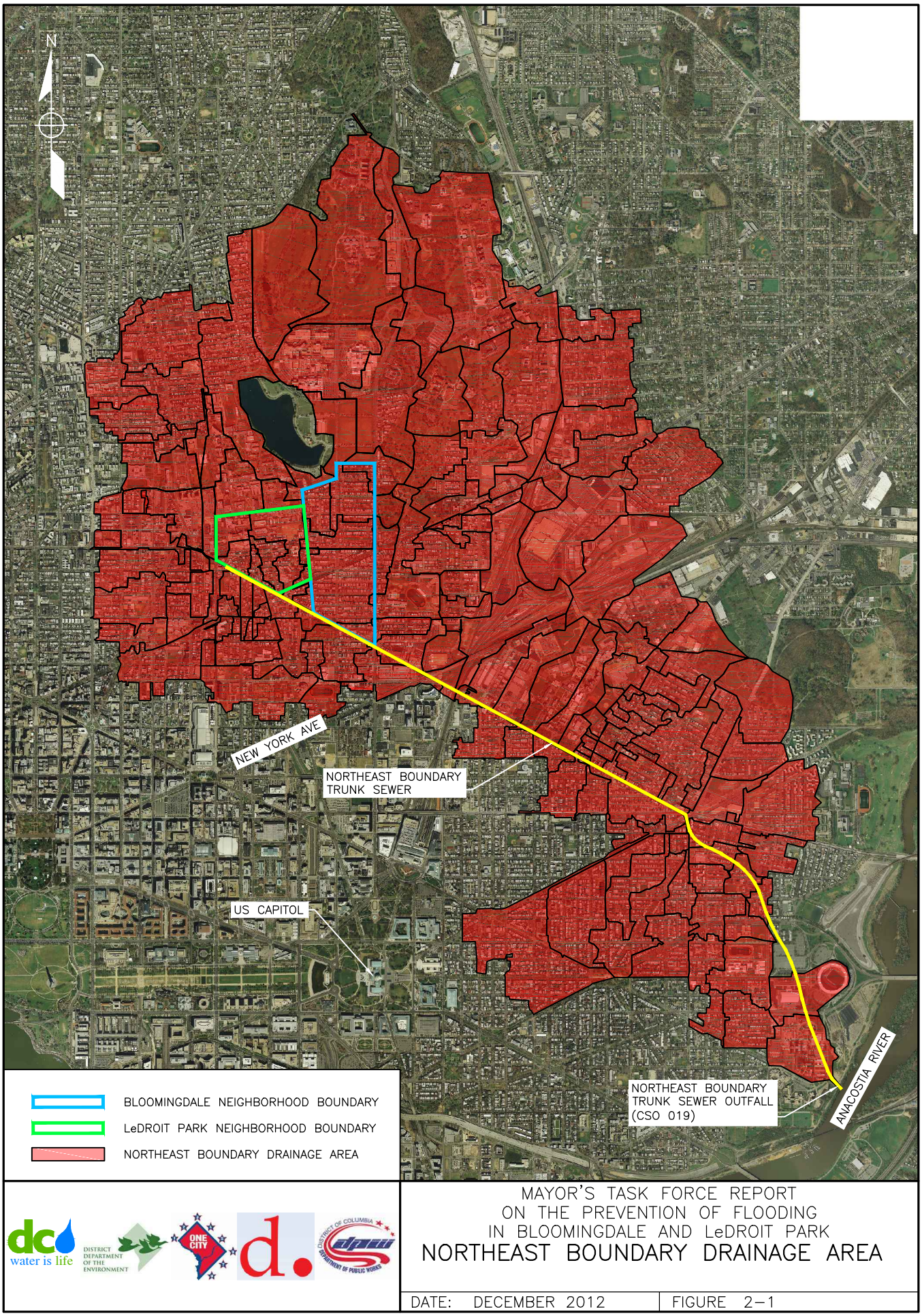
# 2 Existing Conditions

## 2.1 Drainage Area Boundaries

The Bloomingdale and LeDroit Park neighborhoods are a part of the Northeast Boundary (NEB) drainage area. Runoff from rainfall collected in catch basins combines with sewage from homes and businesses and is then conveyed through the sewer system downstream towards the wastewater treatment plant. The NEB drainage area collects runoff and sewage from an area of more than 4,900 acres. The sewershed is bounded to the north by Armed Forces Retirement Home (or Old Soldiers Home) north of Taylor Street, NE/NW, to the south by Capitol Hill East and the Anacostia River, to the east by the Brookland, Ivy City and Trinidad neighborhoods, and to the west by Logan Circle and Howard University (Figure 2-1). The Bloomingdale neighborhood occupies approximately 130 acres, and is part of a drainage area that is 724 acres in area. The LeDroit Park neighborhood occupies approximately 80 acres, and is part of a drainage area that is 405 acres in area (Figure 2-2).

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DRAWING ID: L:\LTCP\11\1110 - DIV J\01 - PRE-DESIGN\700 - CADD\CURRENT\EXHIBITS\BLOOMINGDALE\FIGURE 2-1-NE DRAINAGE AREA AND NEIGHBORHOODS.DWG

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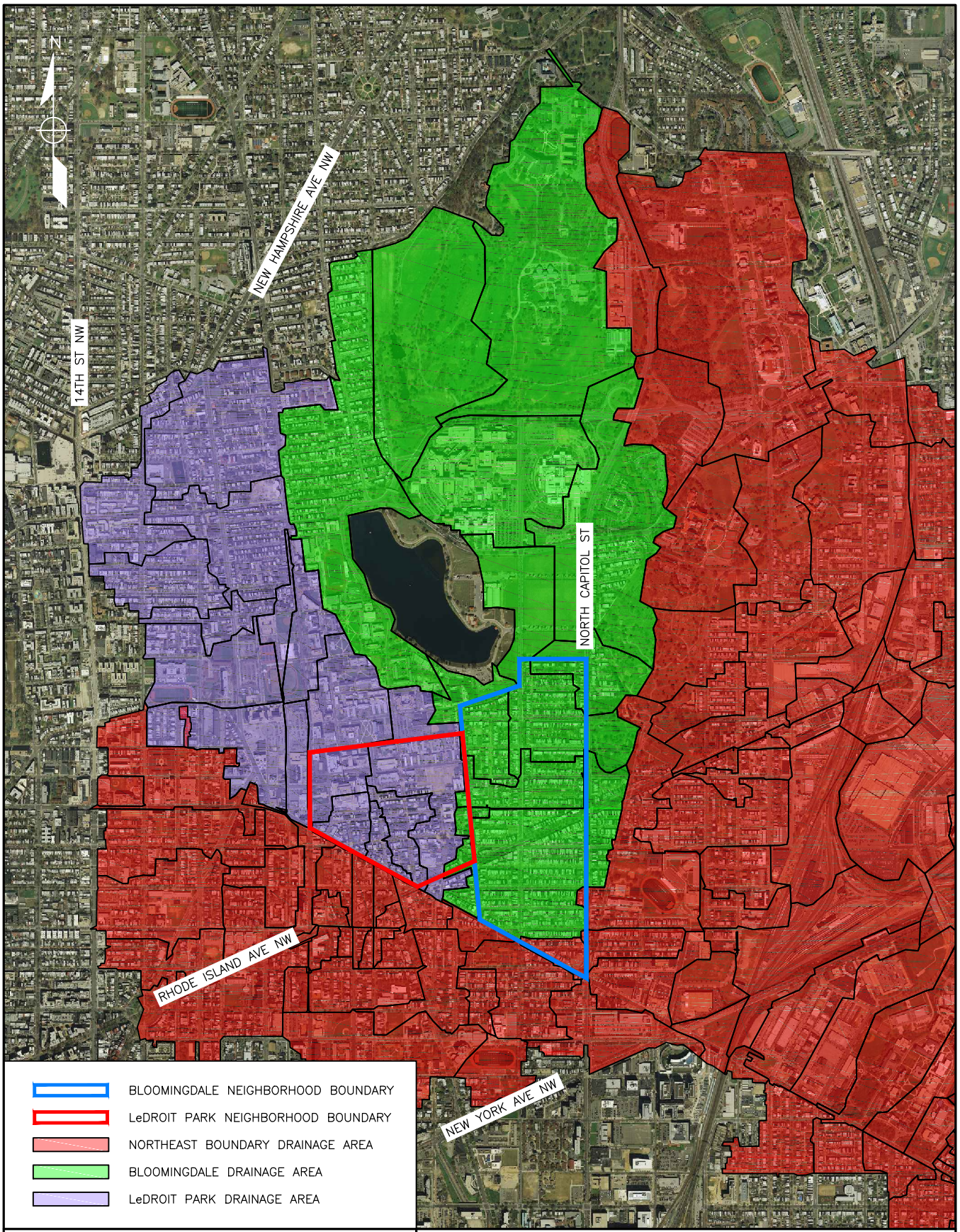
# MAYOR'S TASK FORCE REPORT ON THE PREVENTION OF FLOODING IN BLOOMINGDALE AND LeDROIT PARK

