



March 20, 2013

Mr. Keith Demke, PE  
Director of Utility Operations  
City of Bismarck Public Works  
P.O. Box 5503  
Bismarck, ND 58506-5503

**Re: US 83 / ND 1804 Watershed Stormwater Master Plan Report Executive Summary**

Dear Keith:

Attached for your use and distribution is the Executive Summary for the US 83 / ND 1804 Watershed Stormwater Master Plan. Per your request, we have provided the Executive Summary in electronic format. Hard copies of the final report will be provided under separate cover, along with an electronic copy and the appropriate model files.

We sincerely appreciate the opportunity to work with the City on this project and look forward to continuing to assist the City in the future. If you have any questions or need additional information, please do not hesitate to contact me.

Sincerely,

**AE2S**

Jeffrey M. Hruby, PE  
Water Resources Group Manager

Attachment: US 83 / ND 1804 Watershed Stormwater Master Plan Executive Summary

Cc: Colleen Peterson; Mel Bullinger, PE; Dale Heinert, PE; Linda Oster, PE; Mark Berg, PE; Nancy Huether, PE; Jason Tomanek

## **EXECUTIVE SUMMARY**

### **Project Background**

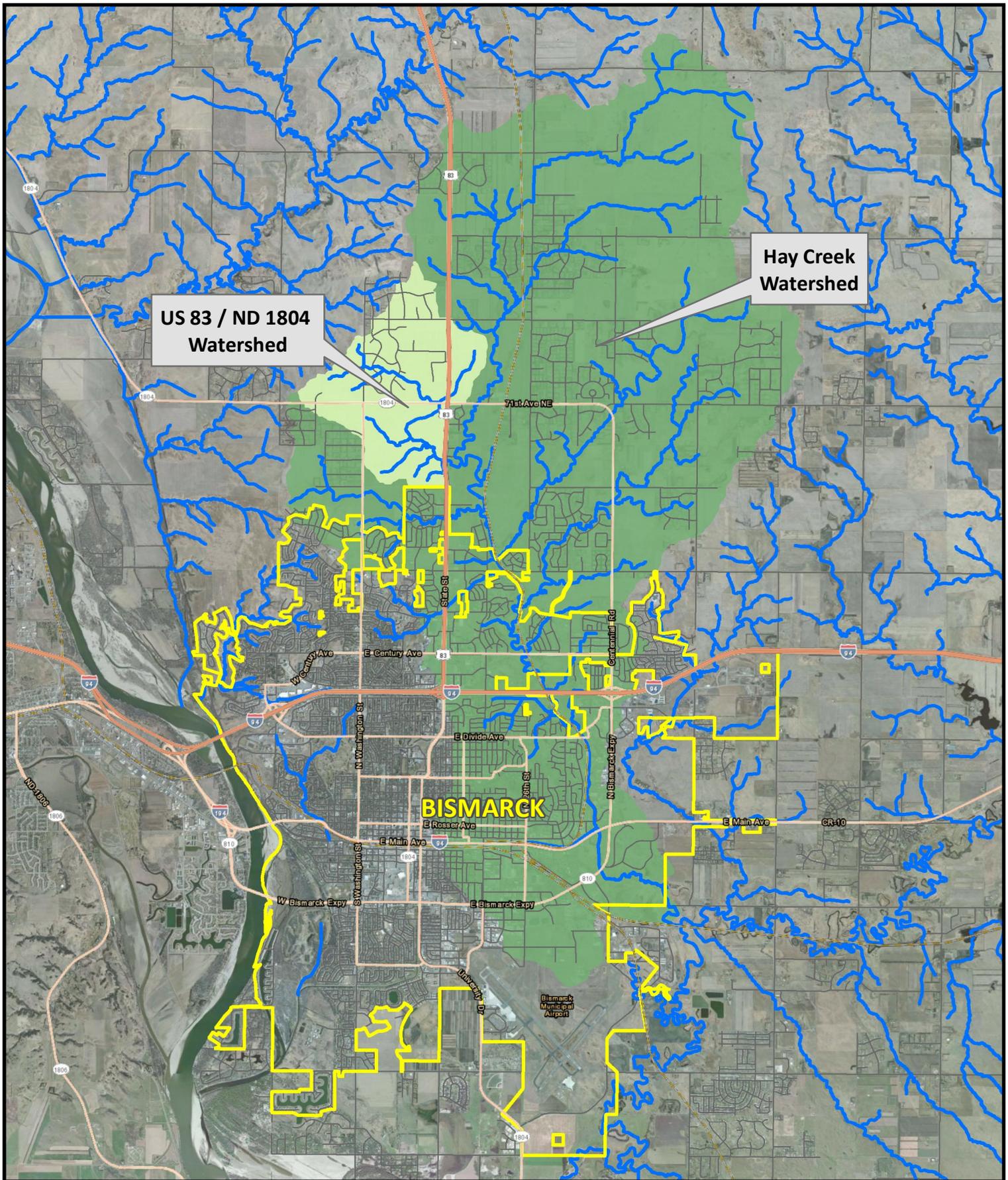
Bismarck is experiencing significant development pressure along the U.S. Highway 83 (US 83) corridor with substantial development being discussed around the intersection with ND State Highway 1804 (ND 1804). The City, recognizing the development pressure, commissioned preparation of a stormwater master plan for approximately 1900 acres located within the Hay Creek watershed and adjacent to the intersection of US 83 and ND 1804 (*Figure ES-1*). The US 83 / ND 1804 Watershed Stormwater Master Plan acts as a stormwater management and drainage guide for the City, landowners, and developers as the watershed develops.

