TECHNICAL MEMORANDUM

This document was originally issued and sealed by
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Registration Number PE-5403
on
August 23, 2019
and the original documents are stored at the offices of
Advanced Engineering & Environmental Services, Inc.

To: Gabe Schell, PE – City Engineer
City of Bismarck

From: Jeffrey M. Hruby, PE

Re: **US 83/ND 1804 Watershed - Section 9 Developer Requested Variance**

Date: August 23, 2019

1 Background/Purpose

The US 83/ ND 1804 Watershed Masterplan (2014 Master Plan), adopted in 2014, relied on regional Best Management Practices (BMPs) to mitigate future development throughout the watershed. Since adoption of the 2014 Master Plan, the City of Bismarck (City) has begun implementing an "allowable unit discharge rate" method of stormwater management as an alternative to regional detention methods of stormwater management. In 2018, the City elected to develop an updated master plan for the US83/ND1804 Watershed that utilized the allowable unit discharge rate approach versus the regional detention approach. The specifics of the analysis and the recommended master plan elements are documented in the February 2019 US83/ND1804 Stormwater Master Plan Update Report (2019 Master Plan Update).

Subsequent to issuance of the draft Master Plan Update, the developer/landowner of an area hereafter referred to as Section 9 (***Figure 1***), requested a variance from the Master Plan Update setback requirements for the areas generally located east of Ridgeland Drive (***Figure 2***). The variance request consists of establishing a new setback line that would consist of a "no grading" zone that extends approximately 20-ft from the edge of the developer provided wetland line and then grading at 3H:1V to a point above the calculated 100-yr water surface elevation plus 1-foot of freeboard.

The City requested AE2S determine the impacts from the variance request and recommend mitigation requirements that could be placed on the developer/landowner if the variance request was granted. The purpose of this memorandum is to document the findings and recommendations of the analysis.

2 Findings and Recommendations

The requested variance results in impacts to the water surface elevations of properties upstream of Section 9. In order to mitigate for the impacts, the following requirements should be placed on development occurring with those portions of Section 9 in the US83/ND1804 Watershed (summarized on ***Figure 3***):

Unit Rate Allowable Discharge

- 100-Year: Reduce the 100-year unit release rate from 0.65 cfs/acre to 0.40 cfs/ acre within Section 9.
- 2-Year: No changes from the Master Plan Update (0.07 cfs/acre).

Crossing Improvements

- Increase the diameter of the proposed culvert under the future Yukon South crossing from 60-inches (2019 Master Plan Update) to a 72-inch diameter pipe.

Development Setback Line

- Establish a no-grading zone within a 20-ft buffer from the developer provided existing wetland line as noted on ***Figure 3.***
- Grading outside of this zone shall not be steeper than 3H:1V and the lowest elevation of a building shall not be below the Lowest Building Elevation noted on ***Figure 3***.

3 Analysis and Modeling Summary

Section 9 stormwater management variance recommendations are based on the following modeling scenarios that are generally referenced in the memorandum:

- **Existing Conditions**: Developed for the 2019 Master Plan Updated that utilized the existing land use, soils, road system, and drainage conveyance systems that were in-place at the start of the Master Plan process. Development Stormwater Management Plans that were approved by the City at the commencement of this Master Plan update process were incorporated into the existing conditions. The Light of Christ, Daybreak Addition, Daybreak Medical and Koch Creek Commercial developments are all included in the existing conditions scenario are all included in the existing conditions scenario. Detention within natural depressions and upstream of the existing road crossings is accounted for.
- **2019 Master Plan Update:** Developed for the 2019 Master Plan and utilized the future land-use plan, the Fringe Area Master Plan, Section 9 revised roadway alignments provided by the developer's engineer and directed for use by the City, and recommended drainage system improvements to show the performance of the watershed when implementing a Unit Rate stormwater detention methodology consistent throughout the watershed. This scenario assumes on-site, or local detention basins will be used to meet the Unit Rate criteria. The development setback line was established at an elevation 1-foot above the 100-year water surface elevation using the higher of existing or 2019 Master Plan Update conditions considering the existing channel and future road crossings.
- **Section 9 Developer Requested Variance without Modifications to the Master Plan Update:** Developed in response to the requested variance and incorporated a new setback line that would consist of a "no grading" zone that extends approximately 20-ft from the edge of

the developer provided wetland line and then grading at 3H:1V to a point above the calculated 100-yr water surface elevation plus 1-foot of freeboard within Section 9 as requested by the developer. All other modeling assumptions including conveyance upstream of the requested setback line variance were maintained from the 2019 Master Plan Update.