## NORTHEAST BOUNDARY DRAINAGE AREA

DATE: DECEMBER 2012 | FIGURE 2-1

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# MAP OF BLOOMINGDALE AND LeDROIT PARK BOUNDARIES

DATE: DECEMBER 2012 | FIGURE 2-2

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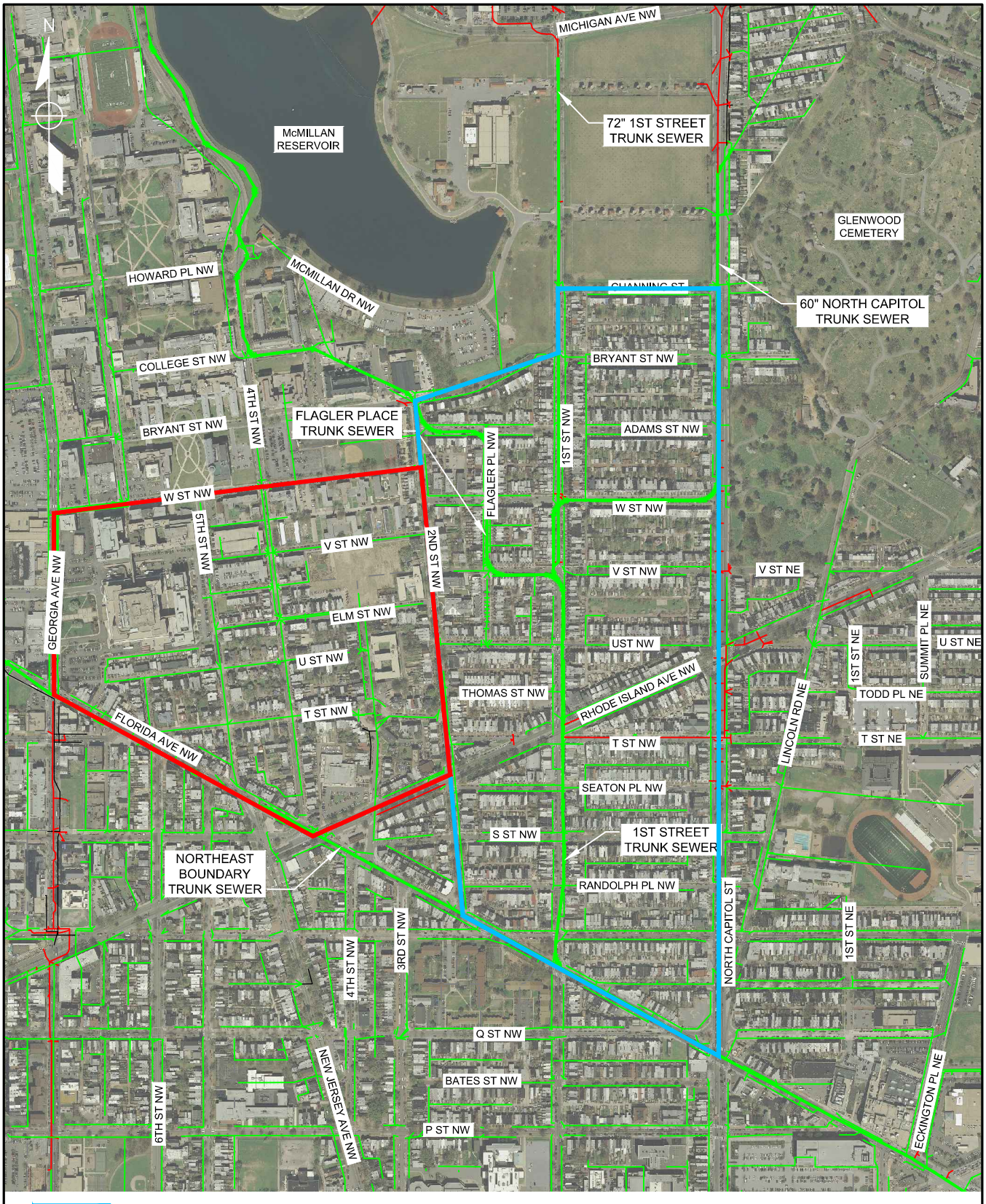
DRAWING ID: L:\LTCP\11\1110 - DIV J\01 - PRE-DESIGN\700 - CADD\CURRENT\EXHIBITS\BLOOMINGDALE\FIGURE 2-2-BLOOMINGDALE AND LEDROIT PARK AREAS.DWG

## 2.2 Sewer System Description

### 2.2.1 Collection System

#### 2.2.1.1 Northeast Boundary Trunk Sewer

Bloomingdale and LeDroit Park are located in the drainage area served by the Northeast Boundary Trunk Sewer (NEBTS). The NEBTS is one of the oldest combined sewers in the District. It begins on the west side of McMillan Reservoir and flows to the southeast, primarily along Florida Avenue toward the Anacostia River. The sewer discharges to the Anacostia River near RFK Stadium. The sewer is approximately 23,000 feet long and varies in size and shape from about 4.5 feet by 3 feet in the upper reaches to over 22 feet wide by 23 feet and 8 inches tall in the lower reaches. Numerous branch sewers near Bloomingdale and LeDroit Park convey wastewater and stormwater to the NEBTS, including trunk sewers on the north side of Florida Avenue, between First Street NW and Georgia Avenue. Figure 2-3 identifies the key sewers in the Bloomingdale and LeDroit Park areas.

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DRAWING ID: L:\LTCP\11\1110 - DIV J\01 - PRE-DESIGN\700 - CADD\CURRENT\EXHIBITS\BLOOMINGDALE\FIGURE 2-3-KEY SEWERS.DWG

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# BLOOMINGDALE AND LEDROIT PARK KEY SEWERS OVERVIEW

DATE: DECEMBER 2012 | FIGURE 2-3

#### 2.2.1.2 First Street Trunk Sewer (Combined Sewer)

The First Street Trunk Sewer, a combined sewer, is the main sewer that runs through the Bloomingdale and LeDroit Park drainage area. The sewer originates at the intersection of First and V Streets NW, where the First Street Storm Sewer terminates. The First Street Trunk Sewer flows south along First Street as a combined sewer until connecting with the NEBTS at Florida Avenue. The sewer is approximately 7,000 feet long and varies in size from 30 inches in the upper reaches to 9 feet at its connection with the NEBTS.

#### 2.2.1.3 First Street Storm Sewer

The First Street Storm Sewer is a separate storm sewer that begins at Old Soldier's Home. The sewer flows south along First Street and terminates at First and V Street NW. At its termination point, the sewer discharges into the First Street Trunk Sewer. The sewer ranges in size from 30" to 90" in diameter and is about 5,000 feet long. The sewer was constructed as a relief sewer in the 1960's.

#### 2.2.1.4 Flagler Place Trunk Sewer (Combined Sewer)

The Flagler Place Trunk Sewer originates from the west side of McMillan Reservoir, where it serves the Howard University campus and neighborhoods to the north. It is a combined sewer, and enters Bloomingdale at Second Street and Bryant Street, running south on Flagler Place to V Street, where it then travels east and connects with the First Street Trunk Sewer at First Street NW and V Street NW. The sewer is approximately 5,500 feet long and ranges in diameter from 36 to 78 inches.

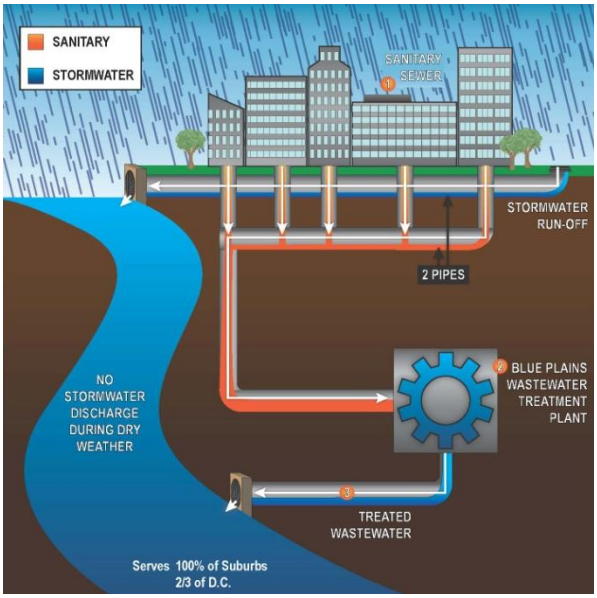
#### 2.2.1.5 North Capitol Street Trunk Sewer (Combined Sewer)

The North Capitol Street Trunk Sewer originates as a stormwater only line at the Old Soldier's Home, and flows to the south along North Capitol Street until connecting with a 4 foot-9 inch combined line just to the south of Evarts Street. The trunk line continues as a combined sewer to the south along North Capitol Street to W Street, where it travels west until First Street, and then heads south to V Street where it connects with the First Street Trunk Sewer at First Street NW and V Street NW. The sewer is approximately 6,000 feet long and ranges in diameter from 42 to 63 inches.

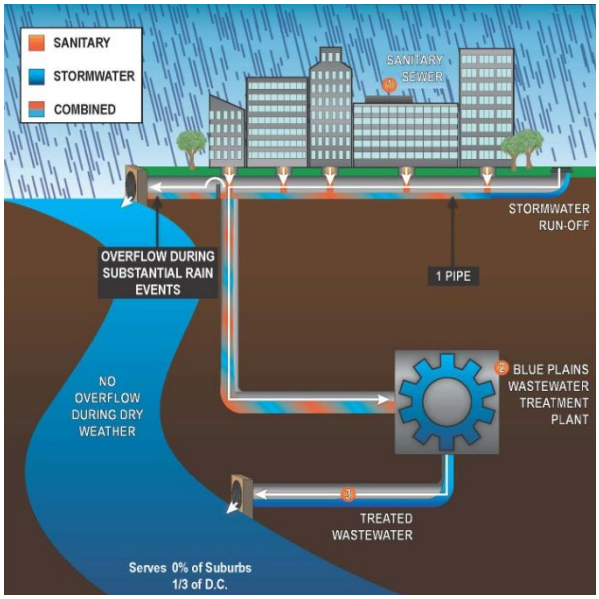
### 2.2.2 Collection System Facilities

In the combined sewer system, sewage from homes and businesses during dry weather conditions is conveyed to the District of Columbia Advanced Wastewater Treatment Plant at Blue Plains (Blue Plains), which is located in the southwestern part of the District on the east bank of the Potomac River. There, the wastewater is treated to remove pollutants before being discharged to the Potomac River. When the capacity of a combined sewer is exceeded during storms, the excess flow, which is a mixture of sewage and stormwater runoff, is discharged to the Anacostia and Potomac Rivers, Rock Creek and tributary waters. These discharge points are referred to as combined sewer outfalls (CSOs).