Existing land use within the watershed is primarily agricultural and rural residential. The regional land use plan adopted by the City calls for the area to be developed as a mix of commercial, mixed use, and urban residential, with higher density land uses adjacent to US 83 (*Figure ES-2*). The proposed development within the watershed will result in a substantial increase in impervious surfaces (roofs, roadways, and parking lots), generating significantly higher stormwater runoff rates and volumes. Peak flow at the downstream end of the watershed would see an increase in peak flows in the 2-year storm from 18 cubic feet per second to 283 feet per second and an increase in the 100-year storm from 355 cubic feet per second to 526 cubic feet per second without stormwater management features.

### **Master Plan**

The City of Bismarck Code of Ordinances requires that increased stormwater runoff from development be controlled such that post-development runoff rates for the 2-year, 10-year, and 100-year rainfall events match existing runoff rates. The City typically utilizes a regional management approach for meeting these stormwater management requirements wherein stormwater management features are constructed, owned and maintained by the City and construction costs are assessed to benefited properties within the watershed. Multiple alternatives were developed and reviewed with the City Working Group, including alternatives that require that the highest density land uses partially mitigate for increased runoff volumes by utilizing on-site volume reduction practices. Ultimately, the City Work Group developed a stormwater master plan that mitigates for the increase in runoff rates through the following management practices:

- Construction of 167 acre-feet of new detention storage through the use of five valley storage facilities and three graded detention facilities distributed throughout the watershed (*Table ES.1*). Valley storage detention facilities are created by constructing an embankment, typically located at a future road crossing, and utilizing the existing natural storage within the upstream valley. Graded facilities involve creation of the storage within a detention facility by mass earthwork. Detention basins were limited to less than 25 acre-feet of storage so that they would not trigger regulation as a medium or high hazard dam.
- Incorporating the existing regional detention basins located within Northridge Estates.

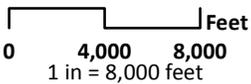


### Figure ES-1 Project Location

Hay Creek Subwatershed Stormwater Master Plan  
 City of Bismarck | Burleigh County, ND