- **Section 9 Developer Requested Variance with Recommended Modifications to the Master Plan Update:** Developed in response to the requested variance and incorporated a reduced development setback line within Section 9 as requested by the developer, reduced the 100-year allowable unit discharge rate within Section 9 to 0.40 cfs/acre, and updated the recommended drainage system improvements within Section 9 by increasing the future Yukon South RCP diameter to 72". The lowest building elevation was established at an elevation 1-foot above the 100-year water surface elevation using the higher of the existing or Master Plan Update conditions considering 3H: 1V bank grading outside the requested setback variance. All other modeling assumptions including conveyance upstream of the requested setback line variance were maintained from the 2019 Master Plan Update.

4 Results

The 2-year peak discharge and headwater elevations are not impacted by the reduced setback line and associated bank grading in Section 9. The 100-year water surface elevations upstream of the variance request are impacted by the reduced setback line and associated 3H:1V grading in Section 9 without further mitigation as shown in ***Table 2***. To mitigate these impacts, the recommendations noted in Section 2 are required:

A Comparison of the 2-year peak discharges and water surface elevations at designated compliance points for Existing Conditions, 2019 Master Plan Update, and Section 9 Developer Requested Variance without mitigation and with mitigation scenarios are listed in ***Table 1.*** A Comparison of 100-year peak discharges and water surface elevations are listed in ***Table 2.***

Table 1 US83/ND1804: 2-Year Peak Headwater Elevations and Discharges (cfs) at Key Compliance Points

	Headwater Elevation				Flow (cfs)			
Compliance Point	Existing Condition	2019 Master Plan Update	Section 9 Variance without Mitigation	Section 9 Variance with Mitigation	Existing Conditions	2019 Master Plan Update	Section 9 Variance without Mitigation	Section 9 Variance with Mitigation
Highway 83 South	1801.5	1801.4	1801.4	1801.4	82	77	77	77
Highway 83 North	1834.5	1834.0	1834.0	1834.0	15	8	8	8
Highway 1804 East	1831.2	1830.9	1830.9	1830.9	51	35	35	35
Highway 1804 Central	1891.3	1891.3	1891.3	1891.3	0	0	0	0
Highway 1804 West	1883.5	1882.7	1882.7	1882.7	14	4	4	4
Washington South	1871.2	1870.8	1870.8	1870.8	14	9	9	9
Washington North	1886.1	1885.5	1885.5	1885.5	24	11	11	11
79th Street	1862.7	1862.3	1862.3	1862.3	14	8	8	8

Table 2 US83/ND1804: 100-Year Headwater Elevations and Peak Discharges (cfs) at Key Compliance Points

	Headwater Elevation				Flow (cfs)			
Compliance Point	Existing Condition	2019 Master Plan Update	Section 9 Variance without Mitigation	Section 9 Variance with Mitigation	Existing Conditions	2019 Master Plan Update	Section 9 Variance without Mitigation	Section 9 Variance with Mitigation
Highway 83 South	1812.2	1805.9	1806.4	1805.8	443	278	294	277
Highway 83 North	1836.6	1836.2	**1838.0 (1.4 feet above existing)**	1835.7	51	36	39	35
Highway 1804 East	1835.2	1835.1	**1837.5 (2.5 feet above existing)**	1834.4	396	238	199	222
Highway 1804 Central	1891.3	1891.3	1891.3	1891.3	0	0	0	0
Highway 1804 West	1887.7	1884.1	1884.1	1884.1	69	21	21	21
Washington South	1875.4	1874.9	1874.9	1874.9	41	39	39	39
Washington North	1889.8	1887.7	1887.7	1887.7	126	71	71	71
79th Street	1863.5	1863.4	1863.4	1863.4	160	103	103	103