Separate and Combined Sewer Systems:




Separate Sanitary and Stormwater Sewer Systems Comprise 66% of DC's Sewer Collection System




A Combined Sewer System Comprises 33% of DC's Sewer Collection System

Facilities near the outfall of the NEBTS are shown on Figure 2-4 and Figure 2-5 and include the Structure 24 Inflatable Dams, Northeast Boundary Swirl Facility (Swirl) and the East Side Pumping Station. The operation of these facilities under different weather conditions is summarized below.

*Dry Weather*- Sanitary sewage in the NEBTS is diverted at East Capitol Street and 21st Street Extended to sewers which convey flow to Main Pumping Station and ultimately to Blue Plains for treatment. The Structure 24 inflatable dams and the NEB Swirl are not used in dry weather. The East Side Pumping Station serves a separate sanitary drainage area that is located northeast of the Northeast Boundary Area. East Side Pumping Station pumps separate sanitary sewage from this drainage area to sewers which convey the flow to Blue Plains for treatment.

*Small Rain Events* - If it rains sufficiently to produce runoff that exceeds the diversion capacity at East Capitol Street and 21st Street Extended, combined sewage in the NEBTS flows down to the Structure 24 inflatable dams. The dams are kept in an inflated position and they divert the flow to the Swirl Facility. The first 15 millions of gallons per day (mgd) of flow is diverted upstream of the screen chamber via the bypass sewer to the 48" Upper East Side Interceptor and then to East Side Pumping Station. When the flow exceeds 15 mgd, the sluice gate closes and all the flow is diverted to the Swirl Facility. At the Swirl Facility, the flow is screened to remove solids and debris before entering the tanks. In the three 57 foot diameter swirl tanks, the flow is directed into a circular spinning motion which pushes solids down and to the outside of the tank (similar to stirring a teacup). Up to 21 mgd of concentrated underflow is withdrawn from the bottom of the tanks, and is sent to the East Side Pumping Station where the flow is conveyed to Blue Plains. The clarified effluent overflows the top of each swirl tank and is directed to the mixing chamber where sodium

hypochlorite is added to disinfect the combined sewage. Flow leaving the mixing chamber is directed to the NEBTS and is discharged to the Anacostia River. Prior to discharging, the flow is dechlorinated using sodium bisulfite.

*Large Rain Events* - During large rain events, the same procedure described above for small rain events occurs at the beginning of the storm. Large rain events can exceed the capacity of the Swirl Facility. The inflatable dams are controlled automatically, based on upstream level and the flow rate through the Swirl facility. The dams deflate to allow combined sewage to discharge to the Anacostia River based on the criteria described below.

*Flow to Swirl* - The dams modulate up and down by letting air in and out of the dam similar to a balloon. The west and middle dams modulate down first when the Swirl influent flow reaches 380 mgd. If the rain event is large enough such that lowering the middle and western dams cannot maintain the flow rate through the Swirl at 380 mgd, then the eastern dam modulates to limit flow through the swirl to 420 mgd. The dams are designed to deflate and lower to control flows to the Swirl Facility in this range.

*Upstream level* – The elevation of water in the Northeast Boundary Sewer is measured by level sensors in the Swirl influent channel. The levels sensors are used to deflate the dams to relieve combined sewage to the Anacostia River. If the upstream water level reaches EL +12.0, then the middle and western dams deflate to maintain the upstream water level at this elevation. If the water level continues to rise to EL 12.5, then the eastern dam also deflates to relieve flow to the river. The dam deflation is staggered to maximize treatment through the Swirl Facility. There is also an emergency mode built into the dams to provide for deflation during large rain events. If the upstream level rises to EL 15.5, the dams will go into emergency mode and will automatically completely deflate.

A profile of the NEBTS and the Flagler Street Trunk Sewer is shown in Figure 2-5. The figure shows that grade at the Bloomingdale area is in the range of EL 60 to 105, which is much higher than the inflatable dams and many other locations in the Northeast Boundary area.

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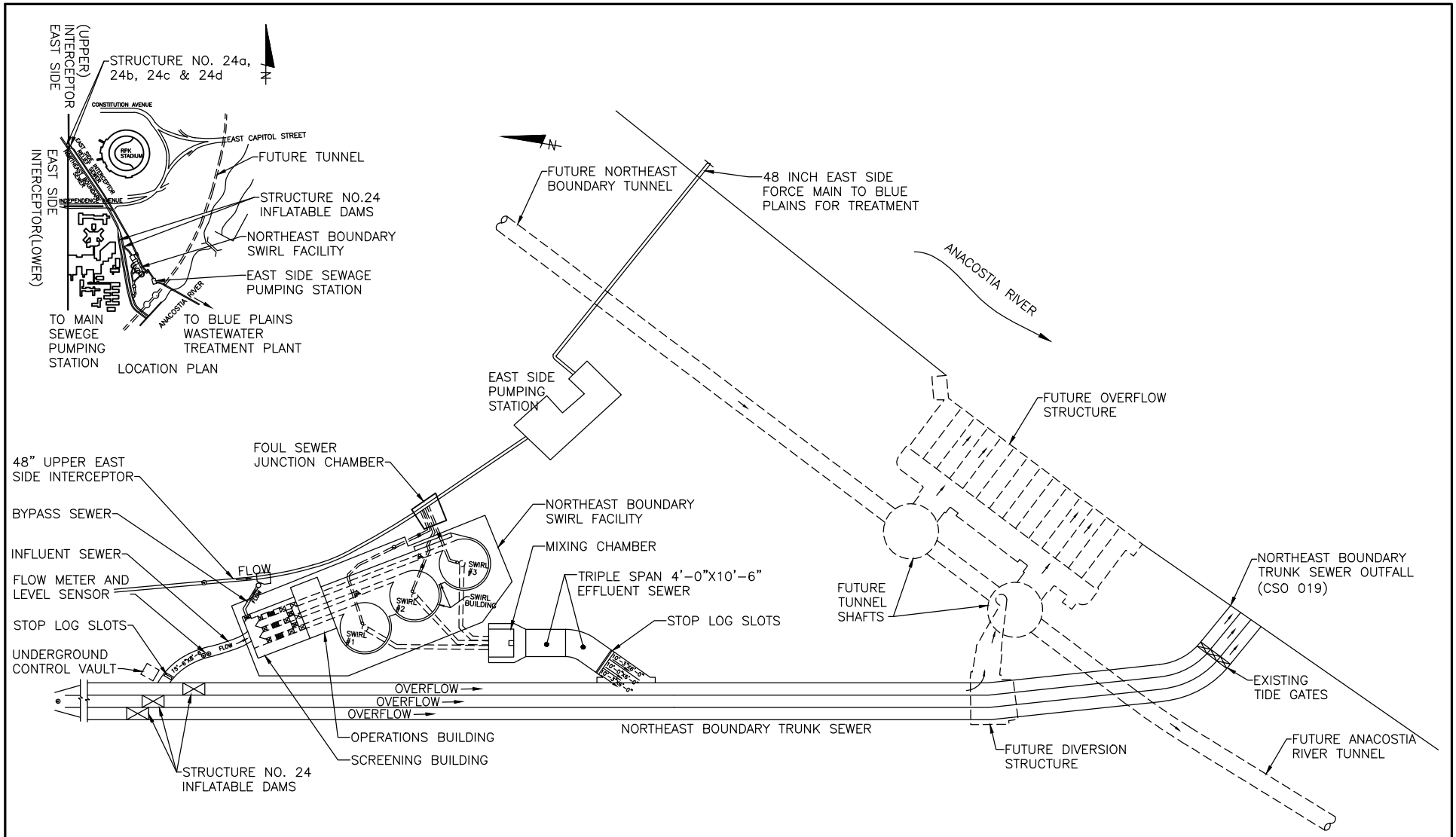
DRAWING ID: L:\LTCP\11\1110 – DIV J\01 – PRE–DESIGN\700 – CADD\CURRENT\EXHIBITS\BLOOMINGDALE\FIGURE 2–4–NEBTS OUTFALL SCHEMATIC.DWG

