, as well as previously identified issues or areas of concern within the Gaulke Pond watershed. During the meeting, initial screening criteria was discussed to identify potential BMP locations and types. The group determined that the sites would be selected as a potential opportunity location, if they met the following criteria:

1. City-owned land, including street right-of-way.
2. City priorities from previously identified flooding concerns and priority areas from the 2021 Central Core Stormwater Project, as well as upcoming street and utility projects.
3. Suitable soils for infiltration (i.e., hydrologic soil group A or B).

2.1 Public Land

Stantec completed a desktop review of the subwatershed in GIS to determine potential opportunity sites and areas to focus our efforts. Of the total 1,938 parcels within the Gaulke Pond subwatershed, 47 were public and quasi-public parcels, summarized in Table 1 and shown in Figure 7.

Reference: Gaulke Pond Subwatershed Assessment—BMP Prioritization

Table 1. Summary of public parcel ownership and areas in Gaulke Pond subwatershed.

Taxpayer Name	No. Parcels	Area (ac)
City of Crystal	21	42.5
City of New Hope	19	43.1
City of Robbinsdale	1	1.7
Hennepin County	1	3.0
Robbinsdale School District No. 281	5	68.7
TOTAL	**47**	**159.0**

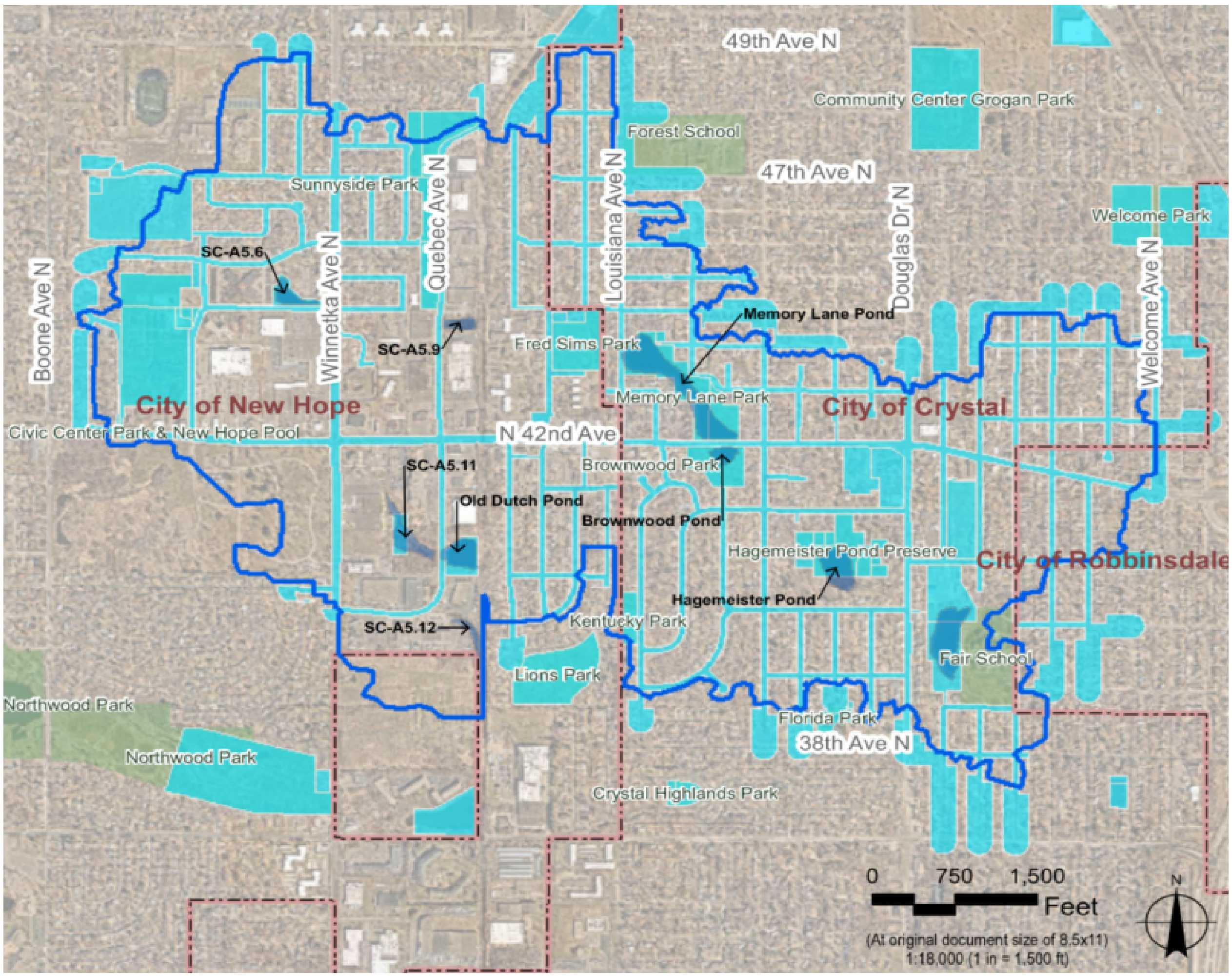

Figure 7. Public parcels within the Gaulke Pond subwatershed.

Reference: Gaulke Pond Subwatershed Assessment—BMP Prioritization

2.2 City Priorities

The goal of this project is to find the most cost-effective BMP to provide maximum volume reduction benefits within the Gaulke Pond watershed. One way to minimize construction costs is to incorporate the BMP construction with an upcoming municipal project that will also require excavation and underground utility work, so that a single contractor can be hired to complete all of the proposed work. An added benefit is that this method can also reduce the disruption to residents and businesses to a single project, rather than multiple construction interruptions.

At the project kickoff meeting, the cities of Crystal and New Hope provided a list of upcoming municipal projects that would result in excavation and or replacement of existing utilities within the public right-of-way. Additionally, the cities ranked these projects for potential political backing and support from councils. The results are summarized in Table 2 and shown on Figure 8.

Table 2. City identified and ranked opportunities for the Gaulke Pond subwatershed BMPs

City Priority	Site ID	Description	Street or Utility Project Construction Year
1	A1	Old Crystal Public Works parking lot	2024
2	A2	Colorado Avenue between 41st and 42nd Avenues	2025
3	A3	Colorado Avenue	2025
4	A4	Brunswick Avenue	2027
5	A5	42nd Avenue and Canadian Pacific Bridge	-
6	A6	43rd Avenue and Xenia Avenue	-
7	A7	Old Dutch Pond	-
8	A8	Nevada Avenue	-
9	A9	Fred Simms Park	-
10	A10	Brownwood Pond	-
11	A11	Hagemeister Pond	-

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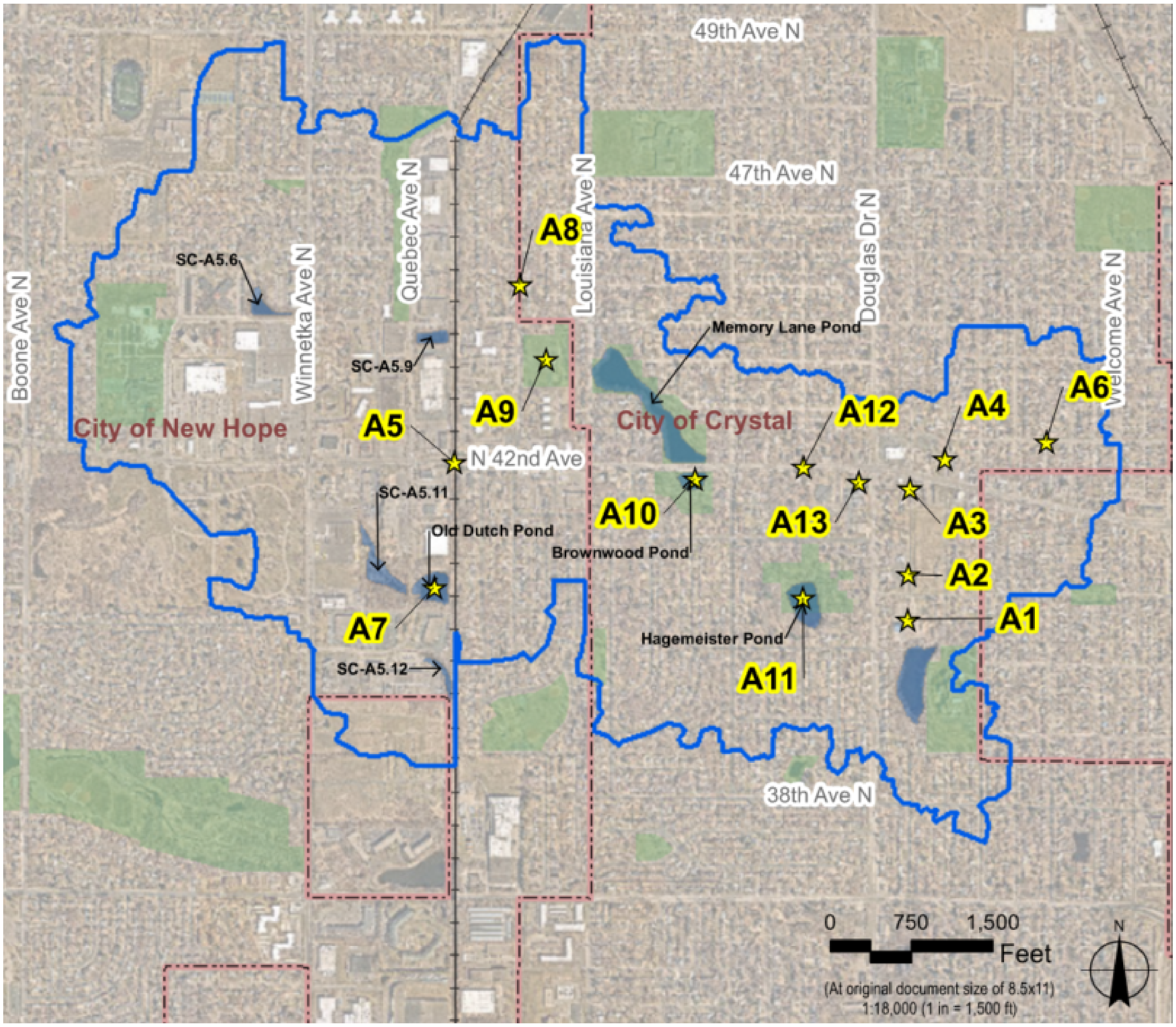