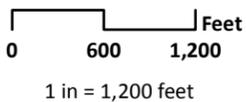
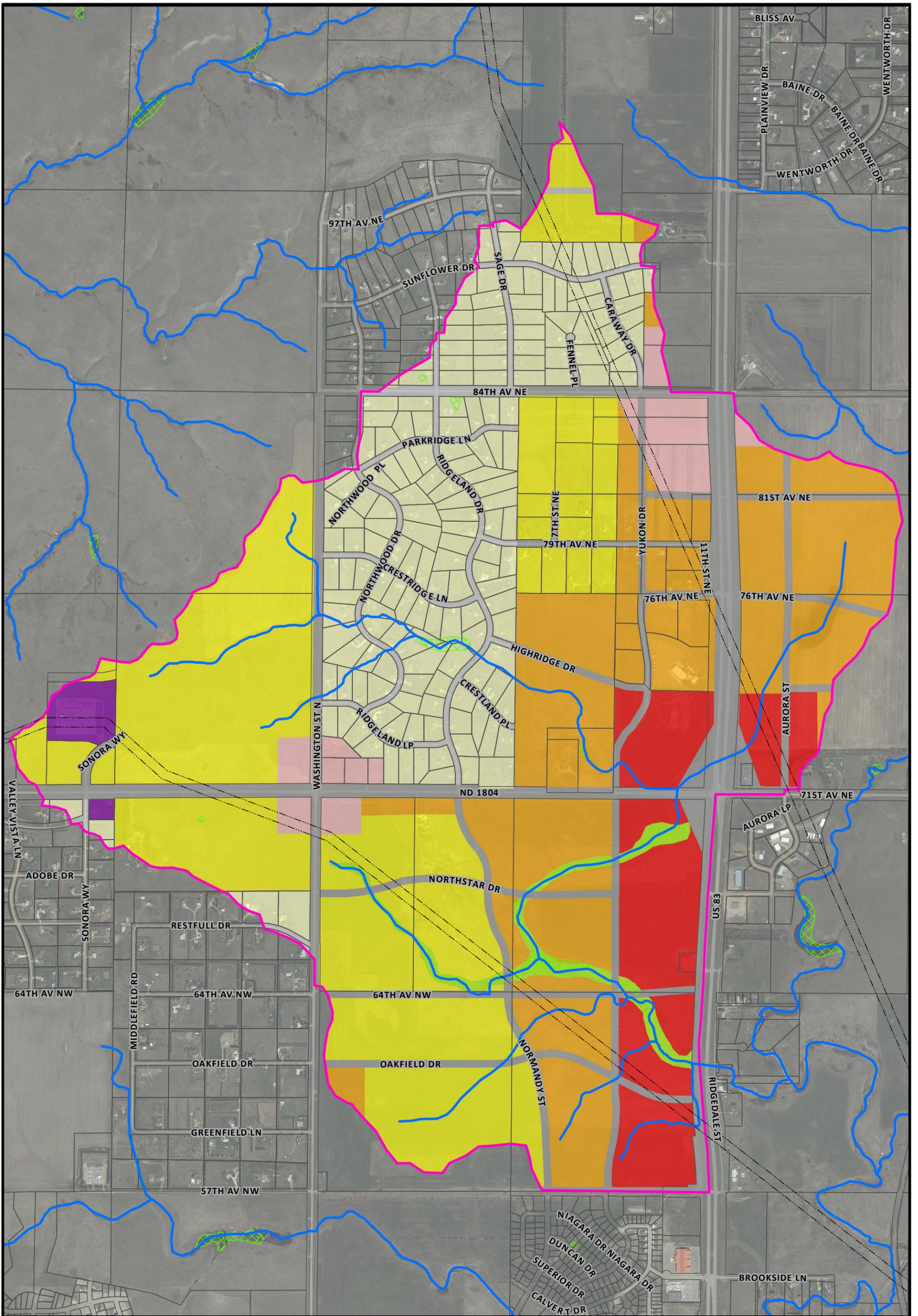


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- Hay Creek Watershed
- US 83 / ND 1804 Watershed
- City of Bismarck
- Hydrography

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 Vertical Datum: NAVD88  
 Metadata Included in the Report



### Figure ES-2 Future Land Use

US 83/ND 1804 Stormwater Master Plan  
City of Bismarck, ND

- |                             |                            |                               |            |
|-----------------------------|----------------------------|-------------------------------|------------|
| US 83 / ND 1804 Watershed   | Transmission Line Corridor | Mixed-Use                     | Open Space |
| Hydrography                 | Commercial                 | Urban Residential             | Urban ROW  |
| National Wetlands Inventory | Neighborhood Commercial    | Rural Residential             | Rural ROW  |
| Parcels                     |                            | Transportation/Infrastructure |            |



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- Requiring on-site detention facilities in key locations upstream of existing rural residential development so as not to increase local drainage and flooding issues.
- Modifying key roadway culverts and roadway profiles to meet level of service requirements.
- Requiring that new developments exceeding the maximum assumed impervious percentages provide on-site stormwater management to mitigate the increased runoff rates for the 2-year, 10-year, and 100-year storms and increased runoff volume for the 2-year storm.