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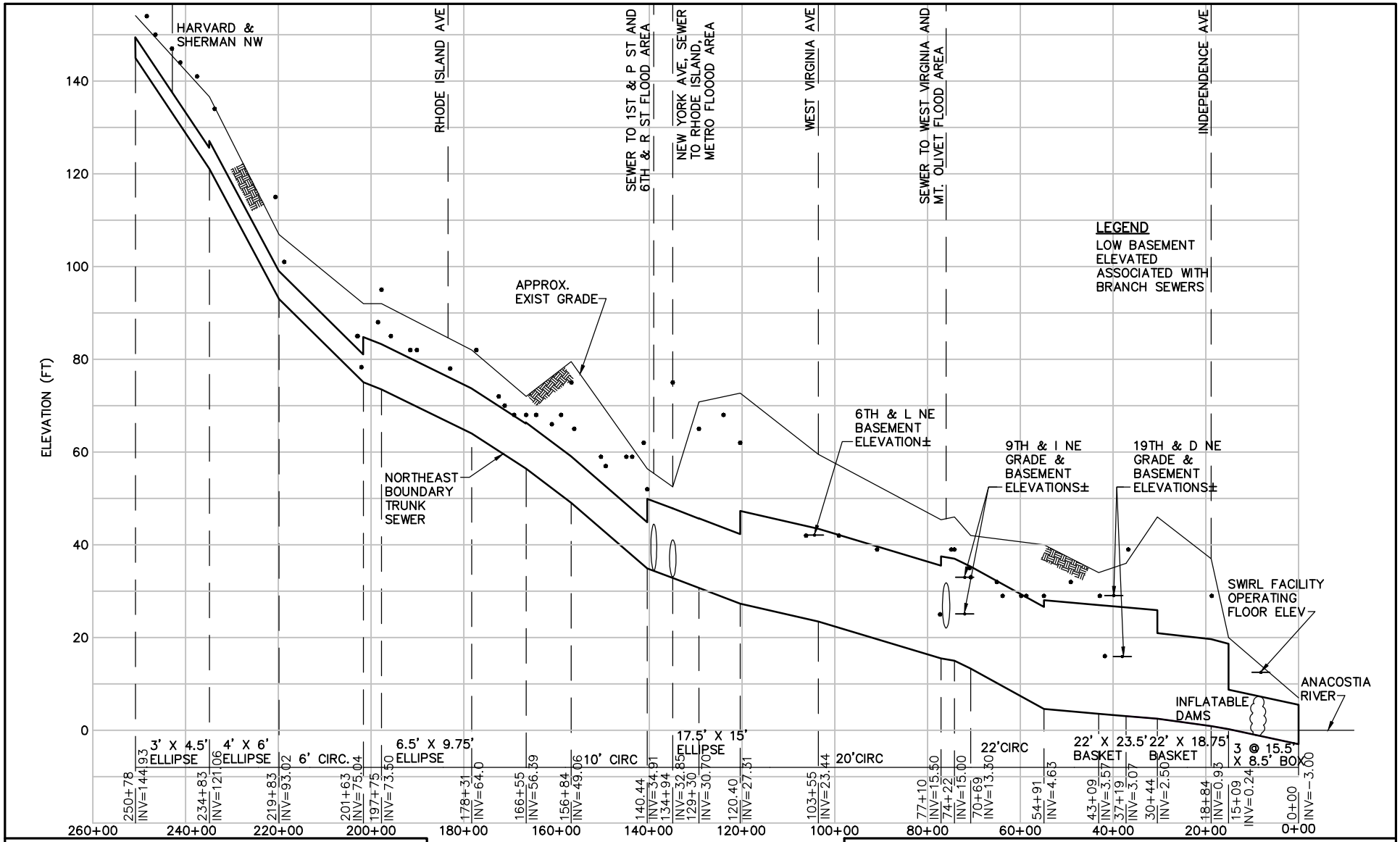
# NORTHEAST BOUNDARY TRUNK SEWER OUTFALL SCHEMATIC

DATE: DECEMBER 2012 | FIGURE 2–4

LAST SAVED BY: HELEN J. KARAU DATE: 11/15/2012 11:20:33 AM

DRAWING ID: L:\LTCP\11\1110 – DIV J\01 – PRE–DESIGN\700 – CADD\CURRENT\EXHIBITS\BLOOMINGDALE\FIGURE 2–5–NEBTS PROFILE.DWG




HORIZONTAL SCALE: 1" = 3,000'
VERTICAL SCALE: 1" = 30'

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IN BLOOMINGDALE AND LeDROIT PARK

# NORTHEAST BOUNDARY TRUNK SEWER PROFILE

DATE: DECEMBER 2012 | FIGURE 2–5

### 2.2.3 Collection System Capacity

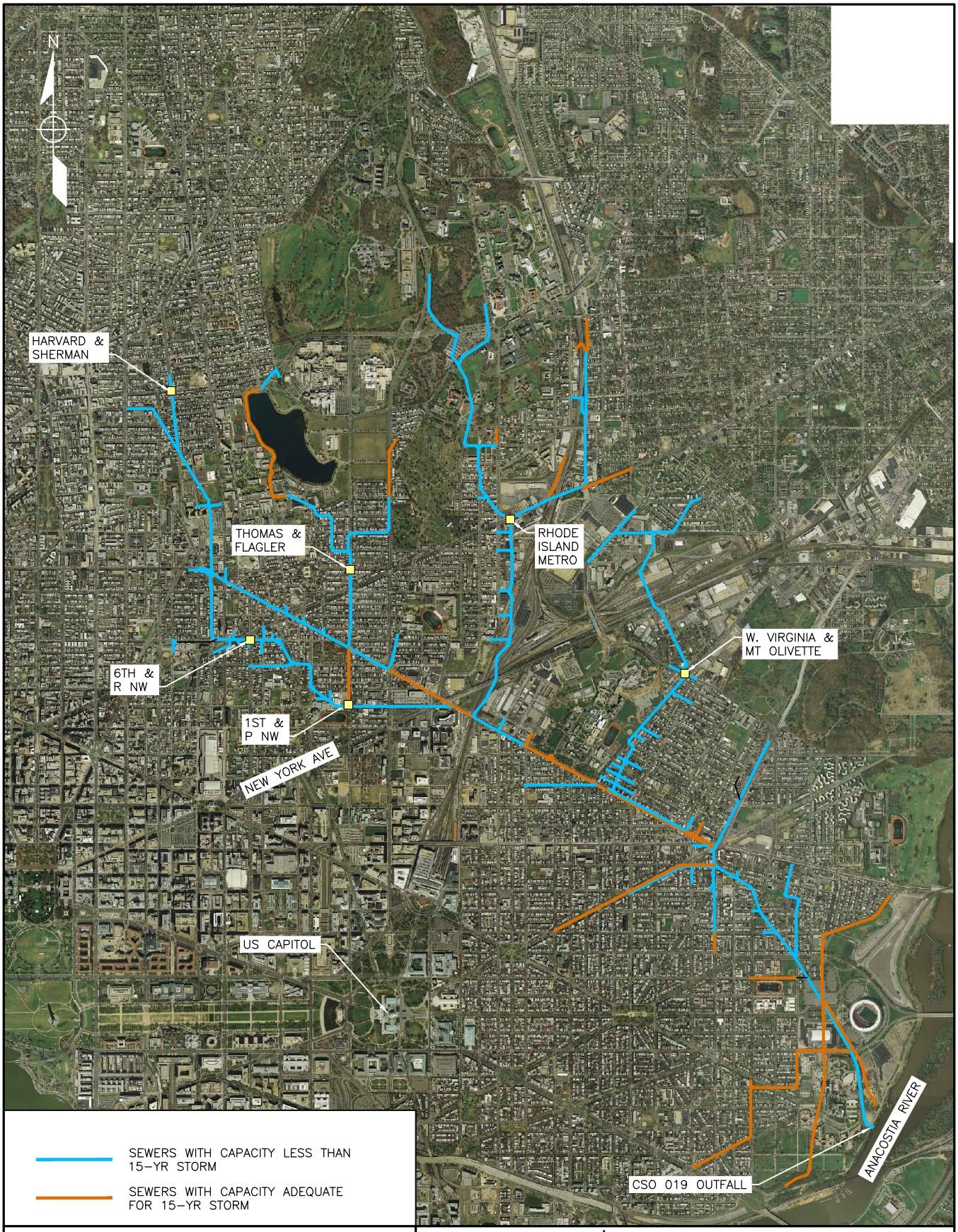
DC Water has established the 15-year storm as the design standard for storm water collection and conveyance. Most of the sewer pipes in the Northeast Boundary drainage areas were constructed prior to 1910, well before the 15-year storm design standard was established. Consequently, the existing NEBTS and many of its trunk sewers do not have the capacity to convey storms with return frequencies beyond the 2-year storm without flooding.

Figure 2-6 identifies the sewers which do and do not have the predicted capacity to convey the 15-year design storm. The figure shows that most of the main trunk sewers, including those serving Bloomingdale and LeDroit Park, do not have the capacity to convey the storm selected as the bases of design for the sewer system.

Hydraulic modeling analyses of the sewer system serving Bloomingdale and LeDroit Park determines that the system has the capacity to convey more than the 2-year rainfall event, but not the 5-year rainfall event. In order to convey the District's standard 15-year design storm, the sewer system capacity would need to be supplemented by constructing a sewer system roughly the same size as the existing system. Runoff volumes and system capacity is summarized in Table 2-1.

**Table 2-1: Summary of Rainfall and Sewer System Capacity in Bloomingdale and LeDroit Park**

| Storm Return Period and Duration | Rainfall Depth (inches) | Rainfall Volume (gallons) | Runoff Volume (gallons) | Adequate Collection System Capacity |
|---|---|---|---|---|
| 2-year 6-hour | 2.3 | 70,400,000 | Not Modeled | Yes |
| 5-year 6-hour | 2.8 | 86,400,000 | 60,700,000 | No |
| 15-year 6-hour | 3.6 | 112,000,000 | 74,000,000 | No |

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ON THE PREVENTION OF FLOODING
IN BLOOMINGDALE AND LeDROIT PARK

# SURCHARGED SEWERS DURING A 6-HOUR, 15-YEAR DESIGN STORM

DATE: DECEMBER 2012 | FIGURE 2-6

## 2.3 Historical Development of Sewershed

The lands that comprise present-day Bloomingdale were historically located outside the original boundary of the City of Washington. Originally a private estate, Bloomingdale was pursued as a water source for the Capitol in the early 19th Century. The City of Washington obtained the land and rights of way to springs in 1834. By the late 1870's, the Bloomingdale estate was divided and sold to several real estate developers.

During this early period of development, Bloomingdale was used for a variety of light industrial uses, including train yards and transportation routes into and out of the City of Washington. Boundary Street, today Florida Avenue, was the dividing line between paved, planned streets that were laid out in the original city plan, and the countryside, where a variety of landowners maintained orchards, large country estates, and a mixture of commercial properties.

The rural nature of this area changed before the turn of the 20th Century, as the rest of Washington neighborhoods began to experience the pressures of growth, stemming from an influx of workers and freed men following the Civil War. Developers and land speculators began to chart the former industrial and orchard lands for proposed development. In the late 1890's, the area was opened up to residential development as streets were improved, and popular trolley lines were introduced.

