Chapter V

Affected Environment

U.S. Department of Transportation
Federal Railroad Administration

Maryland Department
of Transportation

V. AFFECTED ENVIRONMENT

This section presents the existing environmental conditions of resources in the Project Study Area. The human and natural environmental resources within the Project Study Area and associated areas were identified in order to analyze how the Project could potentially affect the environment. Potential environmental impacts to these resources are discussed in **Chapter VI**. Since issuance of the DEIS in December 2015, FRA revised Alternatives 3A, 3B, and 3C in response to public comments and additional engineering work, and identified Alternative 3B as the Preferred Alternative in this FEIS. Because elements of Alternative 3B have been developed to a higher level of design since the DEIS, FRA conducted additional efforts concerning the inventory of resources within the Project Study Area based on the Preferred Alternative and available data. These efforts included: 1) revised visual assessments based on above-ground elements, 2) field surveys and wetland, tree and forested area delineations, 3) detailed noise and vibration modeling, and 4) additional historic properties identifications and effect assessments, and continued coordination with Section 106 consulting parties at meetings.

The resources considered in the environmental analysis include: air quality; water quality; noise and vibration; solid waste disposal; natural ecological systems; wetlands; endangered species; flood hazard evaluation and floodplain management; coastal zone management; production and consumption of energy; use of natural resources other than energy; aesthetic environment; transportation; elderly and handicapped; land use; socioeconomic environment; public health; public safety; recreation areas and opportunities; minority, race, and ethnicity and low-income populations; sites of historical, archaeological, architectural, or cultural significance; construction impacts, and hazardous materials. Each resource is discussed in proportion to its applicability to the B&P Tunnel Project. The Project Study Area is within the Maryland Coastal Zone.

A. Socioeconomics

Existing socioeconomic and demographic conditions within the Study Area include population, land use and zoning, transportation, economy, housing, neighborhood and community facilities, and minority ethnicity and low-income populations. The data used for the analysis are from American Factfinder (US Census Bureau, 2013b) and the American Community Survey (ACS) 2009-2013 (US Census Bureau, 2013a), developed by the US Census Bureau, US Bureau of Labor Statistics (BLS), US Department of Housing and Urban Development (HUD), Maryland Department of Commerce, Baltimore Development Corporation, Baltimore Department of Housing and Community Development, and Baltimore County Department of Economic and Work Force Development. See **Appendix E** for socioeconomic data tables.

FRA defined the Study Area boundary for socioeconomic evaluation using a combination of Census Block Group and Census Tract boundaries. The area was developed to include block groups and tracts within approximately 500 feet of the alternative centerlines of the alternatives considered in the *Alternatives Report*. The Study Area boundary for socioeconomic evaluation is shown in **Figure V-1**.

1. Population

The data presented in this section describes the population and demographic character of the Study Area, local region, and state. Population data also help identify communities of concern or environmental justice (EJ) communities. For this assessment, Census Block Group data was used to provide the highest level of comparable data. Where block group data was unavailable, Census Tract level data was used.