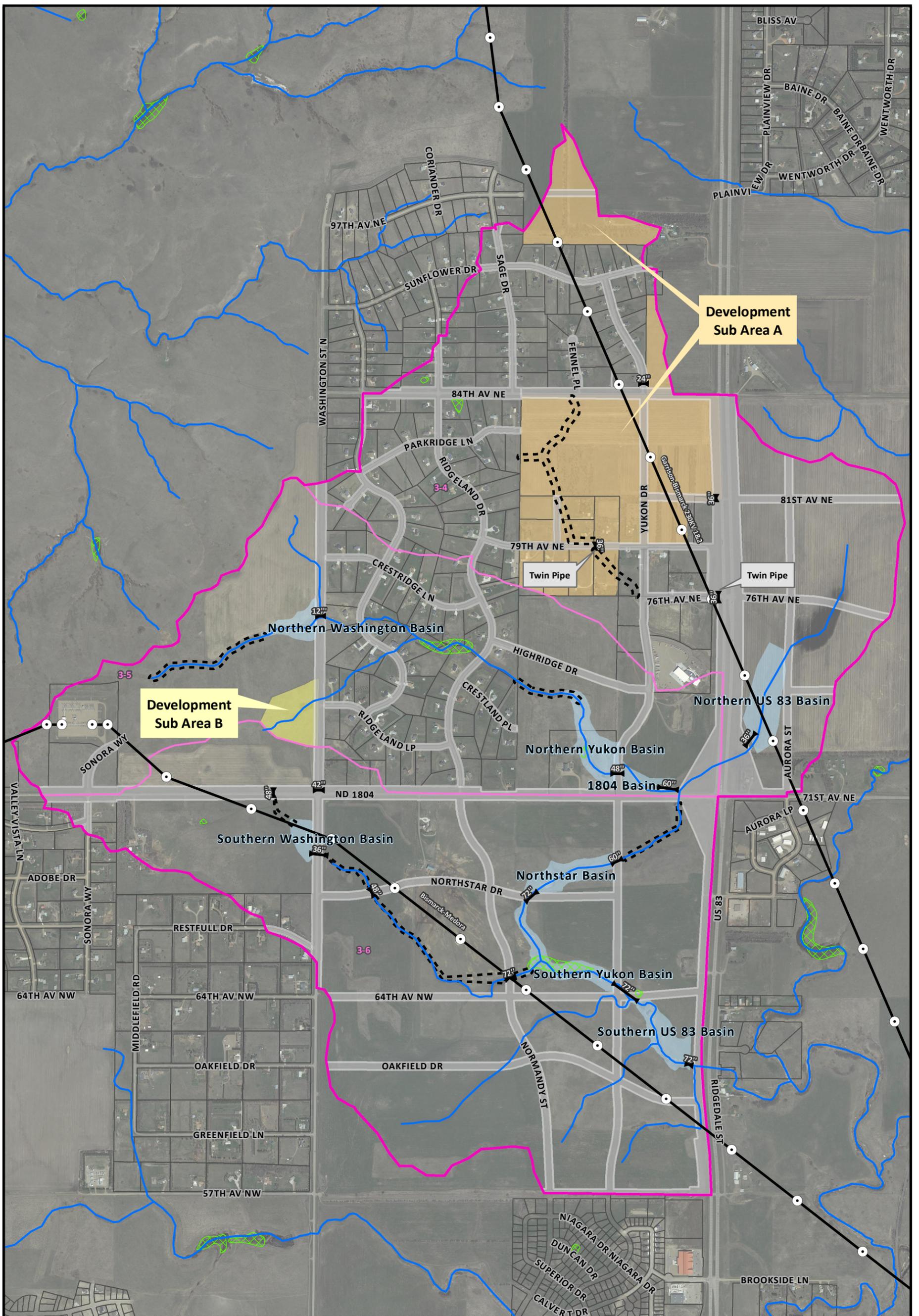
*Figure ES-3* illustrates the master planned improvements for the US 83 / ND 1804 Watershed.

