

APPENDIX H

LOWRY AVENUE NE FLOODING ANALYSIS



To:	Carol Anderson Hennepin County	From:	Dan Edgerton, Rich Klein Saint Paul, MN Office
File:	193802636	Date:	February 28, 2015

Reference: Lowry Avenue and 2nd Avenue NE Flooding Analysis INTRODUCTION AND PROJECT

BACKGROUND

Localized flooding occurs periodically in the vicinity of Lowry Avenue and 2nd Street NE in the City of Minneapolis. Stantec was authorized by Hennepin County to evaluate the causes of the flooding and develop several alternatives to mitigate it.

Stantec evaluated a series of nine alternatives involving combinations of increased storm sewer capacity, dry detention storage ponds, underground storage installations, and stormwater quality bio-retention infiltration facilities. This memorandum describes the analysis approach and summarizes the results.

EVALUATION APPROACH

The City of Minneapolis provided an XP-SWMM model of the existing stormwater conveyance system in the vicinity of Lowry Avenue and 2nd Street NE. This model was modified to reflect the new storm sewers and detention devices comprising the various alternatives. The NOAA Atlas 14 100-year 24-hour runoff depth (7.5 inches) with an SCS Type II rainfall hydrograph was used in the analysis.

DESCRIPTION OF ALTERNATIVES AND SUMMARY OF RESULTS

The flooding experienced at Lowry Avenue and 2nd Street NE occurs because of the presence of the railroad tracks just west of 1st Street NE, resulting in an inadequate overland flow route for high flows, in combination with storm sewers that are too small to convey those flows in time to avoid flooding.

The alternatives developed evaluate the benefits of increasing the capacity of the storm sewer system draining the area, and then seeing if those storm sewers can be reduced in size by introducing different types of storm water detention.

The effects of the various alternatives on the water surface elevation (WSEL) were evaluated at two locations in the area. It should be noted that flooding potential may exist at other locations in the area; however, identification and analysis of additional flooding locations was outside the scope of this study.

- The first location is at the intersection of Lowry Avenue and 2nd Street NE, the primary point of interest in the analysis. The ground surface elevation at this location is modeled at 831.3 feet, while the existing condition 100-year flood WSEL is 833.85 feet, or about 2.55 feet above the ground.
- The second location is in the vicinity of the alley west of the railroad tracks just north of Lowry. This location was chosen as a point of interest based on interim discussions held during the alternative development process and reflects a flooding location identified during the public participation

phase of the corridor study. The ground surface elevation at this location is modeled at 828.1 feet, while the existing condition 100-year flood WSEL is 828.90 feet, or about 0.80 feet above the ground.

Table 1 describes the components of each alternative, and provides a summary of the resulting WSEL at the two locations of interest. Note that the values in parentheses below the WSEL indicate the depth of water relative to the ground surface. A positive number in parentheses indicates flooding above the ground surface. A negative value indicates the depth of water below the ground surface. The main elements of the various alternatives are shown schematically on Figures 1 through 5.

Based on the results in Table 1, it appears that increased storm sewer capacity is required to address the flooding issues. Providing surface ponding can increase the flood reduction but is not in itself sufficient to take care of the problem. It should be noted, however, that surface ponding can provide additional benefits such as water quality treatment, aesthetics, and wildlife habitat. At the same time, surface ponding will require periodic maintenance in the form of mowing, debris removal, and sediment removal.