5 Figures:

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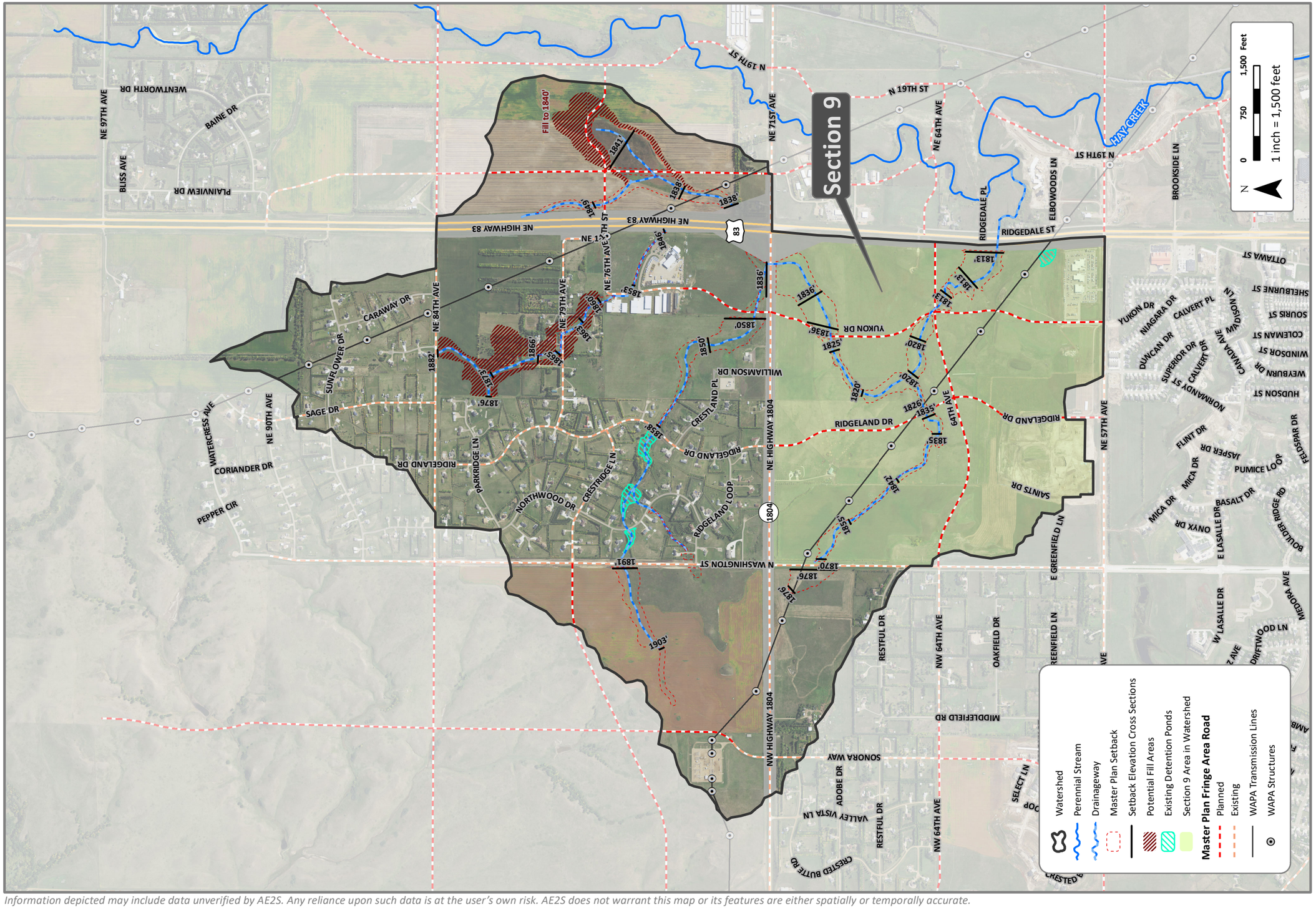

Locator Map Not to Scale

City of Bismarck
Burleigh County, ND

Figure 1

LOCATION MAP

US83/ND1804
MASTER PLAN UPDATE
SECTION 9 VARIANCE

Date: 8/22/2019

Information depicted may include data unverified by AE2S. Any reliance upon such data is at the user's own risk. AE2S does not warrant this map or its features are either spatially or temporally accurate.

Coordinate System: NAD 1983 HARN StatePlane North Dakota South FIPS 3302 Feet Intl | Edited by: dlee | C:\Data\Projects\WAFS\B\Bismarck\00501-2018-000\GIS\TO4\Amendment 2 Memo Figure 1- Location Map.mxd