**Table ES.1** Summary of Master Plan Detention Basin Geometry

Basin Name	Basin Type	Maximum Storage <sup>1</sup> (acre-feet)	Maximum Area <sup>1</sup> (acres)	Bottom Elevation (NAVD 88)	Overflow Elevation (NAVD 88)
Northern Washington	Valley	12.0	4.1	1885.0	1892.6
Southern Washington	Graded	15.6	3.2	1866.0	1872.0 <sup>2</sup>
Northern Yukon	Valley	24.8	9.0	1838.1	1847.2
1804	Graded	15.8	2.3	1830.25	1841.0
Northstar	Valley	24.7	6.3	1816.7	1827.4
Southern Yukon	Valley	24.8	7.6	1807.0	1816.8
Northern US 83	Graded	24.5	10.2	1833.0	1837.9
Southern US 83	Valley	24.8	6.1	1799.0	1809.9
Total		167.0	48.8		

1 - Maximum storage and area are based on the overflow elevation.

2 – Overflow elevation may be higher by approximately 6-12” if the overflow is incorporated into the North Washington Street embankment.



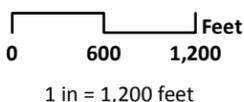
**Figure ES-3 Master Plan**

US 83/ND 1804 Stormwater Master Plan  
City of Bismarck, ND



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- |                             |                               |                         |
|-----------------------------|-------------------------------|-------------------------|
| US 83 / ND 1804 Watershed   | Future Road ROW               | WAPA Transmission Lines |
| Hay Creek Subwatersheds     | Basin Footprints              | WAPA Structures         |
| Hydrography                 | Conceptual Drainage Easements |                         |
| National Wetlands Inventory | Proposed Culvert              |                         |