Table 1
Description of Alternatives and Summary of Results

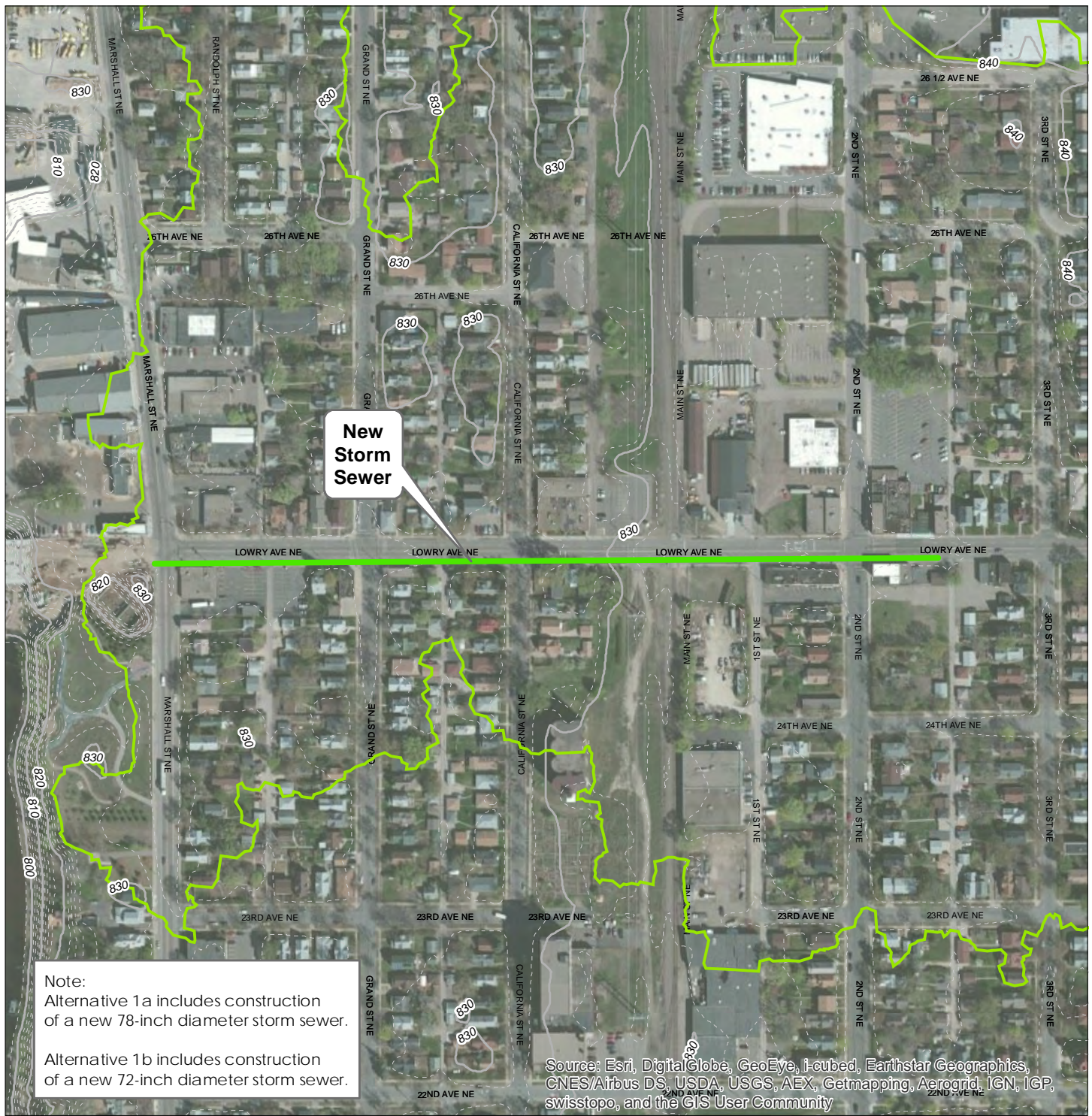
Alternative	Description / Approach	WSEL [feet]	
		at 2nd & Lowry	in alley west of tracks north of Lowry
Existing	<u>Existing Condition:</u> Storm sewers in Lowry Avenue are generally 36-inch diameter for 1,100 LF from Marshall Street east to the railroad tracks, then decreasing to 24-inch diameter for 400 LF from the railroad tracks east to 2nd Street. Sewers upstream of this location are smaller, ranging from 18-inch to 15-inch diameter.	833.85 (+ 2.55)	828.90 (+ 0.80)
1a	<u>Increase Sewer Size to 78-inch Diameter:</u> Replace existing sewers in Lowry Avenue between Marshall Street and 2nd Street with a 78-inch diameter sewer. Upsize certain sewers upstream of this location to reduce street flow.	830.54 (- 0.76)	828.12 (+ 0.02)
1b	<u>Increase Sewer Size to 72-inch Diameter:</u> Replace existing sewers in Lowry Avenue between Marshall Street and 2nd Street with a 72-inch diameter sewer. Upsize certain sewers upstream of this location to reduce street flow.	831.10 (- 0.20)	828.18 (+ 0.08)
2	<u>Install Tree Trench Stormwater BMPs:</u> Install eight stormwater quality BMPs on Lowry Avenue upstream of the intersection with 2nd Street. Each of the eight (8) BMPs consists of a 4-foot deep by 17-foot wide by 200-foot long gravel-filled tree trench with enough storage capacity to detain 5,440 cubic feet (0.125 acre-feet) of runoff.	833.84 (+ 2.54)	828.86 (+ 0.76)
3	<u>Construct One Dry Basin, Increase Sewer Size to 72-inch Diameter:</u> Construct one dry basin just south of Lowry Avenue on 2nd Street (2.3 ac-ft capacity). The pond is modeled as having 4:1 side slopes and a depth of approximately seven (7) feet. Note: low flows bypass the basin, i.e. not for stormwater quality. Replace existing sewers in Lowry Avenue between Marshall Street and 2nd Street with a 72-inch diameter sewer.	830.65 (- 0.65)	828.13 (+ 0.03)
3-2	<u>Construct Two Dry Basins, Increase Sewer Size to 72-inch Diameter:</u> Construct two dry basins, one at the same location as Alternative 3, and a second hypothetical basin at another nearby location upstream of 2nd Street (5.7 ac-ft total capacity between the two). The second pond, similar to the first, is modeled as having 4:1 side slopes and a depth of approximately seven (7) feet. Note: low flows bypass the basins, i.e. not for stormwater quality. Replace existing sewers in Lowry Avenue between Marshall Street and 2nd Street with a 72-inch diameter sewer.	829.98 (- 1.32)	827.93 (- 0.17)