New demands of a growing population prompted the development of the District's sewer system. By 1890, the Boundary Sewer – which comprised the southern portion of the modern day NEBTS – was constructed. The Boundary Sewer originated at the intersection of Maryland Avenue and Benning Road, and diverted flows into the Anacostia River. The Boundary Sewer, along with the Slash Run, Tiber Creek, B Street, and other sewers located throughout the District, comprised the waste and stormwater management system for 230,392 District residents. By the mid-1950's, a comprehensive system of sewers was constructed, and extensions to the Boundary Sewer led way to the NEBTS that currently serves the Bloomingdale and LeDroit Park communities. The Tiber Creek Trunk Sewer, which drained a significant volume of flows in the early 1800's, was replaced by the Flagler Place Trunk Sewer as the main sewer system conveying flows to the NEBTS.

The combined sewers that were installed at the turn of the 20th Century continued to serve the most central and oldest portions of the District. The remaining sewers comprised approximately two-thirds of the entire system and consisted of pipes that either exclusively conveyed sanitary waste or stormwater. Sanitary and combined sewer flows were both directed to wastewater treatment plants, whereas stormwater was discharged into nearby waterways. This system reflects much of the District's sewer system today, and was adapted to support the needs and demands of the numerous government agencies, commercial enterprises, and growing residential neighborhoods of the Capitol.

### 2.3.1 Land Use

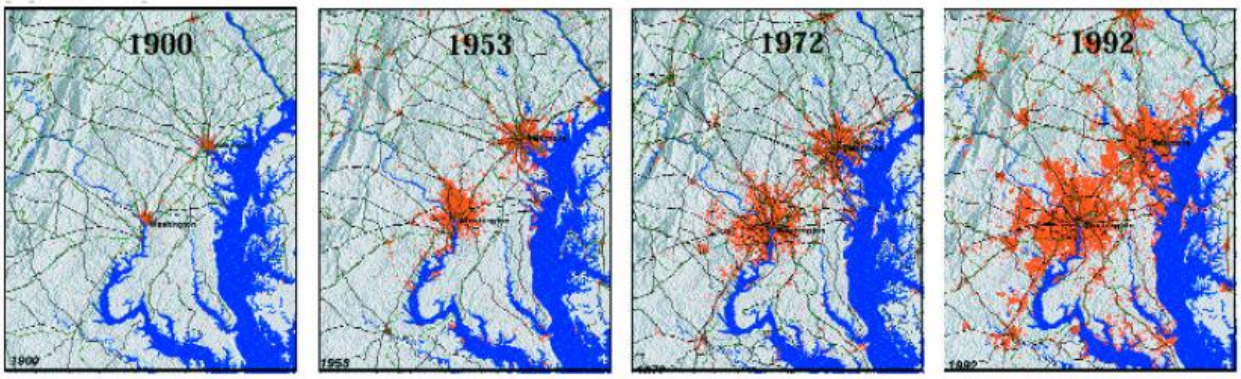
#### 2.3.1.1 Background

In many regions, urbanized areas have expanded dramatically. Urbanized land area in the United States has quadrupled since 1954. From 1992 to 1997, the national rate of development more than doubled to three million acres per year. In most large metropolitan areas, urban land area rose more

than twice as fast as population did between 1950 and 1990 (Figure 2-7). The reasons for these dramatic changes in urban form are numerous, including income increases, living style preferences, and public policy on transportation investment, housing, and taxes that have facilitated these trends.

Development in a watershed changes natural drainage patterns. Increases in impervious area associated with development increase the volume and the rate of surface water runoff. In a study of 40 runoff monitoring sites across the nation, a one-acre parking lot was found to produce a runoff volume almost 16 times as large as the runoff volume produced by an undeveloped meadow. Peak discharge, velocity, and time of concentration of stormwater runoff were also found to be much greater. Furthermore, transportation-related impervious surfaces seem more often to exhibit a greater runoff volume than disconnected rooftop-related imperviousness of the same surface area.

**Figure 2-7: Visual image of growth in urban development for the Baltimore-Washington region**




Source: U.S Environmental Protection Agency (EPA). Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation and Environmental Quality, January 2001.

According to a 2010 planimetric dataset created as part of the DC Geographic Information System (DC GIS) for the D.C. Office of the Chief Technology Officer (OCTO) and participating D.C. government agencies, approximately 40% of the entire 69 square miles containing the District is impervious surface.

### 2.3.1.2 Impervious Surface within Bloomingdale Drainage Area

Within the Bloomingdale drainage area, the total impervious area comprises approximately 320 acres, or 44% of the entire drainage area (Table 2-2). Impervious areas include building rooftops, roads, sidewalks, alleys, and paved surfaces such as parking lots. The non-impervious areas within the Bloomingdale drainage area include open spaces such as lawns (i.e. front and backyards), grass areas, small parks, cemeteries, recreational and sport fields, and above ground rail road system.

**Table 2-2: Impervious Surface within the Bloomingdale Drainage Area**

| Surface Type | Area (acres) | Percentage |
|---|---|---|
| Impervious:<br>(1) Buildings (Rooftops)<br>(2) Roads<br>(3) Sidewalks<br>(4) Alleys<br>(5) Pave Surfaces | 320 | 44% |
| Non-Impervious:<br>(1) Lawns<br>(2) Grass Areas<br>(3) Small Parks<br>(4) Cemeteries<br>(5) Recreational and Sport Fields<br>(6) Railroads | 404 | 56% |
| Total Bloomingdale Drainage Area | 724 | 100% |

** The impervious dataset is derived from the 2010 Planimetric datasets.The impervious dataset contains planimetric features that are typically classified as impervious surface, created as part of the DC Geographic Information System (DC GIS) for the D.C. Office of the Chief Technology Officer (OCTO) and participating D.C. government agencies.*

Within the LeDroit Park drainage area, the total impervious area is approximately 279 acres, or 69% of the entire drainage area (Table 2-3). Impervious areas include building rooftops, roads, sidewalks, alleys, and paved surfaces such as parking lots. The non-impervious areas within the LeDroit Park drainage area includes open space such as lawns (i.e. front and backyards), grass areas, small parks, cemeteries, recreational and sport fields, and above ground rail road system.

The percentage of impervious area in the Bloomingdale and LeDroit Park drainage areas has increased over the past several decades as the neigbhorhoods and the District have been developed. As a result, the volume of stormwater runoff contributing to the sewer system has increased. While the documented incidence of flooding in the neighborhood has increased during the last 10 to 12 years, the impervious area has not increased significantly during that time period. Planimetric datasets are not available before 2010, but a comparison can be made of the net impervious surface change over the last decade by studying aerial images (Figure 2-8). While it is likely that there were some small impervious increases from new driveway or sidewalk construction, there is no evidence to support major increases in impervious area that would drive a large increase in stormwater runoff.

**Table 2-3: Impervious Surface within LeDroit Park Drainage Area**

| Surface Type | Area (acres) | Percentage |
|---|---|---|
| Impervious:<br>(1) Buildings (Rooftops)<br>(2) Roads<br>(3) Sidewalks<br>(4) Alleys<br>(5) Pave Surfaces | 279 | 69% |
| Non-Impervious:<br>(1) Lawns<br>(2) Grass Areas<br>(3) Small Parks<br>(4) Cemeteries<br>(5) Recreational and Sport Fields<br>(6) Railroads | 126 | 31% |
| Total LeDroit Park Drainage Area | 405 | 100% |

** The impervious dataset is derived from the 2010 Planimetric datasets.The impervious dataset contains planimetric features that are typically classified as impervious surface, created as part of the DC Geographic Information System (DC GIS) for the D.C. Office of the Chief Technology Officer (OCTO) and participating D.C. government agencies.*

1999

2010

BLOOMINGDALE NEIGHBORHOOD BOUNDARY

LeDROIT PARK NEIGHBORHOOD BOUNDARY

MAYOR'S TASK FORCE REPORT
ON THE PREVENTION OF FLOODING
IN BLOOMINGDALE AND LeDROIT PARK

# BLOOMINGDALE AND LeDROIT PARK IMPERVIOUS SURFACE COMPARISON

DATE: DECEMBER 2012 | FIGURE 2-8

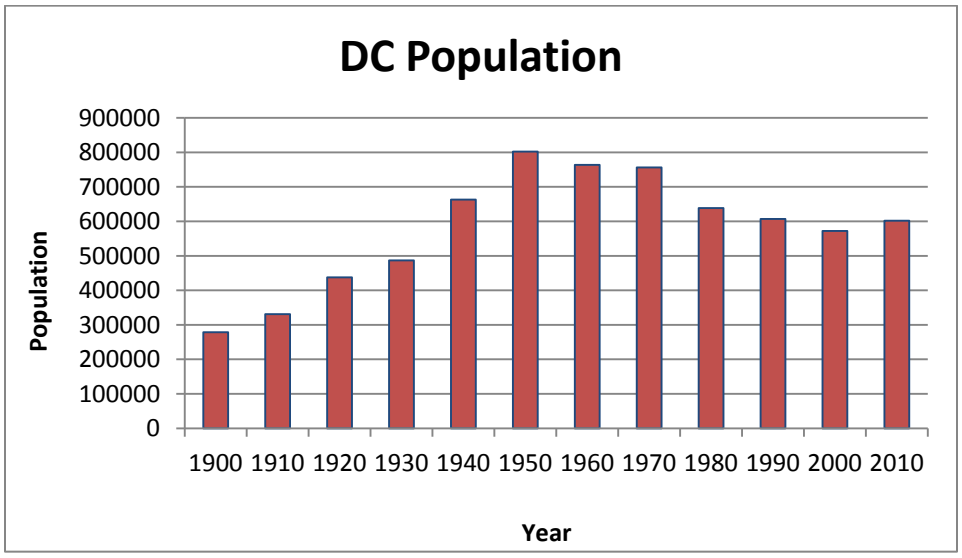
LAST SAVED BY: HELEN J. KARAU DATE: 11/15/2012 8:15:34 AM
DRAWING ID: L:\LTCP\11\1110 - DIV J\01 - PRE-DESIGN\700 - CADD\CURRENT\EXHIBITS\BLOOMINGDALE\FIGURE 2-8-AERIAL IMAGE COMPARISON.DWG

### 2.3.2 Population

As with many cities, widespread development in the District of Columbia has been coupled with dramatic increases in population. These changes have had a direct impact on the greater sewershed by increasing the amount of sanitary load entering into the sewer collection system.