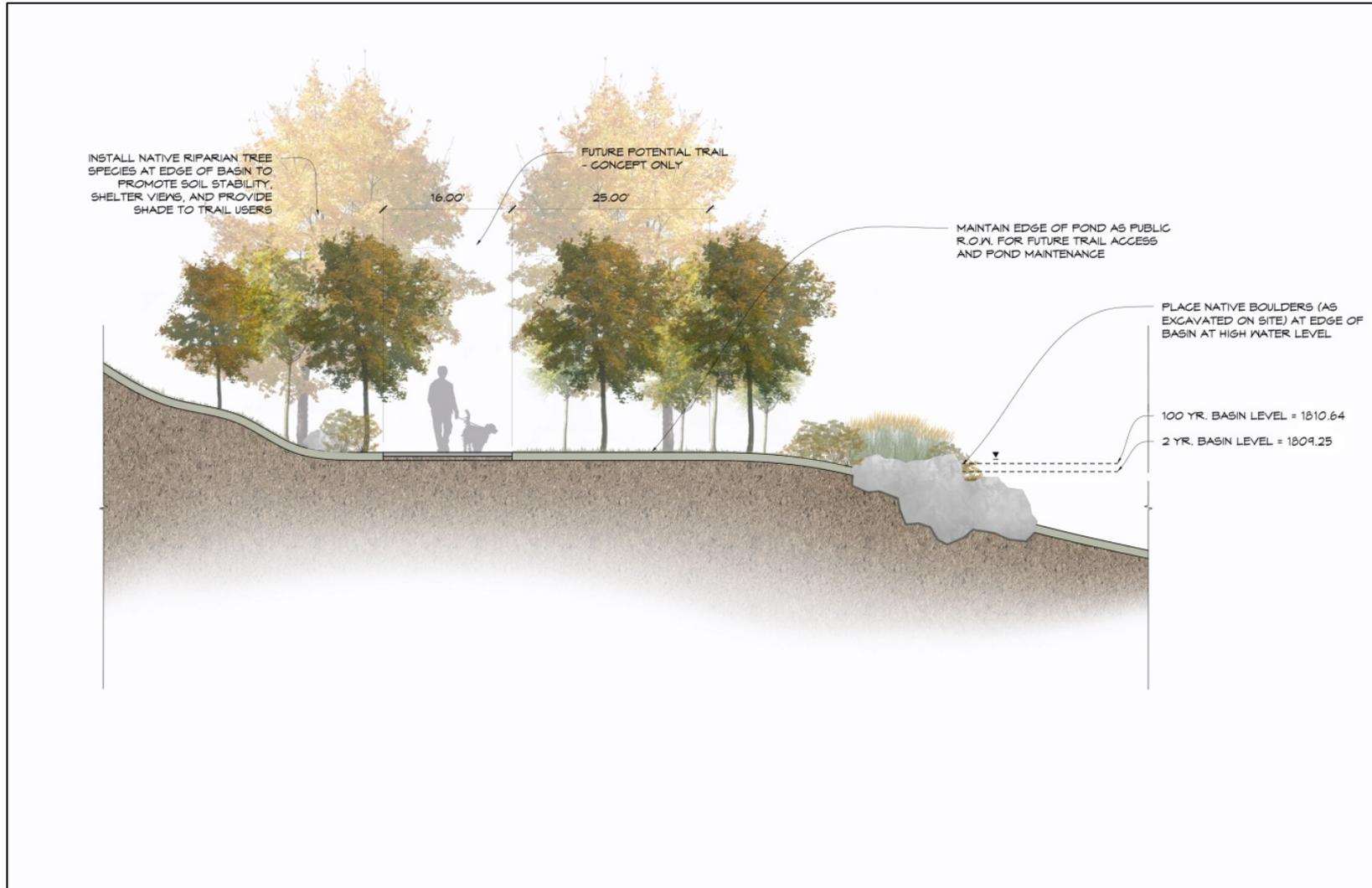
**Landscape Considerations**

Since the US 83 / ND 1804 watershed is adjacent to the main northern gateway into the City of Bismarck, the Master Plan includes landscape considerations for constructed facilities and a specific concept for the detention facility located adjacent to US 83 south of the intersection with ND 1804. Many of the basins are located within the open space corridor in the adopted regional land use plan and as such provide an opportunity to integrate stormwater management with overall green space aesthetics and recreational opportunities. Specific to the Southern US 83 Basin, the location allows for the ability to work with the surrounding terrain to create a unique landscape and recreational element along the US 83 gateway with the dual purpose of providing stormwater management (*Figures ES-4 & ES-5*).

**Figure ES-4** Southern US 83 Basin Concept Landscape Plan



**Figure ES-5** Southern US 83 Basin Concept Landscape Section



**Opinion of Probable Costs**

Opinions of probable costs were developed for each of the regional facilities incorporated into the master plan (**Table ES.2**). The total opinion of probable cost for construction of the proposed facilities is \$14,179,695, which includes \$10,245,700 for anticipated land acquisition costs at an assumed property valuation of \$4 per square foot. The estimated residential assessment for improvements is \$7,130 per acre and the estimated non-residential assessment for improvements is \$14,260 per acre.