Figure 8. City-identified opportunity areas within Gaulke Pond watershed.

2.3 Suitable Soils

As the goal of this project is to reduce stormwater runoff, the most cost-effective method to do so is to increase infiltration of runoff; however, this can only be accomplished in areas with suitable soils and adequate separation to groundwater. Due to the development of the watershed, the standard soil data set, the Natural Resources Conservation Service (NRCS) only classifies the soils as “urban fill” and does not provide insight into the underlying soils’ ability to infiltrate.

Reference: Gaulke Pond Subwatershed Assessment—BMP Prioritization

Due to the NRCS SSURGO dataset primarily indicating "urban fill" within the Gaulke watershed, a historic soil dataset was utilized to identify soil types and corresponding hydrologic soil groups (HSGs). The HSG indicates the soil's ability to infiltrate water, HSG A have the highest infiltration rates, while HSG D soils have the lowest. NRCS data was used to correspond historically present soil series with HSGs. Where NRCS data was not available, the Minnesota Pollution Control Agency (MPCA) Minnesota Stormwater Manual was used to supplement. Specifically, Hayden Loam was classified as HSG B, while Maumee Sandy Loam and Thurston Loamy Sand were classified as HSG A, shown in Figure 9.

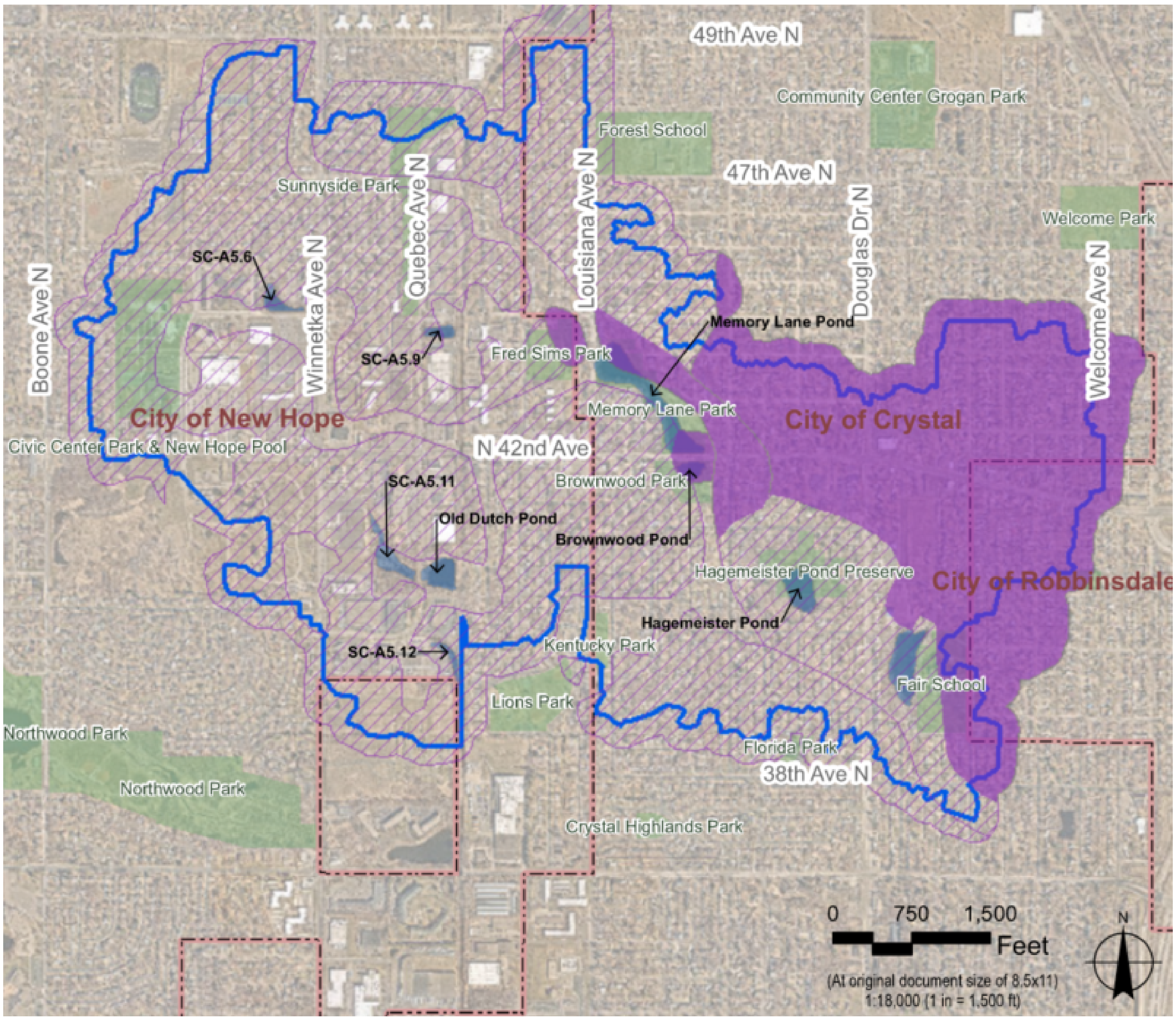


Figure 9. Historic soils with HSG A (solid purple) or B (purple hatch) soils within Gaulke Pond watershed.

Anecdotal information from the cities, the historic soils data, and field observations indicate that the City of Crystal may have more suitable soils for infiltration BMPs than the City of New Hope; however, this should be confirmed as part of any final design.

Groundwater information was not readily available, so for initial site evaluation purposes, it has been assumed to be at the same elevation as the surface of neighboring waterbodies.

2.4 Screening Results

Using the information generated, opportunity areas were identified for further discussion with the cities. Stantec developed a suite of generalized BMP options for consideration and used this to assess potential BMPs for consideration at each of the opportunity sites. Stantec then met with city staff on April 21, 2023, to review each opportunity site, discuss potential for incorporating volume reduction BMPs, and any known existing site constraints that may affect implementing BMPs. The following sections summarize each site's existing conditions, site constraints, potential BMP, and if infiltration is feasible, the maximum volume infiltrated annually using the MPCA Minimal Impact Design Standards (MIDS) calculator. Figures for each of the opportunities considered are presented at the end of this document.

2.4.1 CITY OF CRYSTAL OLD PUBLIC WORKS

<u>Opportunity ID</u>: A1

<u>Existing conditions</u>: Public works storage parking lot, with 36-inch storm sewer beneath that conveys stormwater from the north to Gaulke Pond. As part of the recent Gaulke Pond improvements, a pre-treatment hydrodynamic separator was installed in the southwest portion of the parking lot (Figure 10). Underlying soils at this location are unknown, but historical soil data indicate potential HSG A.

<u>Site constraints</u>: The site is used for storage of city public works equipment and materials, which includes heavy trucks and machinery that result in large weight loads over the parking lot, which drives cover and material requirements for underground stormwater management facilities. Depth of a future stormwater facility at this location would be limited by the water levels in Gaulke Pond. Existing storm sewer depths may not allow for gravity diversions.

<u>Potential BMP opportunities</u>: Underground infiltration

<u>Annual volume infiltrated</u>: 115 AF

2.4.2 COLORADO AVENUE

<u>Opportunity IDs</u>: A2 and A3

<u>Existing conditions</u>: Existing residential street, bounded by the city's drinking water reservoir to the east and residential housing and a church to the west. The street drains north to south towards Gaulke Pond and is intercepted by storm sewer running along the east curb line (Figures 11 and 12).