Population growth for the City of Washington over the past 110 years can be seen in Table 2-3. The District experienced its highest gains in population between 1900 and 1950, with growth from approximately 275,000 to over 800,000 residents. Between 1960 and 2000, population steadily decreased to 575,000 residents, reflecting the development of communities directly outside of the District. The most recent Census in 2010 indicates that population has increased slightly to 600,000 residents since 2000. Overall, population has more than doubled since the sewer collection system's early development at the turn of the 20th century.

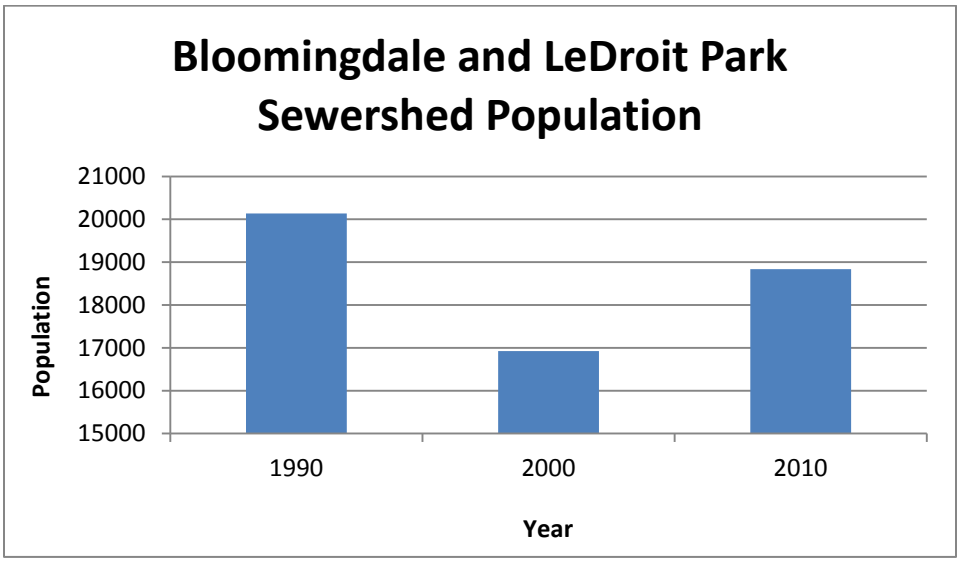
**Table 2-4: City of Washington, DC Population from 1900-2010**




Source: Census Bureau

In order to get a sense of how population has grown specifically in Bloomingdale and LeDroit Park, Census data for the region was estimated using both the neighborhoods' boundaries and the Bloomingdale and LeDroit Park sewershed boundary. Between 2000 and 2010, the population in Bloomingdale and LeDroit Park increased by 10%, from 8,790 to 9,680 residents. Similarly, the sewershed population has increased by 11% from 2000 to 2010 (Table 2-4).

**Table 2-5: Bloomingdale and LeDroit Park Sewershed Population from 1990-2010**




Source: Census Bureau

Overall, population for Bloomingdale, LeDroit Park, the greater sewershed, and the District, has increased in the last 10 years. It is important to note that growth throughout the region in the recent past has increased the number of people both contributing to the sewer collection system and experiencing the effects of flood events.

### 2.3.3 Changes in Dwelling Use

#### 2.3.3.1 Observations from One-on-One Consultations with Residents

Flooded Basement

Following the July and September 2012 storm events, DC Water employed ARCADIS/Malcolm Pirnie to conduct one-on-one consultations with residents within the Bloomingdale and LeDroit Park neighborhoods. Consultations were solicited on an individual resident basis and were coordinated through DC Water's Department of Customer Service. The purpose of these consultations was to provide homeowners with recommended modifications and actions that would reduce or eliminate surface and overland flooding from traveling into individual properties. Consultations were not intended to address sewer backups (Section 5.1.2: Backwater Valve Device and Rebate Program).

Consultations were conducted by ARCADIS/Malcolm Pirnie engineers, who walked around the perimeter of each home to inspect outdoor fixtures and basement configurations relative to the street level. Engineers were instructed to observe properties from the front and rear, and to gain access to rear entrances through alleyways located outside of homes. Following each consultation, residents

received customized reports that summarized recommended actions for each homeowner to take, including backwater valve installation and improvements to existing sump pumps.

Although the consultations were not intended to evaluate the nature and scope of basement-level modifications to homes, several observations were made regarding the overall changes in dwelling use in the Bloomingdale and LeDroit Park neighborhoods. Although largely anecdotal, these observations are important insofar that they document fundamental changes that have contributed to both the severity and urgency of flooding in the region (Table 2-5).

**Table 2-6: Engineering Consultation Observational Data**

| Consultation Question | Yes | No | Unknown |
|---|---|---|---|
| Do you have a finished basement? | 95% | 5% | 0% |
| Did you experience a sewer backup? | 85% | 8% | 8% |
| Do you have plumbing fixtures in your basement? | 100% | 0% | 0% |
| Was your basement finished within the last 5 years? | 37% | 41% | 22% |
| Of those who have finished their basement within the last 5 years, was your basement finished within the last 2 years? | 53% | 47% | 0% |
| Where did you experience flooding? | Home | Yard | Both |
| | 71% | 6% | 19% |

Based on data gathered from over 40 consultations that have been performed, these observations include the following:

- Almost all of the basements surveyed featured entry points at the front and rear of the property, with stairwells leading down to each entry way. ARCADIS/Malcolm Pirnie engineers noted that it was typical for area drains to be located at the bottom of the stairwells, such that runoff and rainfall that makes it into the stairwell flows into the area drain. Based on observations made by residents, these area drains comprise the primary pathway for sewer backups that enter into the property through door sills.
- A large number of consulted properties rent out the basement level as individual apartments. This has been facilitated by the fact that row houses and properties that previously acted as single-family homes have been subdivided into condominiums, including condo units at the basement level. Thus, the overall amount of below-ground living space has increased.
- Approximately 95% of basements surveyed had finished basements, complete with plumbing fixtures and private-entries that would allow them to serve as rentable units. Each of these plumbing fixtures acts as a pathway for sewer-backups to occur; basements that lacked showers, toilets, or other drains were less likely to experience sewer backups, and coincidently, represented a small percentage of the basements surveyed. Only 5% of consultations were performed for unfinished basements, suggesting that people with finished basements had a greater likelihood of initiating a consultation following a flood event. This suggests that homeowners with unfinished basements, although represented in the total

number of consultations conducted, may consider flood events to be less critical than homeowners who have invested in basement renovations.

- Of the basements surveyed, 37% have undergone renovation within the past five years, 41% within the past 10-30 years, and 22% of which the date when basements were renovated is unknown. Of the respondents who answered that renovations have taken place within the past five years, over 50% of those renovations have occurred within the past two years. This suggests that basement units have not historically functioned as livable space, and that basement renovations are a recent phenomenon for Bloomingdale and LeDroit Park. Basement conversions have coincided with a large influx of new property owners who are investing in basement renovations. Among these renovations, engineers noted that a substantive number of property owners have lowered the foundations of their properties by one to two feet in order to maximize space at the basement level. Consequently, lowering the property's elevation at the lowest point (e.g. the basement) may have rendered properties more susceptible to flooding.

### 2.3.4 Water and Sewer Availability Certificates

Changes in the use of residences in the Bloomingdale and LeDroit Park neighborhoods can be assessed through permit activity. Permits can only account for renovation projects in which permits are applied for, and do not reflect the total construction activity of the neighborhoods including non-permitted work. A review of DC Water's records of Water and Sewer Availability Certificates (WSACs) issued indicates that since 2000, approximately 56 locations in the Bloomingdale and LeDroit Park areas submitted plans and received WSACs for construction or reconstruction. Of those 56 locations, approximately 20 are identified as Commercial accounts (36%). Commercial accounts are those with either four or more individual tenants, or those that actually house a commercial establishment.

The rate of DC Water permit applications appears to have stayed fairly constant from 2000 to 2009 at approximately three and a half (3 ½) permit applications per year. However, since 2010 the rate has more than doubled, rising to nine and a half (9 ½) per year. A review of DCRA plumbing permit records for the past five years indicates that 10 permits were issued were for backflow preventers. Over the same 5-year period DC Water issued approximately 30 WSACs.