**Table ES.2** Summary of Opinion of Probable Costs

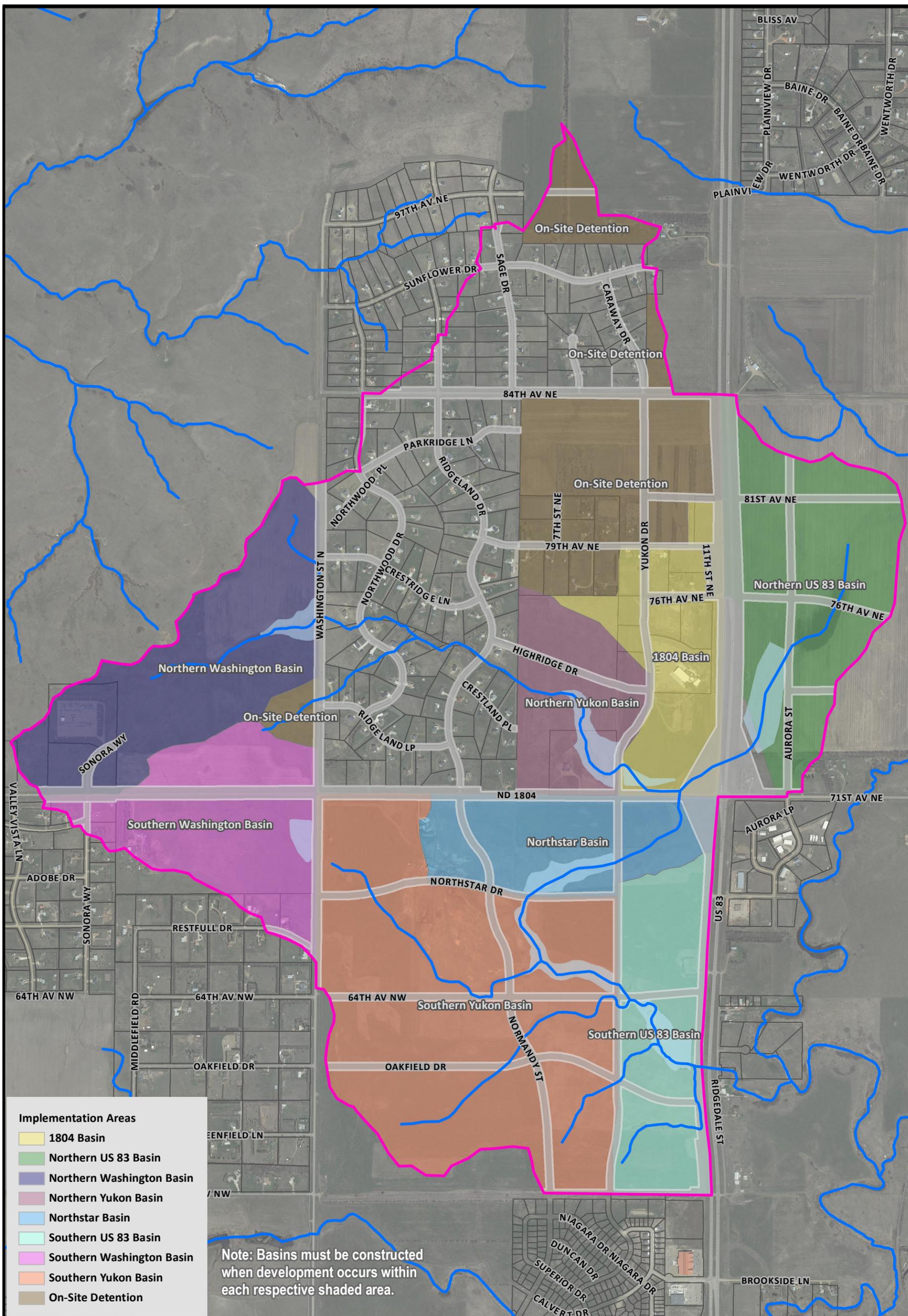
Regional Facility	Design and Construction Cost <sup>1</sup>	Land Acquisition Cost	Total
Southern US 83 Basin	\$335,385	\$1,515,900	\$1,851,285
Southern Yukon Basin	\$246,065	\$1,568,200	\$1,814,265
Northstar Basin	\$300,585	\$1,289,400	\$1,589,985
Northern Yukon Basin	\$293,190	\$1,620,500	\$1,913,690
1804 Basin	\$609,290	\$453,100	\$1,062,390
Northern US 83 Basin	\$936,555	\$2,195,500	\$3,132,055
Southern Washington Basin	\$911,905	\$575,000	\$1,486,905
Northern Washington Basin	\$152,685	\$819,000	\$971,685
Southern Washington Swale	\$148,335	\$209,100	\$357,435
Total	\$3,933,995	\$10,245,700	\$14,179,695

<sup>1</sup> – Includes a 15% estimating contingency and 30% for Engineering and Administration

**Conclusions**

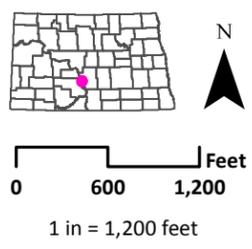
An implementation plan has been developed to balance capital outlays with proposed development patterns (**Figure ES-6**). Key triggers for construction of regional facilities include development within the areas noted and/or construction of roads that will ultimately be located along embankments for regional detention facilities.

This Master Plan meets City requirements for stormwater management given the proposed land use plan currently adopted by the City. Modifications of the proposed land use plan, including changes to the planned US 83 / ND 1804 interchange, will necessitate review of this Master Plan.



- Implementation Areas**
- 1804 Basin
  - Northern US 83 Basin
  - Northern Washington Basin
  - Northern Yukon Basin
  - Northstar Basin
  - Southern US 83 Basin
  - Southern Washington Basin
  - Southern Yukon Basin
  - On-Site Detention

Note: Basins must be constructed when development occurs within each respective shaded area.



### Figure ES-6 Implementation Sequence

US 83/ND 1804 Stormwater Master Plan  
City of Bismarck, ND

- US 83 / ND 1804 Watershed
- Hydrography
- Basin Footprints



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