<u>Site constraints</u>: Existing utilities, including maintaining adequate separation between water main and any proposed storm sewer, as well as separation from city's reservoir limit width of any potential BMP.

Additional constraints include basement elevations and existing storm sewer inverts, which will limit opportunities to divert water via gravity into a new BMP.

Potential BMP opportunities: Underground infiltration chamber or pipe gallery, perforated pipe underdrains, infiltration trenches within right-of-way.

Annual volume infiltrated: 20.6 AF (A2) and 16.3 AF (A3)

2.4.3 BRUNSWICK AVENUE LOW POINT

Opportunity ID: A4

Existing conditions: Low point on Brunswick Avenue is known to flood several feet deep, flooding cars parked in the street and the neighboring Brunswick United Methodist Church (Figure 13). This area also appears to have once served as the original overflow outlet for Gaulke Pond. Historic soils data indicate this area may be HSG A.

Site constraints: Underground utilities and limited public right-of-way dictate the maximum BMP footprint. Additional constraints include groundwater, low floor elevation of the Brunswick United Methodist Church, and existing storm sewer inverts, which will limit opportunities to divert water via gravity into a new BMP.

Potential BMP opportunities: Offsite BMP through a partnership with Brunswick United Methodist Church; underground infiltration gallery or chamber, perforated pipe underdrains, or infiltration trenches within right-of-way.

Annual volume infiltrated: 13.4 AF

2.4.4 42ND AVENUE LOW POINT

Opportunity ID: A5

Existing conditions: Low point on 42nd Avenue frequently floods and results in standing water at the low point under the Canadian Pacific Railway (CPR) bridge. Historic soils data indicate this area is predominately HSG D soils and not suitable for infiltration.

Site constraints: Underground utilities, including gas mains. Increased coordination due to multiple ownerships within the public right-of-way, including the CPR bridge pier, abutments and footings, as well as Hennepin County, as 42nd Avenue is also a County State Aid Highway (CSAH). Existing storm sewer inverts will limit opportunities to divert water via gravity into a new BMP and underlying soils are not conducive to infiltration.

Potential BMP opportunities: None identified, infiltration not feasible.

2.4.5 43RD AVENUE

Opportunity ID: A6

Existing conditions: Historic soils indicate HSG A soils, which were confirmed by city staff observations. The opportunity area is located along 43rd Avenue between Adair and Zane Avenues. A 27-inch storm sewer run from east to west and neighboring structures appear to have basements elevated above the existing inverts (Figure 14).

Site constraints: Limited right-of-way and existing utilities, unknown groundwater elevation.

Potential BMP opportunities: Underground infiltration chamber or pipe gallery, perforated pipe underdrains, infiltration trenches within right-of-way.

Annual volume infiltrated: 13.3 AF

2.4.6 OLD DUTCH POND

Opportunity ID: A7

Existing conditions: Heavily wooded, the site is bounded by Quebec Avenue and the CPR tracks (Figure 15). Standing water observed during April 2023 site visit and historic soils data indicate HSG D soils.

Site constraints: Public waters and wetland regulations, high groundwater elevations, and unsuitable soils for infiltration.

Potential BMP opportunities: None identified, infiltration not feasible.

2.4.7 NEVADA AVENUE

Opportunity ID: A8

Existing conditions: Previous studies identified this as an opportunity to reduce flooding in the Gaulke Chain in previous studies; however, upon further investigation, the placement of the existing sanitary sewer and water main within the right-of-way limit any infiltration practice to 10-feet in width (Figure 16).

Site constraints: Only a portion of the street has HSG B soils and unfortunately this is located more than 150-feet away from the nearest storm sewer.

Potential BMP opportunities: None identified, infiltration not feasible due to site constraints.

2.4.8 FRED SIMS PARK

Opportunity ID: A9

Existing conditions: A 27-inch storm sewer runs along 43rd Avenue, south boundary of Fred Sims Park in New Hope, starting at Nevada Avenue and discharges into Memory Lane Pond in Crystal (Figure 17). The soils in this area are HSG B and may be suitable for infiltration.

Site constraints: Existing stormwater pond and wetland in the northeast corner of the park indicate groundwater may be at El. 878 and neighboring basement elevations are estimated at El. 881, leaving no vertical distance for infiltration.

Potential BMP opportunities: None identified, infiltration not feasible due to site constraints.

2.4.9 BROWNWOOD PARK

Opportunity ID: A10

Existing conditions: Brownwood Park in the City of Crystal has a mixture of HSG A, B, and D soils. At the outfall of an 18-inch storm sewer, the soils appear to be HSG B. Public waters and wetland regulations apply to Brownwood Pond, but there appears to be enough area near the outfall to grade in a shallow infiltration basin (Figure 18).

Site constraints: Public waters and wetland regulations, as well as high groundwater and poor soils may limit infiltration potential.

Potential BMP opportunities: Surface infiltration basin at storm sewer outfall.

Annual Volume Infiltrated: 22.4 AF

2.4.10 HAGEMEISTER POND PRESERVE

Opportunity ID: A11

Existing conditions: Hagemeister Pond Preserve in the City of Crystal has some open space near the northwest corner of the park near an outfall for a 36-inch storm sewer (Figure 19). The historic soil data indicates the soils may be suitable for infiltration with HSG B and there is enough relief to provide separation from groundwater. Public waters and wetland regulations apply to Hagemeister Pond, but there appears to be enough area near the outfall to grade in a shallow infiltration basin.

Site constraints: Public waters and wetland regulations, as well as high groundwater and poor soils may limit infiltration potential. In addition, existing storm sewer inverts appear to be lower than the proposed grading, preventing gravity flow.

Potential BMP opportunities: None, infiltration not feasible due to site constraints.

2.4.11 CITY OF NEW HOPE PARKS

Because the soils in New Hope do not appear to be conducive to infiltration, Stantec discussed the possibility of using city park area to provide stormwater detention, to reduce flooding concerns downstream in the Gaulke Pond chain. The city representative was receptive to the idea, but further internal discussions with city staff indicated that the city highly values usable park space, limiting the feasibility of this option due to existing topography and adjacent water levels prohibiting the use of underground systems. In addition to reviewing Fred Sims Park, Sunnyside Park and Corner Park were evaluated, but found not to have adequate separation from the assumed groundwater or large enough drainage areas to pursue conceptual designs further.

2.4.12 ADDITIONAL OPPORTUNITIES

The Robbinsdale Independent School District No. 281 and YMCA own a significant amount of land near Old Dutch Pond that could be used to increase stormwater storage and detention capacity. Further consideration is contingent on future discussions, led by the cities, with the landowners to determine interest before any partnership or designs are developed.

3 BMP Evaluation

Using the information and feedback provided by the cities, as well as the site constraints observed, conceptual BMP footprints and annual volume reductions, Stantec narrowed the potential BMPs down from fifteen to five feasible options and one option in need of more data to confirm its validity. The results are summarized in Table 3.

Table 3. Summary of potential BMPs for consideration.

ID	Site Name	BMP Type	Drainage Area (ac)	Feasible?	Annual Volume Infiltrated (AF)
A1	Old Public Works	Underground Infiltration Vault	136	Underlying soils, depth to groundwater, and storm sewer inverts need to be confirmed	115
A2	Colorado Ave	Infiltration Trench	129	Yes	20.6
A3	Colorado Ave	Infiltration Trench	122	Yes	16.3
A4	Brunswick Ave	Infiltration Trench	50	Yes	13.4
A6	43rd Ave	Infiltration Trench	38	Yes	13.3
A10	Brownwood	Infiltration Basin	33	Yes	22.4

Using Water Research Foundation (WRF) lifecycle costs, Stantec the estimated conceptual-level capital cost for each of the feasible BMPs and ranked the by the cost to infiltrate a single acre-foot of stormwater runoff.