## 2.4 Prior Studies

Flooding along the NEBT Sewer and its branch sewers has been reported since the late 1800's. As a result, several engineering studies have been conducted over the years in an attempt to address these flooding complaints. These studies include, but are not limited to, the following:

- "Report to David V. Auld, Director of Sanitary Engineering Upon Investigation of Sewerage System," Metcalf & Eddy, 1955
- "Improvements to Sewerage System," Board of Engineers, 1957
- "Report on Planning Studies NE Boundary Relief Sewer," Burns & McDonnell, 1968
- "Northeast Boundary Relief Sewer Alignment Study," Advanced Engineering, 1997
- "Northeast Boundary Sewer Conceptual Plan for Local Flooding Control," Greeley and Hansen, 1999
- "Combined Sewer System Long Term Control Plan," Greeley and Hansen, 2002

- "Sewer Investigation: Bloomingdale Neighborhood," Greeley and Hansen, 2006

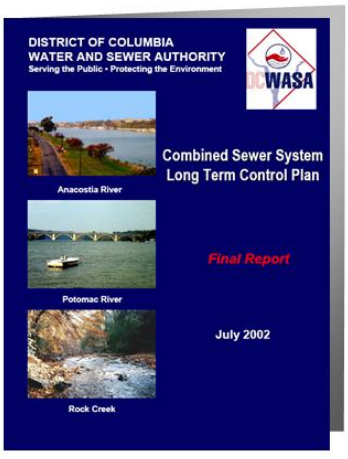
### 2.4.1 Studies from 1955 to 1999

The Report on Planning Studies NE Boundary Relief Sewer, published in 1968, found that the existing NEBTS system was not hydraulically balanced, which has resulted in the following:

- The NEBTS and portions of its branch sewers have inadequate capacities to carry stormwater flows generated by moderate rain storms.
- During intense storms where the NEBTS and connecting sewers are overloaded with a greater volume of stormwater and wastewater than the system can handle, catch basins may overflow and basement backups may occur in certain areas.
- Collecting sewers that drain the Bloomingdale area are of adequate capacity, but are ineffective due to backwater conditions in the NEBTS. Backwater conditions take place during large storms when the sewer system fills to maximum capacity, pushing excess water attempting to enter the system backwards (or against gravity) and into connecting branch sewers, sewer laterals, and house fixtures.
- The NEBTS system is poorly configured. Certain areas that are served by the NEBTS' branch sewers are located at a lower elevation than the pipes' connection points to the NEBTS. Basements located at a lower elevation than the sewer system itself are susceptible to flooding as a result of water's innate tendency to flow in a downwards motion.

These conclusions have been reiterated in studies since the 1968 report. In turn, various projects have been identified to provide relief for the Northeast Boundary area. These projects have spanned a wide variety of options, including the construction of a relief sewer for the local sewer system, underground storage facilities for excess sewer flows, and pump stations to convey water outside of regions prone to flooding. These projects have not been constructed in the past due to the complexity and great expense of constructing large relief sewers in a highly developed urban area.

### 2.4.2 2002 Long Term Control Plan and 2006 Bloomingdale Sewer Investigation Report




The original purpose of the 2002 Long Term Control Plan (LTCP) was to select combined sewer overflow controls for the combined sewer system. To address the need for capacity and flood relief, the LTCP initiated a city-wide evaluation of the sewer system. During this analysis, an opportunity was identified to address long standing flooding problems in the Northeast Boundary drainage area. This included the areas of West Virginia and Mt. Olivet NE, the Bloomingdale and Trinidad neighborhoods, and Rhode Island and 4th Avenues NE. These areas were addressed due to the historical and well known nature of chronic flooding occurring in these areas. Many areas that flooded on August 11, 2001 were not previously known to be susceptible to significant flooding. Having been identified in the 2002 LTCP, these areas were then prioritized as targeted areas for the city-wide assessment of the sewer system.

In 2006, the "Sewer Investigation: Bloomingdale Neighborhood" study identified the LTCP, slated to construct a tunnel and appurtenances in the Northeast Boundary area by 2025, as the permanent mitigation solution to the long-standing flooding problem in Bloomingdale and LeDroit Park. Given that the NEBTS and Flagler Place Trunk Sewers are under capacity to convey additional flows out of the area, improvements to the local sewers in the Bloomingdale and LeDroit Park area would not relieve flooding during intense storm events. Further assessment of sewer condition in the region found that the sewer system had no significant blockages or obstructions. Thus, the 2006 analysis concluded that sewer condition was not one of the primary causes of flooding.

Since the LTCP tunnel will not be operational for a considerable time, and improvements to the local drainage system will not provide flooding protection without the tunnel in service, the 2006 report identified that interim flood protection measures implemented on private property appeared to be the most practical approach for interim relief from flooding. To be initiated independently on a household-by-household basis, these measures included installation of a backflow preventer, pump-around system/ejector pump, an elevated sewer system, sump pump system, or plumbers plugs; construction of barriers at basement entrances, waterproofing basements, addressing roof downspouts, improving lot grading, and maintaining clean sewer laterals.

In addition to recommendations to households, improvements were made to mitigate the severity of flood events in Bloomingdale and LeDroit Park. These were based upon recommendations outlined in the 2006 report. These improvements encompassed efforts made on behalf of DC Water and other governing agencies, and do not include efforts made by individual homeowners to floodproof their properties. Data on such activities taken by individual homeowners have not been routinely documented, and thus are not presented in this report.

The 2006 report recommendations provided the basis for the capital improvements projects implemented in Bloomingdale, which were completed in 2008. Specifically, four key measures were taken to alleviate flood conditions:

- On Thomas Street NW, approximately 600 linear feet of 12 inch and 18 inch (diameter) existing sewer pipe was replaced with larger 24 inch PVC pipe, inlets, and tee and wye connections. Four manholes were also installed along this replacement sewer line. The enlarged sewer and new connections serve to increase capacity and enable better drainage.
- At the intersection of Flagler Place NW and U Street NW, three inlets were installed to improve drainage capacity.
- Thomas Street NW was reconstructed from First Street to Second Street NW to increase curb height and encourage better drainage.
- On Flagler Place NW from W Street to V Street NW, approximately 557 linear feet of sewer was lined to "restore flow capacity and eliminate infiltration of groundwater" by providing structural support against the defects identified in Greeley & Hansen's pipe condition assessment.

## 2.5 Future Development Projects

There are a number of known development projects planned within or near the Bloomingdale and LeDroit Park drainage area. These development projects include buildings that were recently

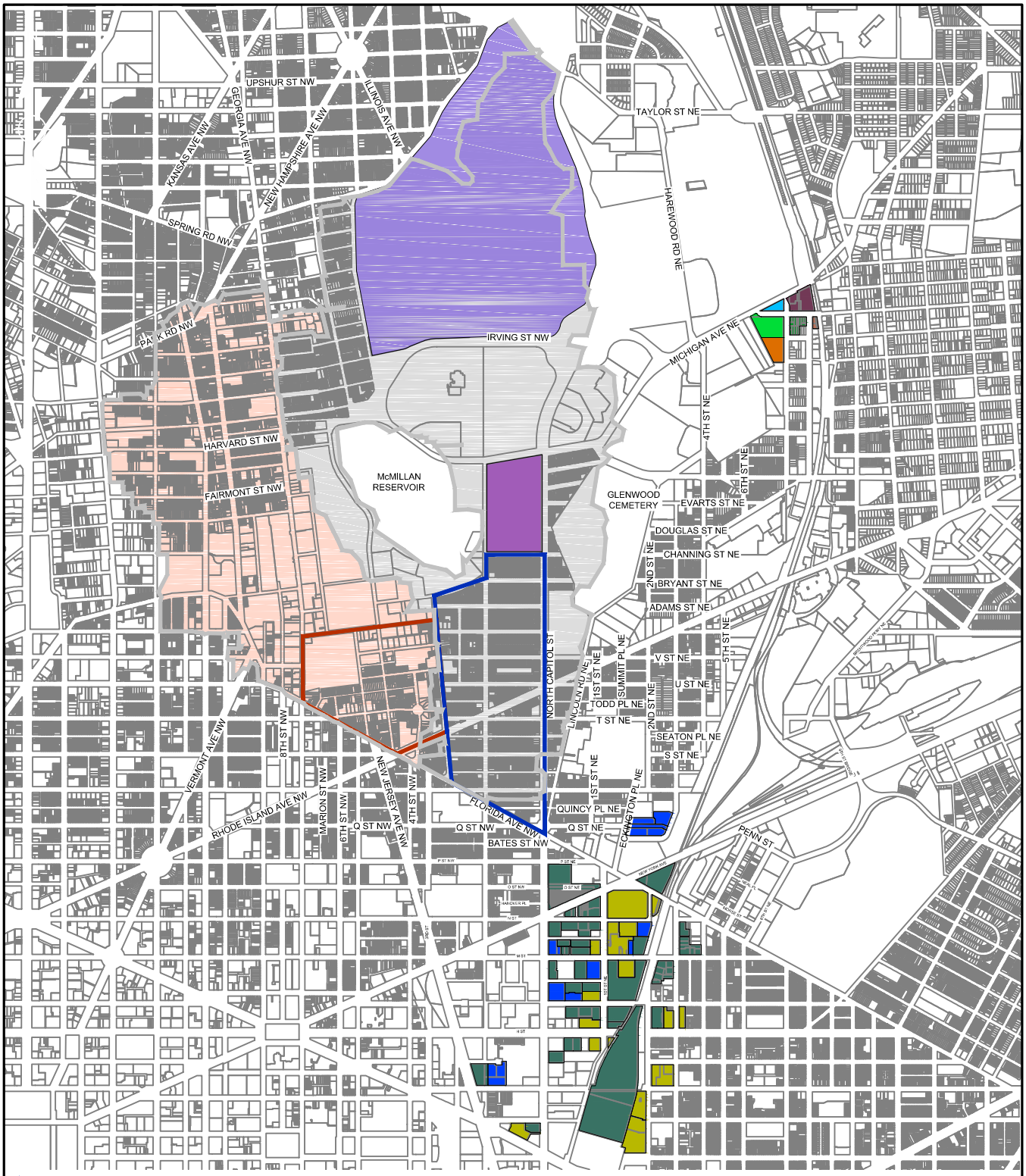
delivered and occupied, are currently under construction, or are planned for near future construction. These development projects span several zone districts, and are both privately and publicly owned by the District of Columbia, federal government agencies, and other entities. The five identified projects are discussed in detail below, shown in Figure 2-9, and are summarized in Table 2-6. The Envision McMillan and Armed Forces Retirement Home projects are in the Bloomingdale drainage area, while the others would not directly impact Bloomingdale but are located within the Northeast Boundary drainage area. For detailed descriptions of zone districts, refer to Appendix 5: Summary of Zone Districts in the District of Columbia.