Table 1
Description of Alternatives and Summary of Results

Alternative	Description / Approach	WSEL [feet]	
		at 2nd & Lowry	in alley west of tracks north of Lowry
3-2a	<u>Construct Two Dry Basins, Increase Sewer Size to 66-inch Diameter:</u> Construct two dry basins as described in Alternative 3-2. Note: low flows bypass the basins, i.e. not for stormwater quality. Replace existing sewers in Lowry Avenue between Marshall Street and 2nd Street with a 66-inch diameter sewer.	830.53 (- 0.77)	828.00 (- 0.10)
4	<u>Construct Under-Street Storage, Increase Sewer Size to 78-inch Diameter:</u> Construct six large under-street storage pipes both north and south of Lowry Avenue along 2nd Street, 3rd Street, and the alley between them. Each storage pipe consists of a 600-foot length of 7-foot by 8-foot box section pipe. Note: low flows bypass the storage pipes, i.e. not for stormwater quality. Replace existing sewers in Lowry Avenue between Marshall Street and 2nd Street with a 78-inch diameter sewer.	830.07 (- 1.23)	827.85 (- 0.25)
4a	<u>Construct Under-Street Storage, Increase Sewer Size to 72-inch Diameter:</u> Construct six large under-street storage pipes both north and south of Lowry Avenue along 2nd Street, 3rd Street, and the alley between them. Each storage pipe consists of a 600-foot length of 7-foot by 8-foot box section pipe. Note: low flows bypass the storage pipes, i.e. not for stormwater quality. Replace existing sewers in Lowry Avenue between Marshall Street and 2nd Street with a 72-inch diameter sewer.	830.55 (- 0.75)	827.93 (- 0.17)
5	<u>Construct Dry Storage Basin to Address Alley Flooding West of Tracks:</u> Lower ground surface west of tracks in the area between the tracks and the alley and between Lowry Avenue and 26th Avenue (approximately 1 acre) by several feet, increasing the available storage capacity in this vicinity. Replace existing sewers in Lowry Avenue between Marshall Street and 2nd Street with a 78-inch diameter sewer.	830.50 (- 0.80)	827.46 (- 0.64)

Note:

1. WSEL = Water Surface Elevation
2. Ground EL = Ground Surface Elevation



New Storm Sewer

Note:
 Alternative 1a includes construction of a new 78-inch diameter storm sewer.
 Alternative 1b includes construction of a new 72-inch diameter storm sewer.