Reference: Gaulke Pond Subwatershed Assessment—BMP Prioritization

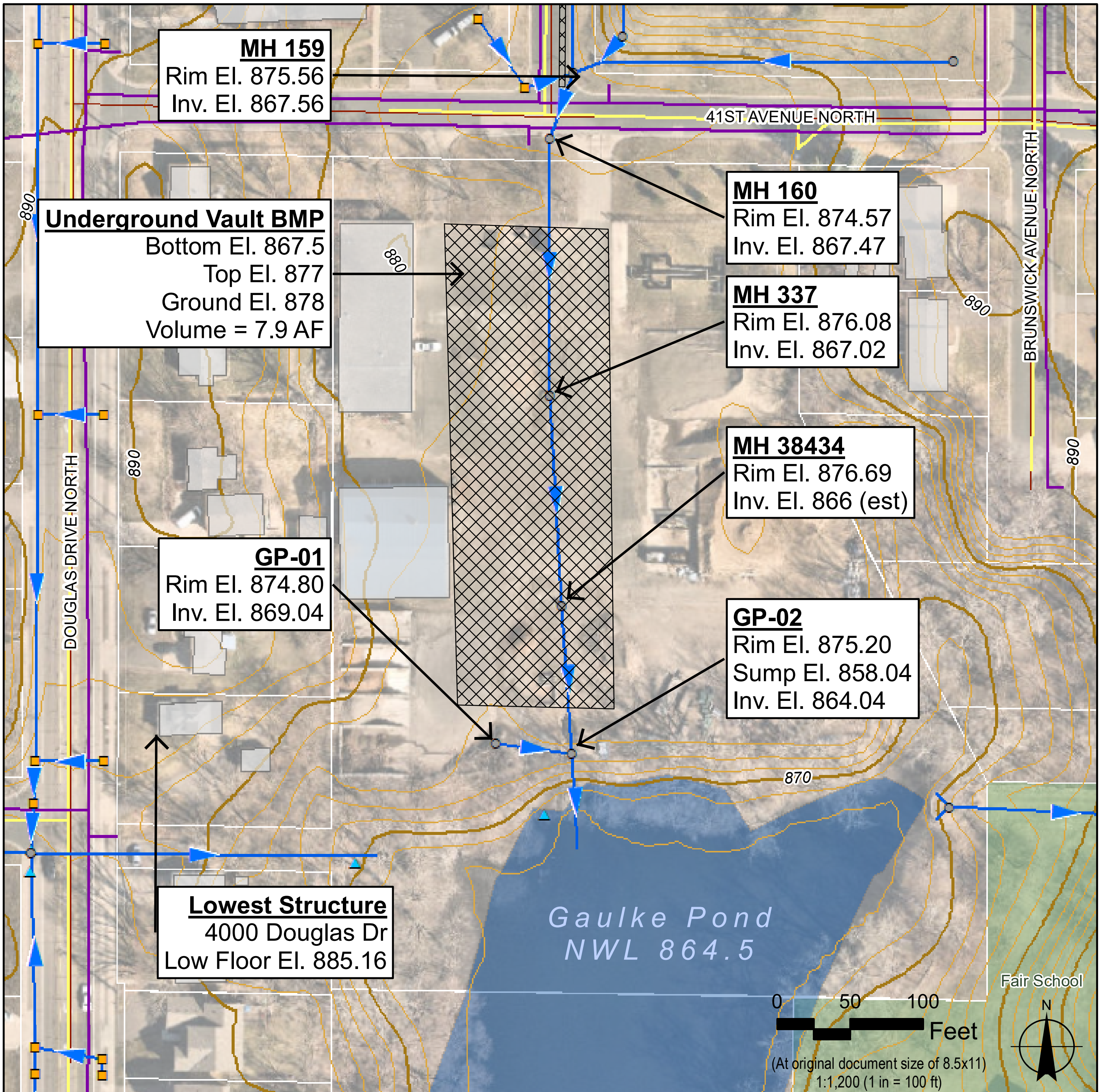
Table 4. Summary of potential BMPs for consideration.

ID	Site Name	BMP Type	Capital Cost ($)	Lifetime Maintenance Costs (30-years)	Lifetime Volume Infiltrated (AF)	Cost per Acre-Foot Infiltrated
A1	Old Public Works	Underground Infiltration Vault	$3,273,010	$24,570	3,450	$956
A2	Colorado Ave	Infiltration Trench	$130,326	$36,855	618	$271
A3	Colorado Ave	Infiltration Trench	$99,349	$36,855	489	$279
A4	Brunswick Ave	Infiltration Trench	$93,116	$36,855	402	$323
A6	43rd Ave	Infiltration Trench	$105,581	$36,855	399	$357
A10	Brownwood	Infiltration Basin	$281,938	$73,338	672	$529

The WRF whole-life analysis results indicate that the best option to reduce costs over the lifetime of the project would be A3: Colorado Avenue infiltration trench just south of 42nd Avenue.

4 Results and Next Steps

Based on the methodology, results and ranking presented above, Stantec will proceed with 30% design plans for the larger of the two underground infiltration trenches on Colorado Avenue (Opportunity A2). The next steps are to prepare the 30% design plans, update volume reduction calculations based on the design, update the cost estimate, and present the final 30% design to the Commission.



LEGEND

- BMP Footprint
- Storm Manholes
- Storm Catchbasins
- Outfalls
- Storm Sewer
- Water Main
- Sanitary Sewer

MnDNR 2-ft Contours

- *Index*
- *Intermediate*
- Building Footprints
- Hennepin County Parks

Notes
1. Coordinate System: NAD 1983 Hennepin County
2. Data Sources: Hennepin County, MnDOT, MnDNR, MPCA, City of Crystal, City of New Hope, Stantec
3. Background: Hennepin County 2021 Aerial

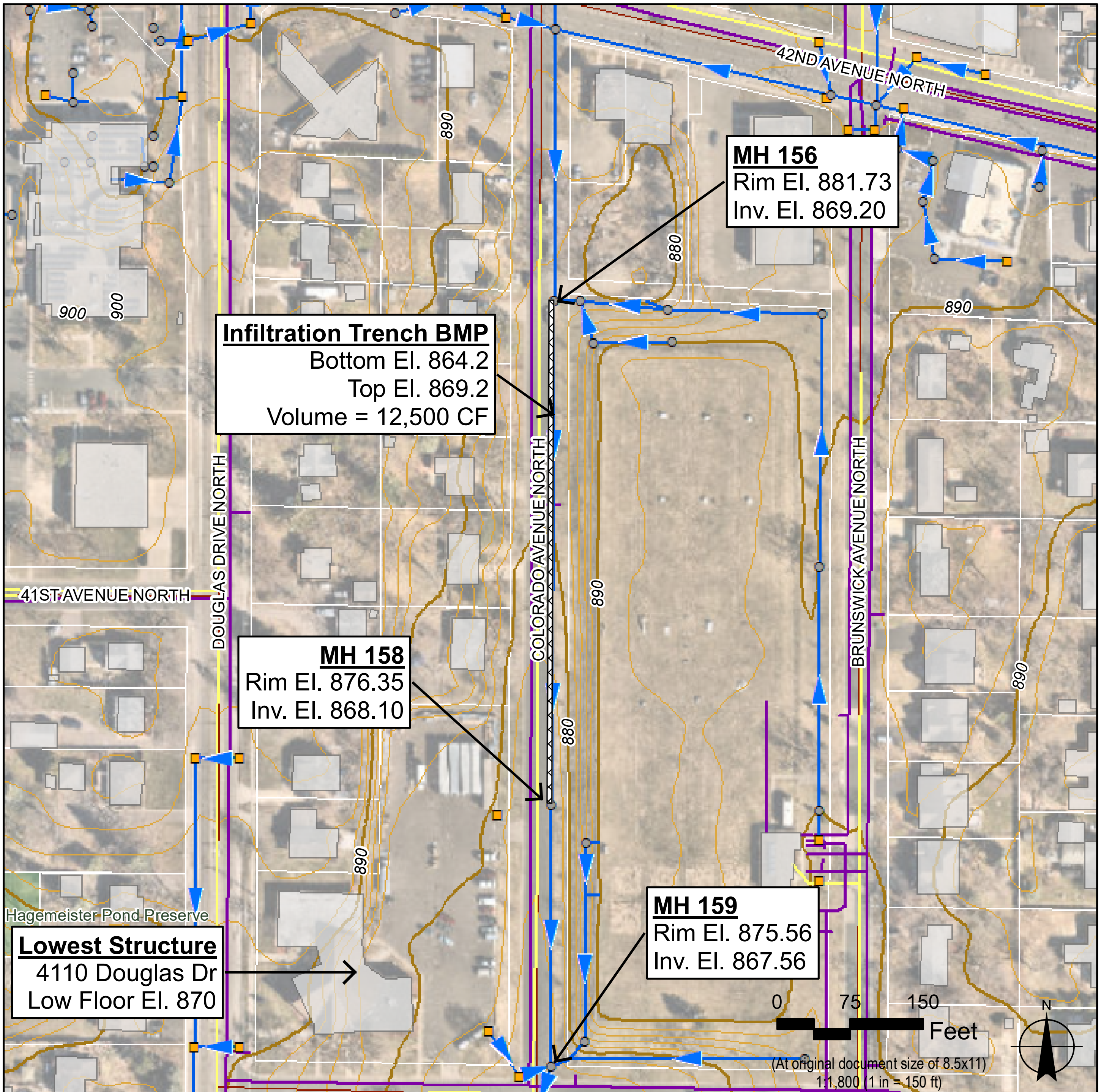
Stantec

Project Location Prepared by KAT on 2023-07-27
City of Crystal, Hennepin Co., MN

Client / Project 227705751
Shingle Creek Watershed Management Commission
Gaulke Pond Subwatershed Assessment