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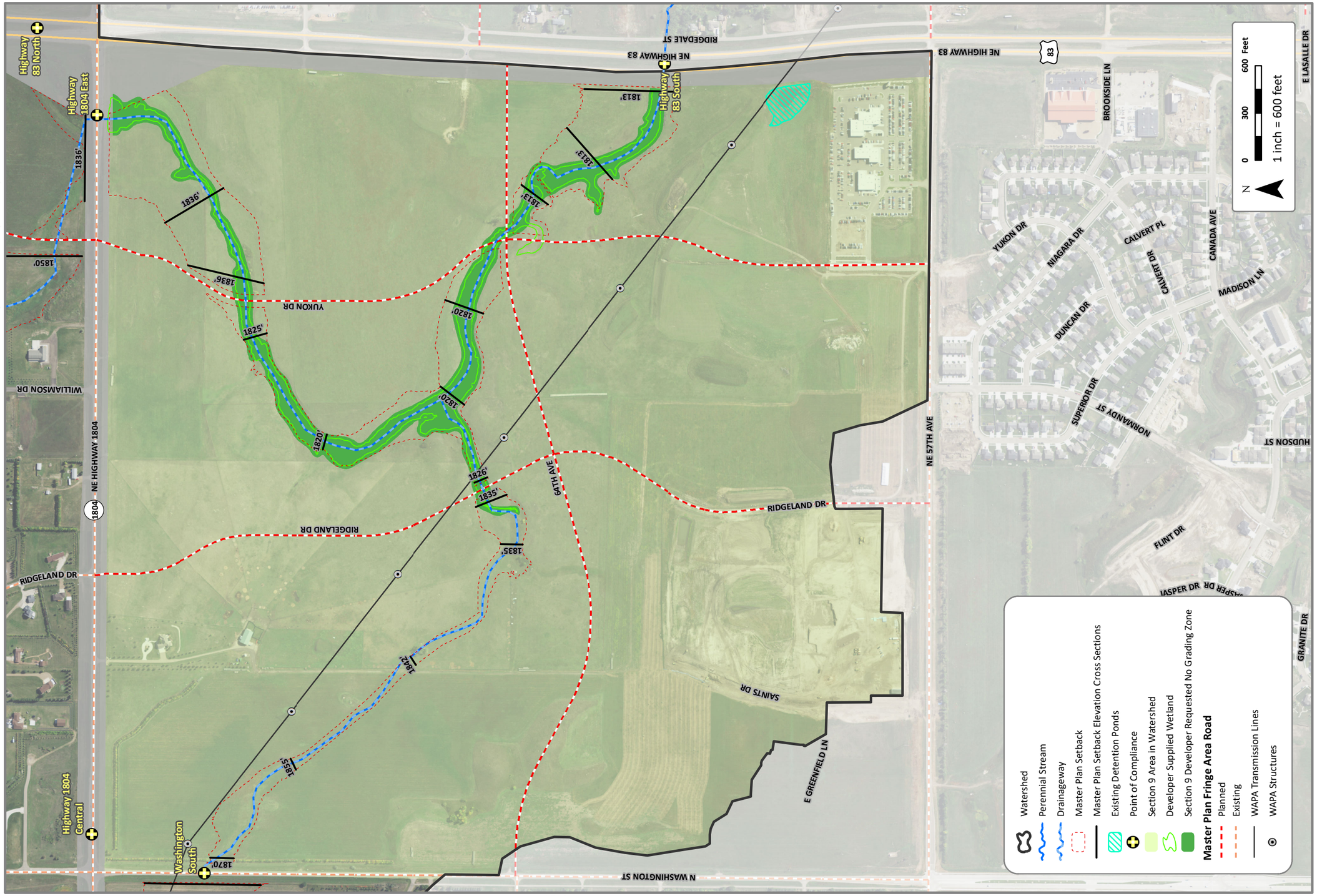

Locator Map Not to Scale

City of Bismarck
Burleigh County, ND

Figure 2

US83/ND1804 SECTION 9 DEVELOPER REQUESTED VARIANCE

US83/ND1804
MASTER PLAN UPDATE
SECTION 9 VARIANCE

Date: 8/22/2019

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Coordinate System: NAD 1983 HARN StatePlane North Dakota South FIPS 3302 Feet Intl | Edited by: dlee | C:\Data\Projects\WAFS\B\Bismarck\00501-2018-000\GIS\TO4\Amendment 2 Memo Figure 2- US83 ND1804 Section 9 Developer Requested Variance.mxd

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Coordinate System: NAD 1983 HARN StatePlane North Dakota South FIPS 3302 Feet Intl | Edited by: dlee | C:\Data\Projects\WAFS\B\Bismarck\00501-2018-000\GIS\TO4\Amendment 2 Memo Figure 3- US83 ND1804 Section 9 Recommended Mitigation Requirements.mxd

Locator Map Not to Scale

City of Bismarck
Burleigh County, ND

Figure 3

US83/ND1804 SECTION 9 RECOMMENDED MITIGATION REQUIREMENTS

US 83 / ND 1804
STORMWATER
MASTER PLAN UPDATE

Date: 9/12/2019