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



- Legend**
- New Storm Sewers
 - Watershed Boundary
 - 2-Foot Contours
 - Index
 - Intermediate

Notes
 1. Coordinate System: HENNEPIN COUNTY
 2. Data Sources Include: Hennepin Co, Stantec

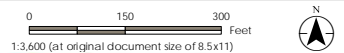
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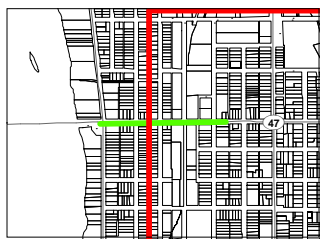
Figure No. **1** **DRAFT**

Title **Figure 1
 Alternatives 1a & 1b
 New Storm Sewers**

Client/Project
 County of Hennepin
 Lowery Av NE Corridor

Project Location 193802636
 City of Minneapolis Prepared by PM on 2014-09-26
 Hennepin Co., MN Technical Review by xx on 2014-xx-xx
 Independent Review by xx on 2014-xx-xx





- Legend**
- Tree Trenches
 - Watershed Boundary
 - 2-Foot Contours
 - Index
 - Intermediate

- Notes**
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Figure No. **2** **DRAFT**

Title **Figure 2
Alternative 2
Tree Trenches**

Client/Project
**County of Hennepin
Lowry Av NE Corridor**

Project Location 193802636
City of Minneapolis Prepared by PM on 2014-09-26
Hennepin Co., MN Technical Review by xx on 2014-xx-xx
Independent Review by xx on 2014-xx-xx





- Legend**
- New Storm Sewers
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Figure No. **3** **DRAFT**

Title **Figure 3
 Alternatives 3, 3-2, 3-2a
 Dry Detention Basin and
 New Storm Sewer**

Client/Project
 County of Hennepin
 Lowry Av NE Corridor

Project Location 193802636
 City of Minneapolis Prepared by PM on 2014-09-26
 Hennepin Co., MN Technical Review by xx on 2014-xx-xx
Independent Review by xx on 2014-xx-xx





Note:
 Alternative 4 includes construction of six (6) under-street storage structures and a new 78-inch diameter storm sewer.
 Alternative 4a includes construction of six (6) under-street storage structures and a new 72-inch diameter storm sewer.

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



- Legend**
- New Storm Sewers
 - Under-Street Storage
 - Watershed Boundary
 - 2-Foot Contours
 - Index
 - Intermediate

Notes
 1. Coordinate System: HENNEPIN COUNTY
 2. Data Sources Include: Hennepin Co, Stantec