Figure No.
10

Title
Opportunity A1 - Crystal Old Public Works



LEGEND

BMP Footprint
Storm Manholes
Storm Catchbasins
Outfalls
Storm Sewer
Water Main
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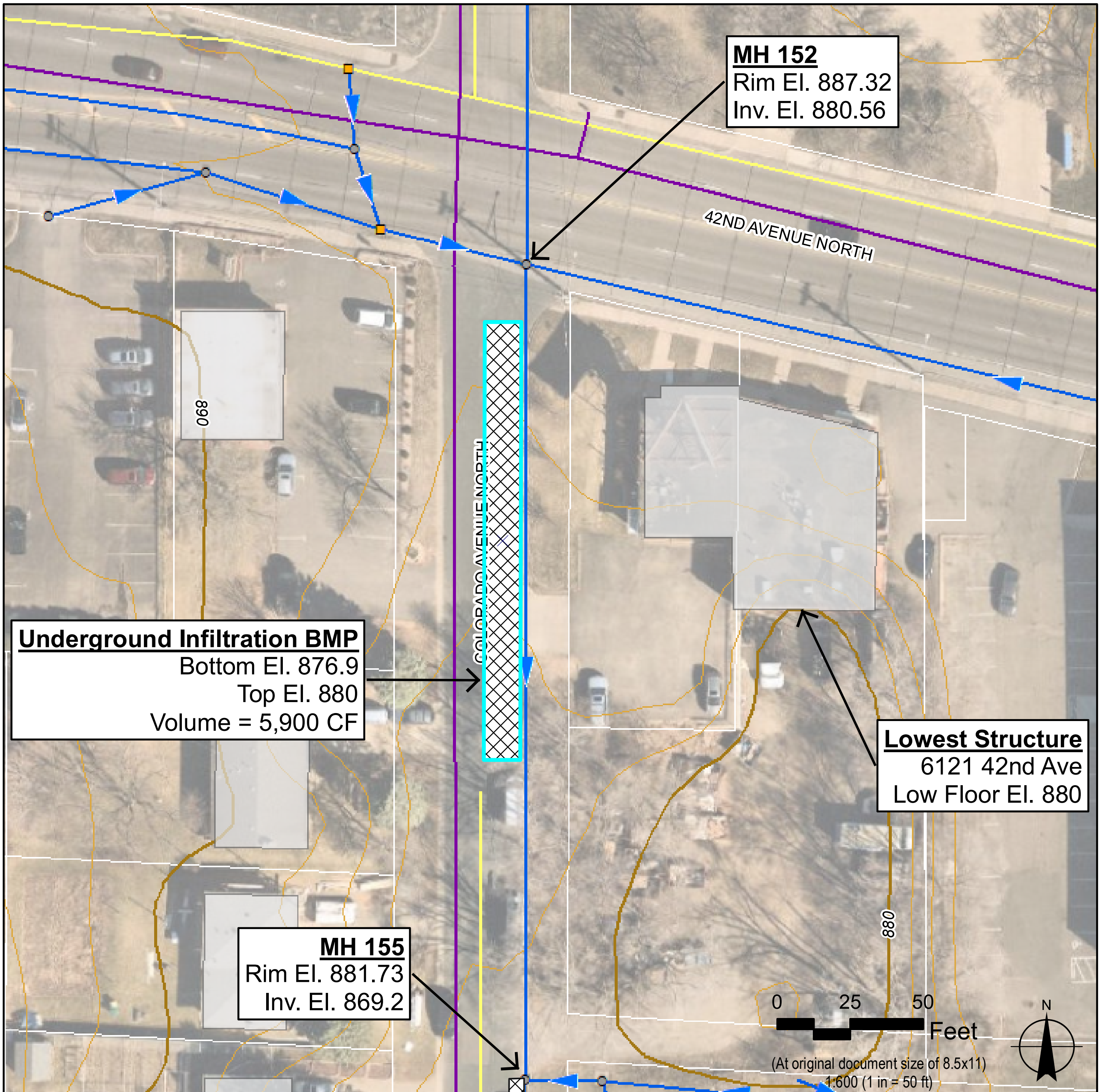
Client / Project 227705751
Shingle Creek Watershed Management Commission
Gaulke Pond Subwatershed Assessment

Figure No.
11

Title
Opportunity A2 - Colorado Avenue



LEGEND

- BMP Footprint
- Storm Manholes
- Storm Catchbasins
- Outfalls
- Storm Sewer
- Water Main
- Sanitary Sewer

MnDNR 2-ft Contours

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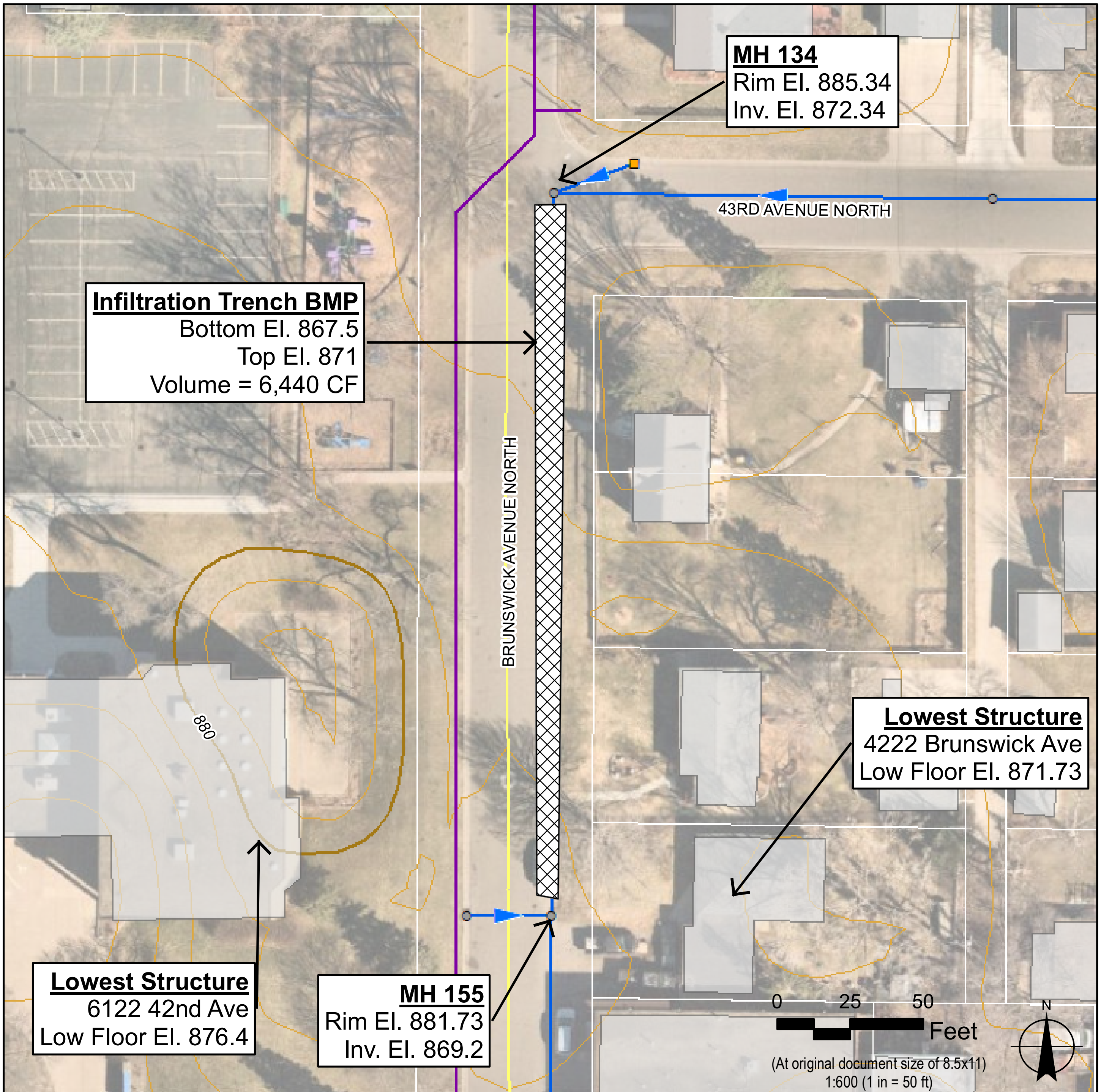
Gaulke Pond Subwatershed Assessment