**Table 2-7: Summary of Identified Development Projects**

| No | Development Name | Location | Ward | Construction Timeframe | Project Area (ac.) |
|---|---|---|---|---|---|
| 1 | Envision McMillan | N. Capitol St NW, First St NW, Michigan Ave NW, and Channing St NW | 5 | 2013 | 26.77 |
| 2 | Armed Forces Retirement Home | N. Capitol St NW, Harewood Rd NW, Rock Creek Church Rd NW, Park Pl NW, and Irving St NW | 5 | 2016 | 271.77 |
| 3 | NoMa | New York Ave NE, Florida Ave NE, N. Capitol St NW, Massachusetts Ave NE, 2nd St NE, 3rd St NE | 5 & 6 | 2005-2011, 2012, Future Planned | 99.44 |
| 4 | Eckington (North Part of NOMA) | New York Ave NE, Eckington Pl NE, and Harry Thomas Way NE | 5 | 2012 | 4.32 |
| 5 | Catholic University of America – South Campus (Block A1, A2, B, C, D & E) | Michigan Ave NE, Monroe St NE, 7th St NE, 8th St NE, and Kearney St NE | 5 | 2012 | 10.21 |

### Envision McMillan:

The development site, namely the McMillan Slow Sand Filter Plant, is located on the eastern edge of the northwest quadrant of the District of Columbia. The site is bounded by First Street NW to the west, Michigan Avenue NW to the north, North Capitol Street NW to the east, and Channing Street NW to the south. The total site area is approximately 27 acres. Currently, the District of Columbia government is the owner of the site.

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DISTRICT OF COLUMBIA DEPARTMENT OF PUBLIC WORKS

MAYOR'S TASK FORCE REPORT
ON THE PREVENTION OF FLOODING
IN BLOOMINGDALE AND LeDROIT PARK

# SUMMARY OF PROPOSED NEW DEVELOPMENT PROJECTS – BLOOMINGDALE & LeDROIT PARK

DATE: DECEMBER 2012 | FIGURE 2–9

According to the D.C. Office of Planning's existing land use map (2005), the site is assigned as TCU land use code (Transportation, Communication, Utilities). The TCU land use code mainly includes the above ground railroad system. According to the D.C. Office of Zoning's electronic Zoning Map, effective April 13, 2012, the site is zoned R-5-B District. According to the Stage One Planned Unit Development (PUD) application dated July 25, 2011, the proposed land uses are Residential, Commercial, Mixed Use and Open Space, and the proposed Zoning Districts are C-2-C, C-3-C and R-5-B.

Two existing storm sewer systems are available for connecting proposed stormwater runoff from the site: (1) along First Street NW (72" Dia.), and (2) along North Capitol Street NW (60" Dia.). The North Capitol Street storm sewer system is connected to the combined sewer system north of Channing Street NW. The First Street storm sewer size increases to 90" diameter just south of Channing Street NW. This storm sewer system continues south along First Street NW, then is connected to the combined sewer systems at V Street NW, and is ultimately connected to the NEBTS.

The Envision McMillan team proposes to incorporate and re-use the most characteristic elements of the historic McMillan site. The cylindrical sand bins of the north and south service courts are to remain and be incorporated, along with the rectangular regulator houses, into the park at the south service corridor and also into the urban, mixed-use street at the north service corridor.

### Armed Forces Retirement Home (AFRH)

The Armed Forces Retirement Home (AFRH) development site is located on the eastern edge of the northwest quadrant of the District of Columbia. The site is bounded by Rock Creek Church Road NW and Park Place NW to the west, Harewood Road NW to the north, North Capitol Street NW to the east, and Irving Street NW to the south. The total site area is approximately 272 acres. Currently, the U.S. government is the owner of the site.

According to the D.C. Office of Planning's existing land use map (existed in 2005), the site is assigned as FP land use code (Federal Public). The FP land use code is for all federal properties. According to the D.C. Office of Zoning's electronic Zoning Map, effective April 13, 2012, the site is identified as UNZONED. As a federal property, AFRH is not subject to DC zoning regulations. The area immediately west of AFRH is zoned R-4. The areas to the east and south of the site are zoned R-5-A. Areas north of the site are zoned R-5-A, R-3, and C-1. According to the development's final Environmental Impact Statement dated November 2007, GSA signed an MOU with DC Office of Planning and NCPC on Aug 2, 2007 to establish a hybrid approach for controls over the mixed use redevelopment of a portion of AFRH. The proposed plan for redevelopment of the site includes the following land uses: Institutional, Residential, Hotel/Conference Center, Research & Development, Retail and Medical.

Three existing combined sewer systems currently serve the existing buildings at the site. Two combined sewer systems serve a small northern portion of the site not within the NEBTS sewershed. The storm sewer system along North Capitol Street NW collects runoff from North Capitol Street. The North Capitol Street storm sewer system is connected to the combined sewer system just south of Irving Street NW at Michigan Avenue NW. The combined sewer system collecting most stormwater

runoff and sanitary sewer from the site is connected to the combined sewer system of Children's Hospital.

According to the development's final Environmental Impact Statement dated November 2007, AFRH has identified the preferred plan for redevelopment of the site. The plan best meets the needs of AFRH and the objectives of its Master Plan by accomplishing the following:

- Maximize development of AFRH while maintaining the historic character of the site and retaining significant existing open space;
- Provide development uses that are complementary to the Home;
- Ensure that AFRH's facilities are conveniently located for its residents and that there is room for new AFRH facilities on the north campus;
- Provide for the security of the residents of the Home;
- Encourage the rehabilitation and reuse of historic buildings;
- Integrate the landscape and the built form; and
- Where appropriate, respect the character of the adjacent communities and integrate the new development into the city fabric.

The proposed development is nearly the least dense of the other proposed alternatives. It best addresses issues raised through community review, Section 106 consultation and National Capitol Planning Commission actions on the draft Master Plan. From a revenue generating perspective, the development includes a diverse program of uses, thus allowing for flexibility to adjust to changes in market conditions and demand for particular uses.

### North of Massachusetts Avenue (NoMa)

The development in North of Massachusetts Avenue area, or NoMa, is a large tract of land located just north of Capitol Hill and Union Station. The site is bounded by North Capitol Street NE to the west, R Street NE and Q Street NE to the north, Second, Third, and Fourth Streets NE to the east, and New Jersey Ave NW and Massachusetts Avenue NW to the south. The total NoMa neighborhood area is approximately 280 acres including buildings (before 2005, delivered between 2005 -2011, under construction, planned), and public rights of way. Tenants of buildings include the private and public sectors, federal agencies, and District of Columbia government agencies.

According to the D.C. Office of Planning's existing land use map (existed in 2005), existing land uses within NoMa's neighborhood consist of mostly Mixed Use, Federal Public (FP), and Institutional (I), and Transportation, Communication, Utilities (TCU). The TCU land use code mainly includes the above ground railroad system. According to the D.C. Office of Zoning's electronic Zoning Map, effective April 13, 2012, properties within NoMa's neighborhood are zoned C-3-C, C-M-1, C-M-2, C-M-3, R-5-B, and R-5-D Districts.

Not all development projects within NoMa are within the NEBTS sewershed. The NoMa neighborhood has a total development potential of roughly 32 million square feet of mixed-use and transit-oriented development. This translates to approximately 100 high density buildings. NoMa's new design features modern glass, steel and brick designed by well-known local and national architecture firms. The wide setbacks along First Street, NE and K Street provide room for linear park space, café seating, and lush plantings that will help mitigate stormwater runoff.

NoMa is roughly 50% built out or under construction with:

- 16 million square feet
- 2 hotels
- 2,700 residential units
- 200,000 square feet of retail

### Eckington/NoMa West

The development site, known as NoMa West, is a part of the NoMa neighborhood development located just north of New York Avenue NE and Florida Avenue NE. The site is bounded by Eckington Place NE to the west, R Street NE to the north, the railroad and metro line (Red Line) to the east, and New York Avenue NE and Florida Avenue NE to the south. The project area is approximately four acres and is currently under construction. The project site is within the NEBTS sewershed.

According to the D.C. Office of Planning's existing land use map (2005), existing land uses within NoMa's neighborhood consist of mostly Mixed Use. According to the D.C. Office of Zoning's electronic Zoning Map, effective April 13, 2012, the previous zone of the site is M. The project has been approved as zone C-3-C District through the Planned Unit Development (PUD) process.

The three-building complex within the project site, which is located just a few blocks from the NoMa-Gallaudet U metro stop, will be made up of a mix of studios and one to two bedroom apartments, with an average apartment size of 770 square feet. Construction of the project is almost complete, and will include 570 parking spaces and 1,200 square feet of retail space.

### The Catholic University of America South Campus

The Catholic University of America (CUA) South Campus redevelopment site is located on the west side of Brookland/CUA Metro Station. The project site is within the NEBTS sewershed.
The site is bounded by Michigan Avenue NE to the west, the railroad and metro line (Red Line) to the east, and Lawrence Street NE and Kearny Street NE to the south. The project area is approximately 10 acres, including six blocks: A1, A2, B, C, D, and E. All six blocks are slated for construction this year.

According to the D.C. Office of Planning's existing land use map (2005), existing land uses of the site are School, Commercial, and TCU (Transportation, Communication, Utilities). According to the D.C. Office of Zoning's electronic Zoning Map, effective April 13, 2012, the previous zones of the site are R-5-A District (Block A1, A2 and B), C-1 and C-M-1 Districts (Block C), C-M-1 (Block D), and R-4 (Block E). The project has been approved as C-2-B and R-5-B Districts for all Blocks through the Planned Unit Development (PUD) process.