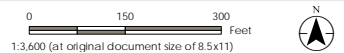
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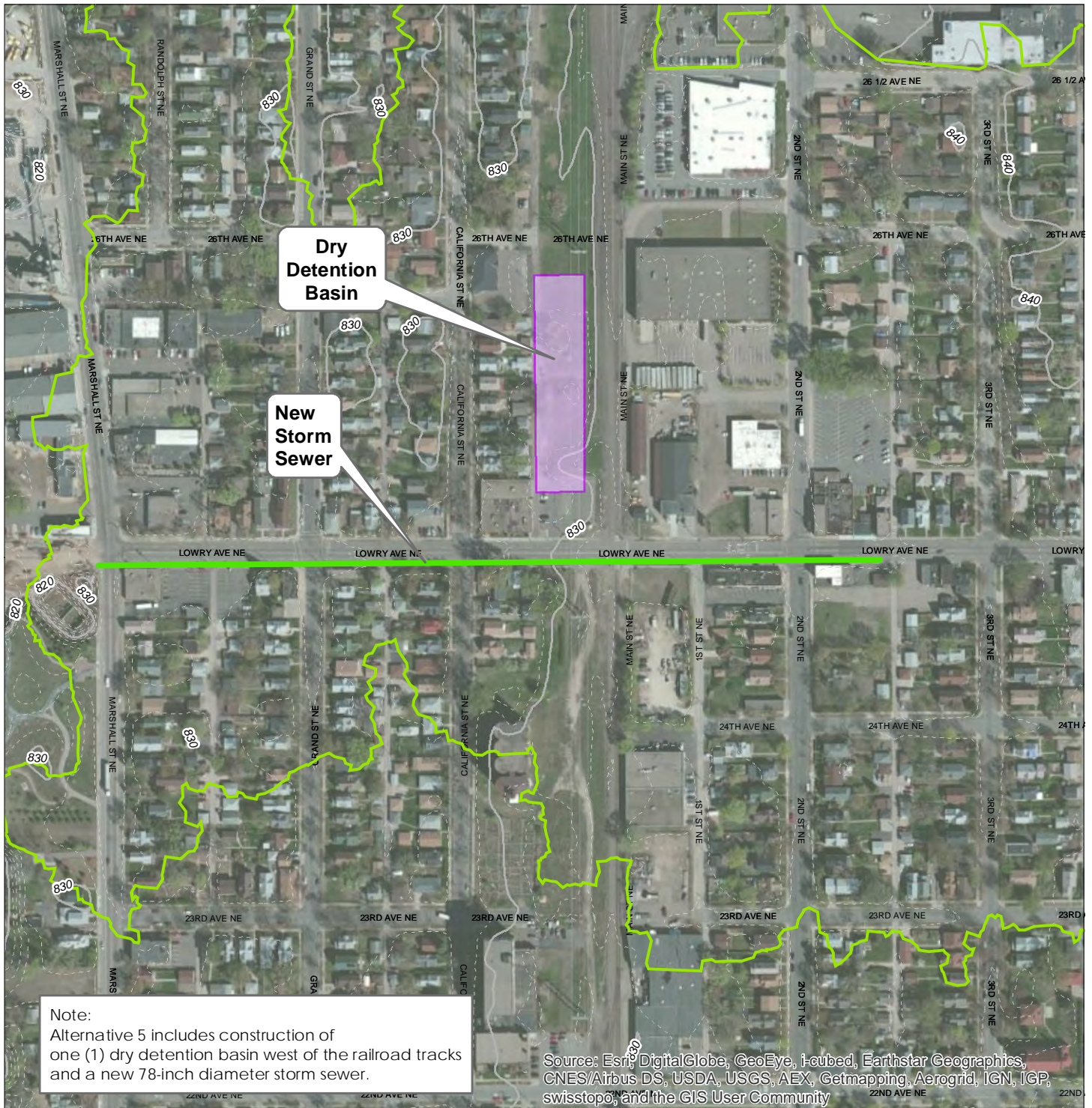
Figure No. **4** **DRAFT**

Title **Figure 4
 Alternatives 4a & 4b
 Under-Street Storage and
 New Storm Sewer**

Client/Project
 County of Hennepin
 Lowry Av NE Corridor

Project Location 193802636
 City of Minneapolis Prepared by PM on 2014-09-26
 Hennepin Co., MN Technical Review by xx on 2014-xx-xx
Independent Review by xx on 2014-xx-xx





Note:
Alternative 5 includes construction of one (1) dry detention basin west of the railroad tracks and a new 78-inch diameter storm sewer.

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



- Legend**
- █ New Storm Sewers
 - █ Dry Detention Basin
 - ~ Watershed Boundary
 - 2-Foot Contours
 - Index
 - - - Intermediate

- Notes
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Figure No. **5** **DRAFT**

Title: Figure 5
Alternative 5
Dry Basin and New Storm Sewer to address Alley Flooding

Client/Project
County of Hennepin
Lowery Av NE Corridor

Project Location: 193802636
City of Minneapolis: Prepared by PM on 2014-09-26
Hennepin Co., MN: Technical Review by xx on 2014-xx-xx
Independent Review by xx on 2014-xx-xx