Figure No.
12

Title
Opportunity A3 - Colorado Avenue



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- BMP Footprint
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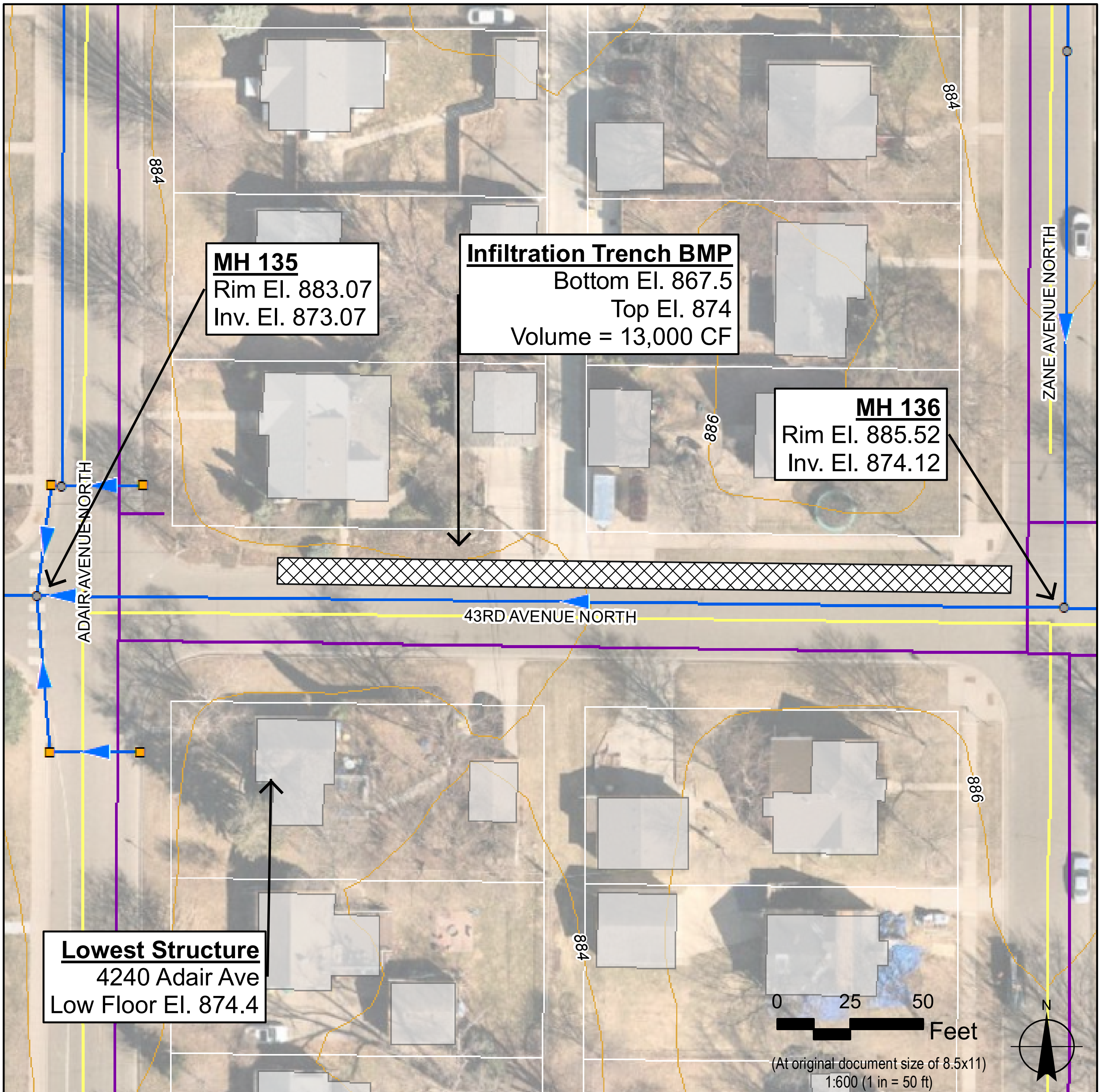
Gaulke Pond Subwatershed Assessment

Figure No.
13

Title
Opportunity A4 - Brunswick Avenue



LEGEND

- BMP Footprint
- Storm Manholes
- Storm Catchbasins
- Outfalls
- Storm Sewer
- Water Main
- Sanitary Sewer

MnDNR 2-ft Contours

- *Index*
- *Intermediate*
- Building Footprints
- Hennepin County Parks

Notes
1. Coordinate System: NAD 1983 Hennepin County
2. Data Sources: Hennepin County, MnDOT, MnDNR, MPCA, City of Crystal, City of New Hope, Stantec
3. Background: Hennepin County 2021 Aerial

Stantec

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City of Crystal, Hennepin Co., MN

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Gaulke Pond Subwatershed Assessment

Figure No.
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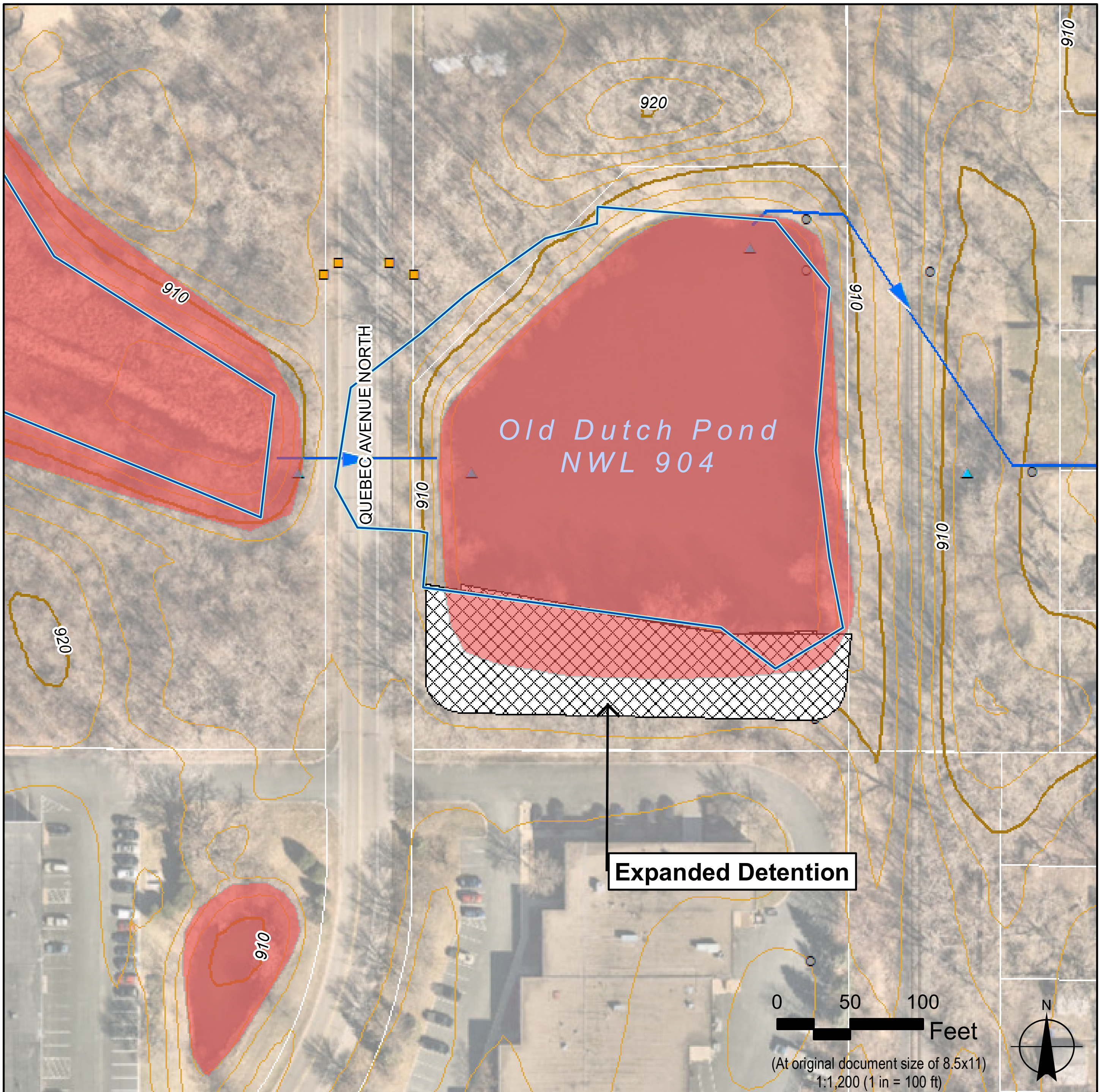
Title
Opportunity A6 - 43rd Avenue



LEGEND

- BMP Footprint
- Storm Manholes
- Storm Catchbasins
- Outfalls
- Storm Sewer
- Water Main
- Sanitary Sewer

MnDNR 2-ft Contours

- *Index*
- *Intermediate*
- Public Waters
- Probable Wetland - NWI

Notes
1. Coordinate System: NAD 1983 Hennepin County
2. Data Sources: Hennepin County, MnDOT, MnDNR, MPCA, City of Crystal, City of New Hope, Stantec
3. Background: Hennepin County 2021 Aerial

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Figure No.
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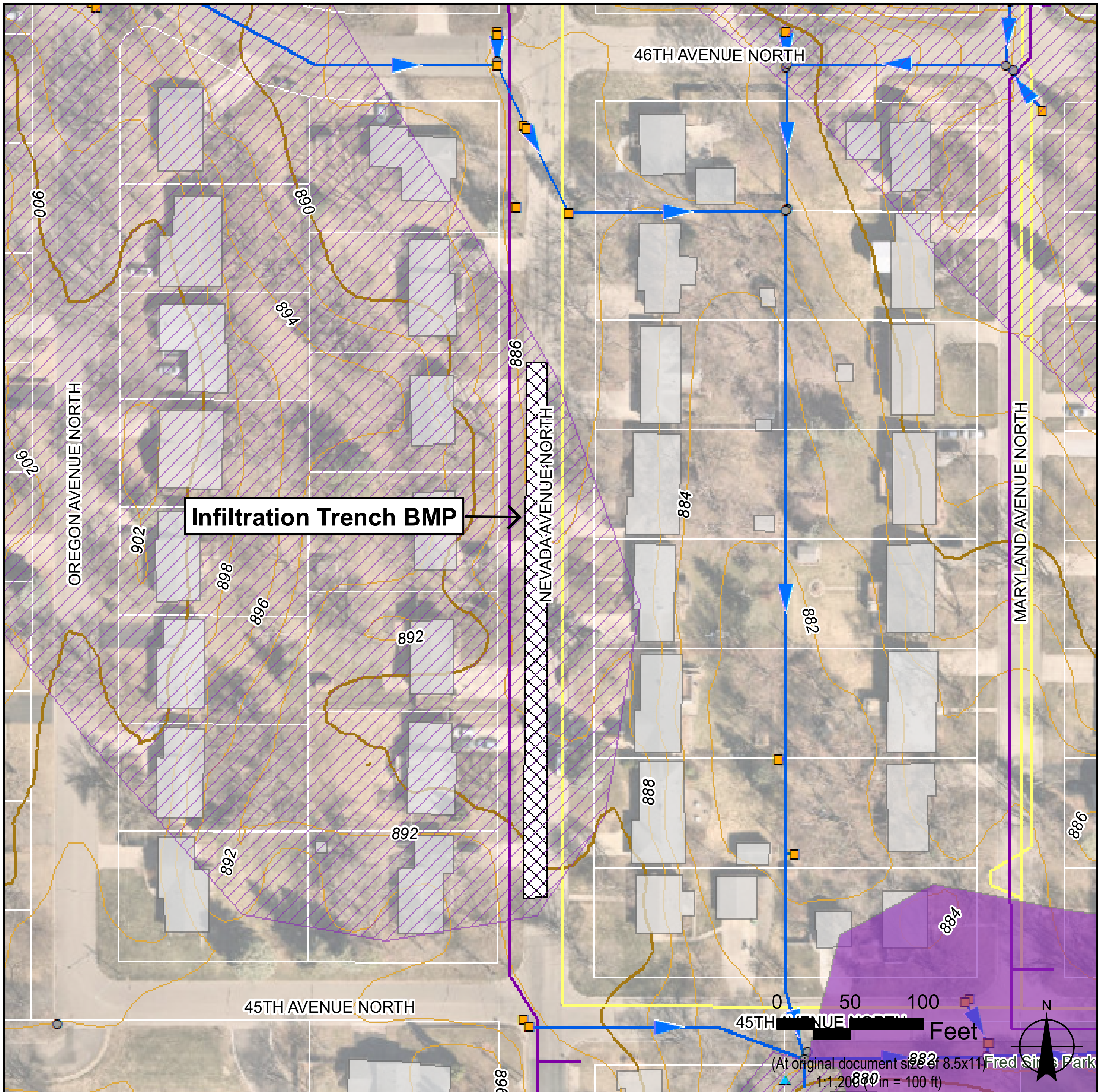
Title
Opportunity A7 - Old Dutch Pond



LEGEND

BMP Footprint
Storm Manholes
Storm Catchbasins
Outfalls
Storm Sewer
Water Main
Sanitary Sewer

MnDNR 2-ft Contours

Index

Intermediate

Building Footprints

HSG A

HSG B

Notes
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2. Data Sources: Hennepin County, MnDOT, MnDNR, MPCA, City of Crystal, City of New Hope, Stantec
3. Background: Hennepin County 2021 Aerial

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City of New Hope, Hennepin Co., MN

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Figure No.
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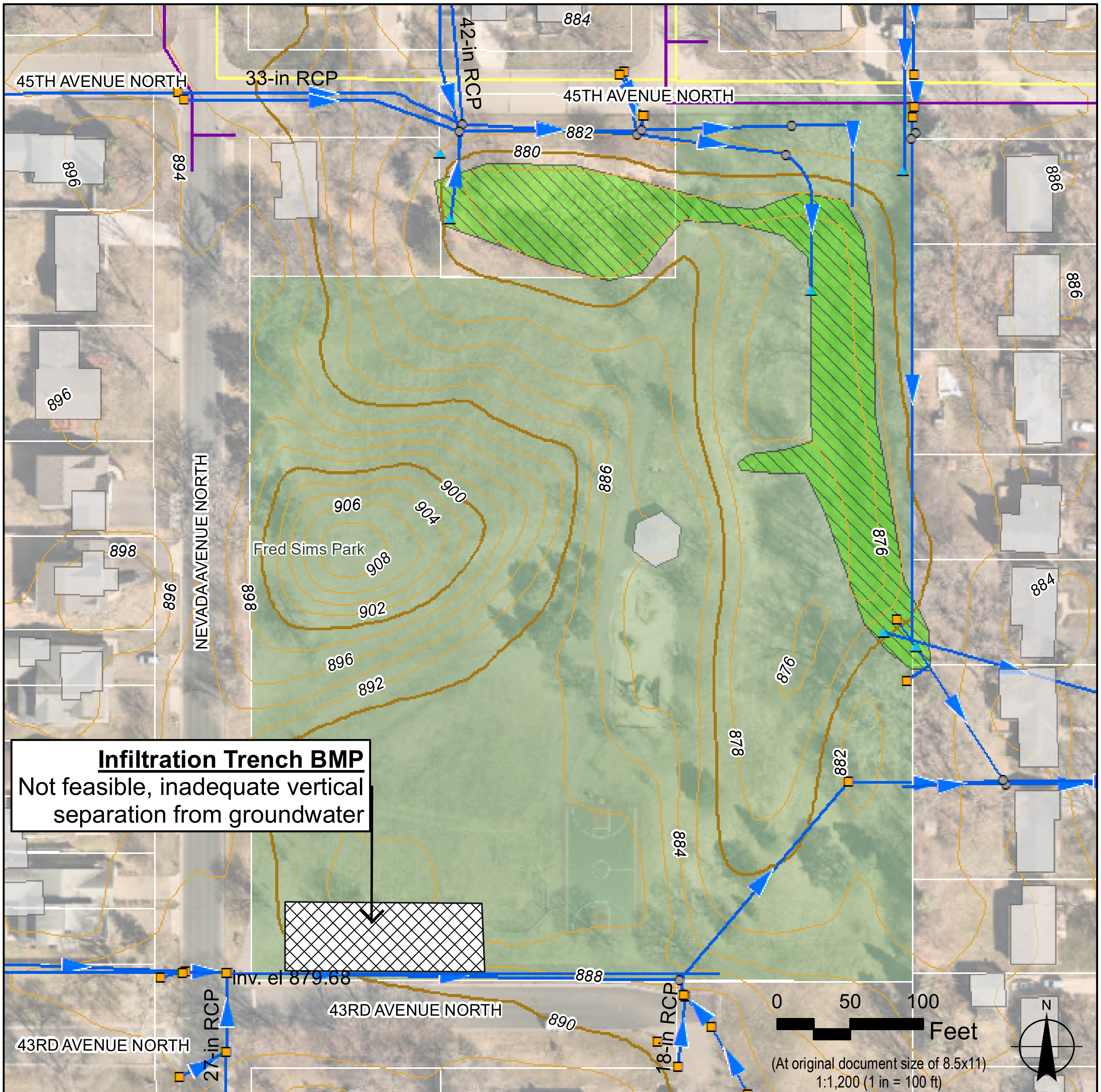
Title
Opportunity A8 - Nevada Avenue



LEGEND

- BMP Footprint
- Storm Manholes
- Storm Catchbasins
- Outfalls
- Storm Sewer
- Water Main
- Sanitary Sewer

MnDNR 2-ft Contours

- *Index*
- *Intermediate*
- Stormwater Ponds
- Building Footprints

Notes
1. Coordinate System: NAD 1983 Hennepin County
2. Data Sources: Hennepin County, MnDOT, MnDNR, MPCA, City of Crystal, City of New Hope, Stantec
3. Background: Hennepin County 2021 Aerial

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Figure No.
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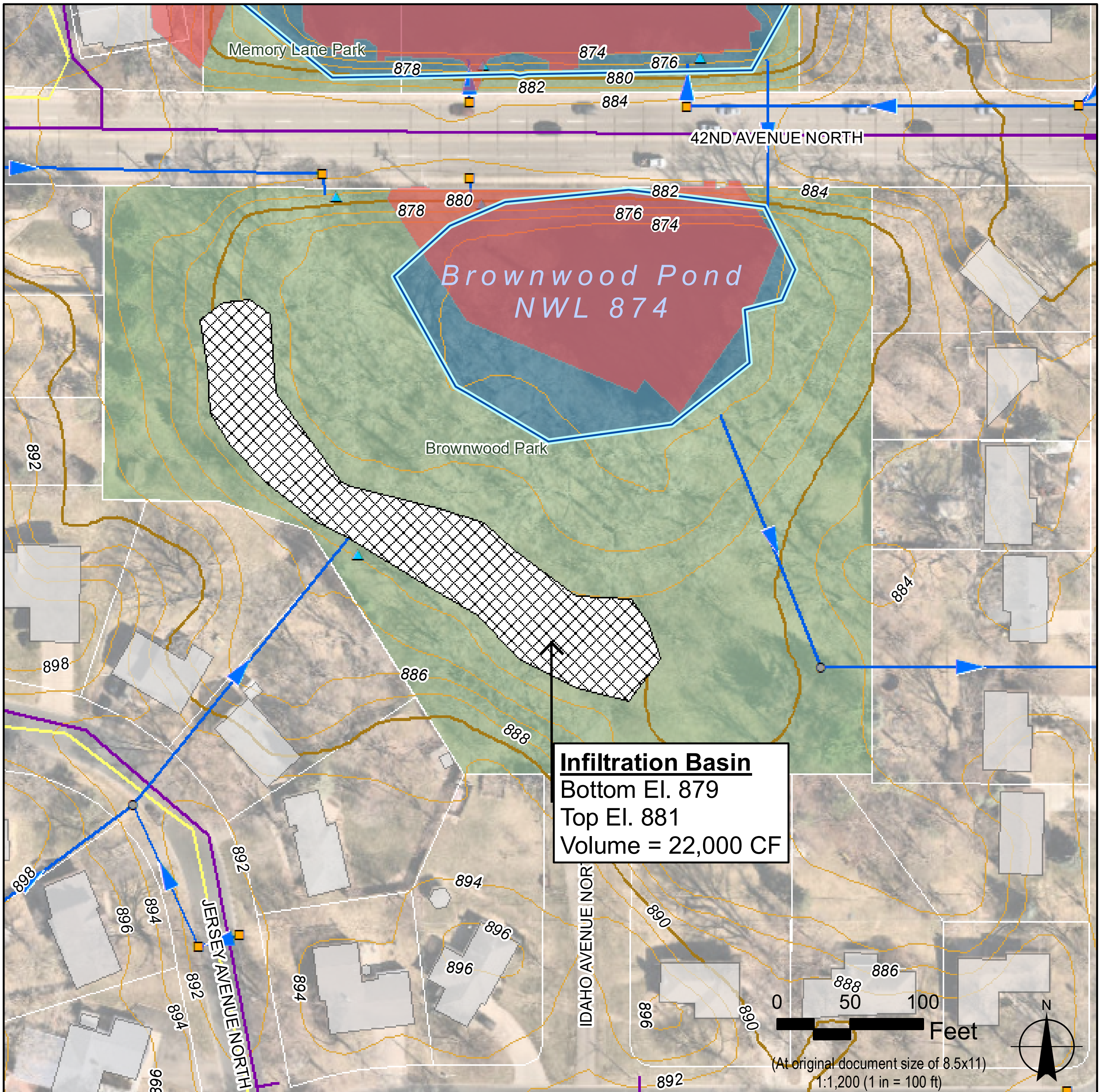
Title
Opportunity A9 - Fred Simms Park



LEGEND

- BMP Footprint
- Storm Manholes
- Storm Catchbasins
- Outfalls
- Storm Sewer
- Water Main
- Sanitary Sewer

MnDNR 2-ft Contours

- *Index*
- *Intermediate*
- Building Footprints
- Public Waters
- Probable Wetland - NWI

Notes
1. Coordinate System: NAD 1983 Hennepin County
2. Data Sources: Hennepin County, MnDOT, MnDNR, MPCA, City of Crystal, City of New Hope, Stantec
3. Background: Hennepin County 2021 Aerial

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Figure No.
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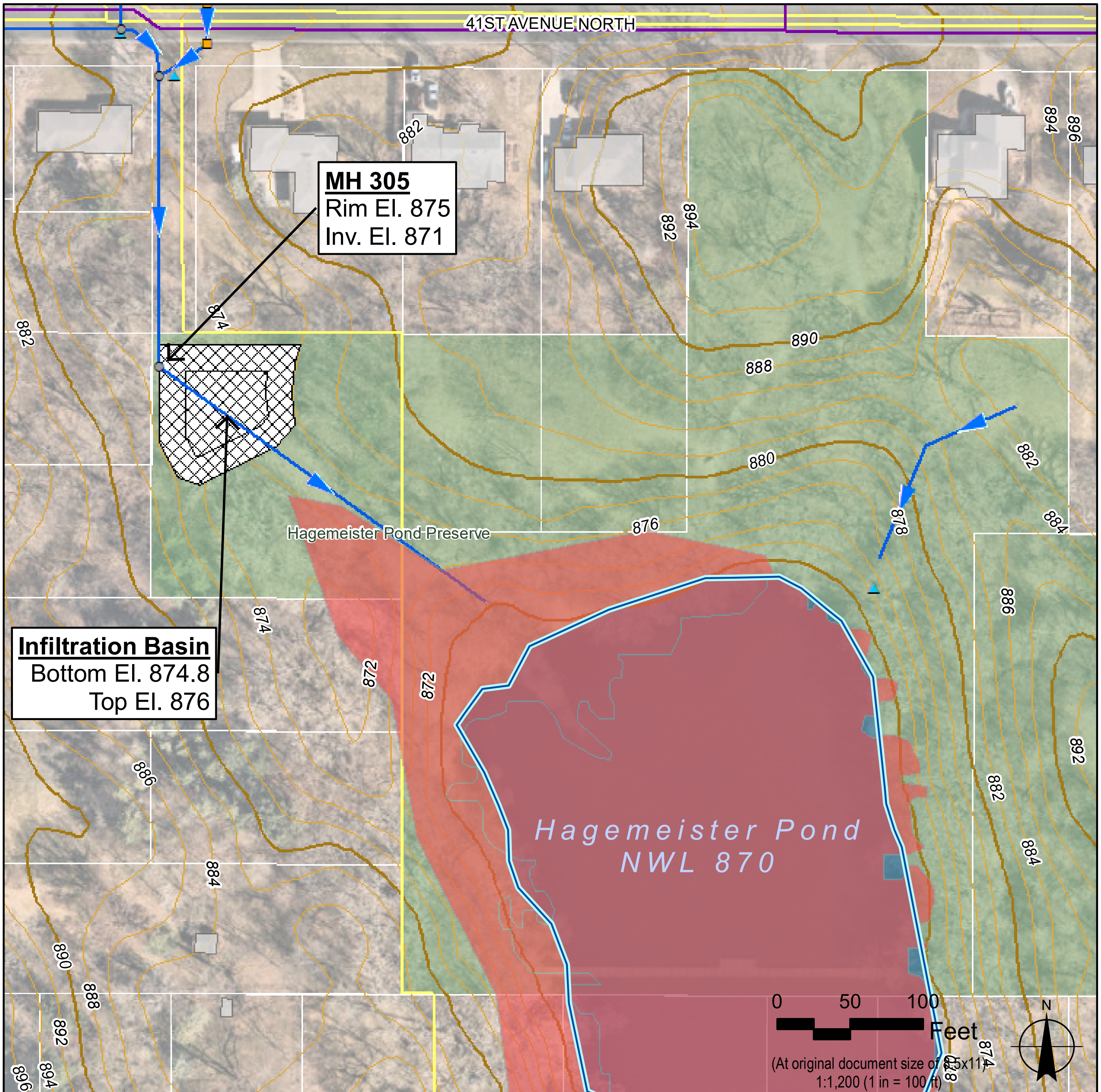
Title
Opportunity A10 - Brownwood Park



LEGEND

- BMP Footprint
- Storm Manholes
- Storm Catchbasins
- Outfalls
- Storm Sewer
- Water Main
- Sanitary Sewer

MnDNR 2-ft Contours

- *Index*
- *Intermediate*
- Building Footprints
- Public Waters
- Probable Wetland - NWI

Notes
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2. Data Sources: Hennepin County, MnDOT, MnDNR, MPCA, City of Crystal, City of New Hope, Stantec
3. Background: Hennepin County 2021 Aerial

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Figure No.
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Title
Opportunity A11 - Hagemeister Pond Preserve