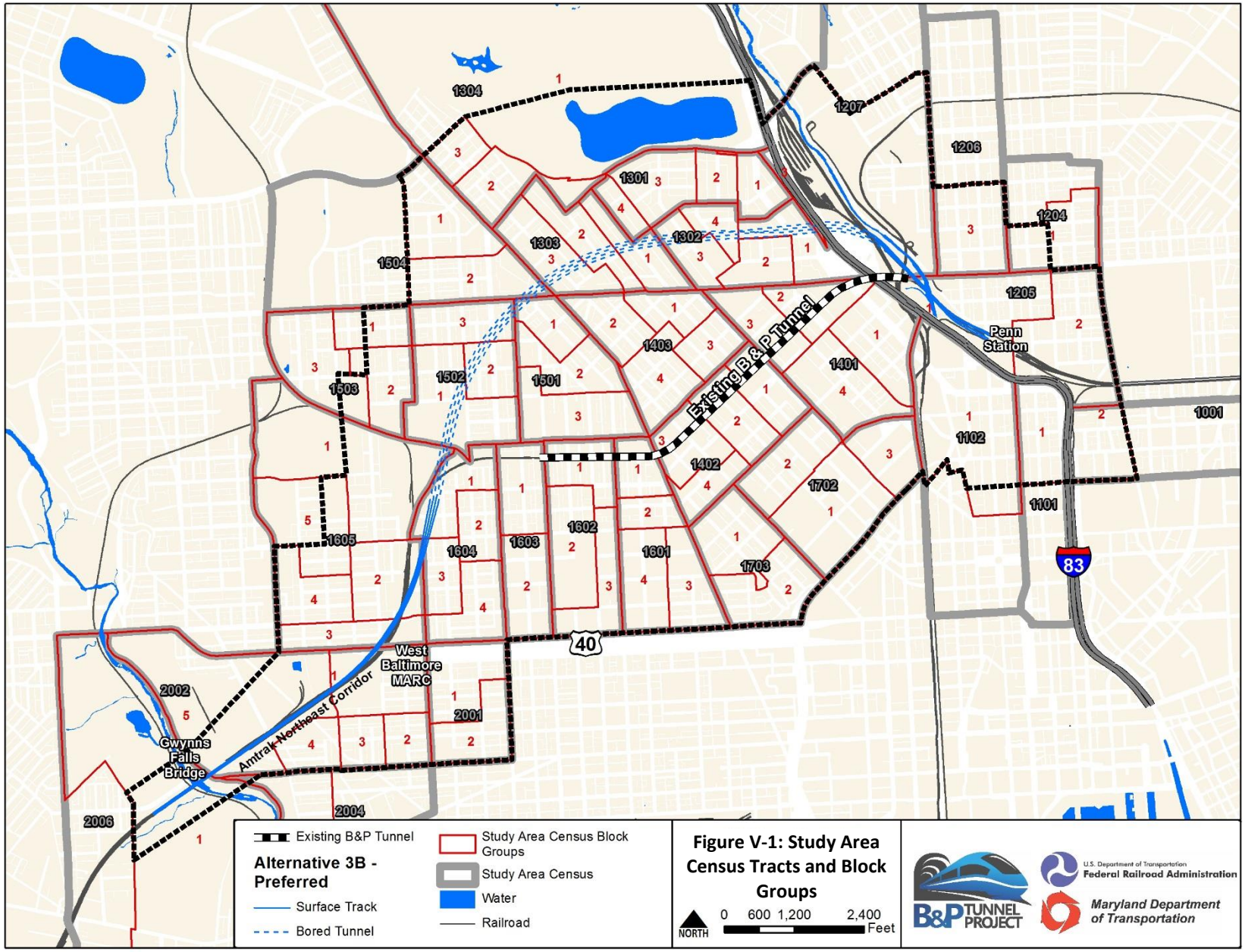


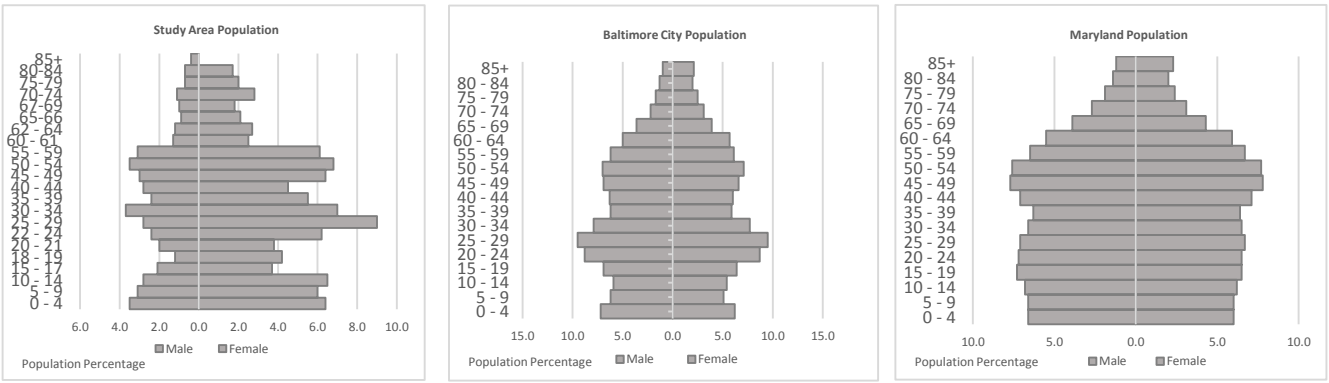
Figure V-1: Study Area Census Tracts and Block Groups

Based on Census Block Group data, the total population of the Study Area was approximately 65,762 in 2013 (US Census Bureau, 2013a), which represents 10.5 percent of Baltimore City's population and 1.1 percent of the state population. The residents are distributed across 77 individual Census Block Groups. Census Block Group 1101-1 is the most populous block group with a population of 2,612 residents, located in the Mid-Town Belvedere neighborhood, in the northeast portion of the Study Area. Census Block Group 2002-2 is the least populous block group with a population of 249 residents, located in the Penrose/Fayette Street neighborhood in the southwest portion of the Study Area. The average number of residents per block group was 854 people.

a. Age

Figure V-2 shows the age distribution of male and female populations in the Study Area, with Baltimore City and Maryland provided for comparison. The most populous age cohort in the Study Area is age 25-29 for females, and age 30-34 for males. In Baltimore City, the most prevalent age cohort is aged 25-29 for both males and females; in Maryland the most prevalent cohort is age 45-49 for both males and females. The Study Area population pyramid skews noticeably towards female; males are generally underrepresented relative to the city or state, particularly in the 15-17, 18-19, and 20-21 age cohorts.

Figure V-2: Age Distribution of the Study Area



Source: US Census Bureau, American Community Survey, 2009 – 2013, Five year estimates (US Census Bureau, 2013a).

b. Racial Composition

Table V-1 presents a summary of the racial composition of the Study Area, Baltimore City, and Maryland. This data is detailed by Census Block Group in **Appendix E**. In 2013, the majority of the Study Area population was African American or Black Alone (81.2 percent), which is higher than that of Baltimore City (63.0 percent) and substantially higher than Maryland (29.4 percent). Nearly thirteen percent (12.8 percent) of the Study Area population is classified as White Alone, which is approximately half the percentage of the White population in Baltimore City, and substantially less than that of Maryland. The remaining populations include Asian Alone, Other Alone, and Two or More Races Alone, each representing below three percent of the Study Area population. The total Hispanic or Latino population within the Study Area was 1.3 percent, compared to 4.0 percent for Baltimore City and 8.5 percent for Maryland.

Table V-1: Racial Composition of the Study Area

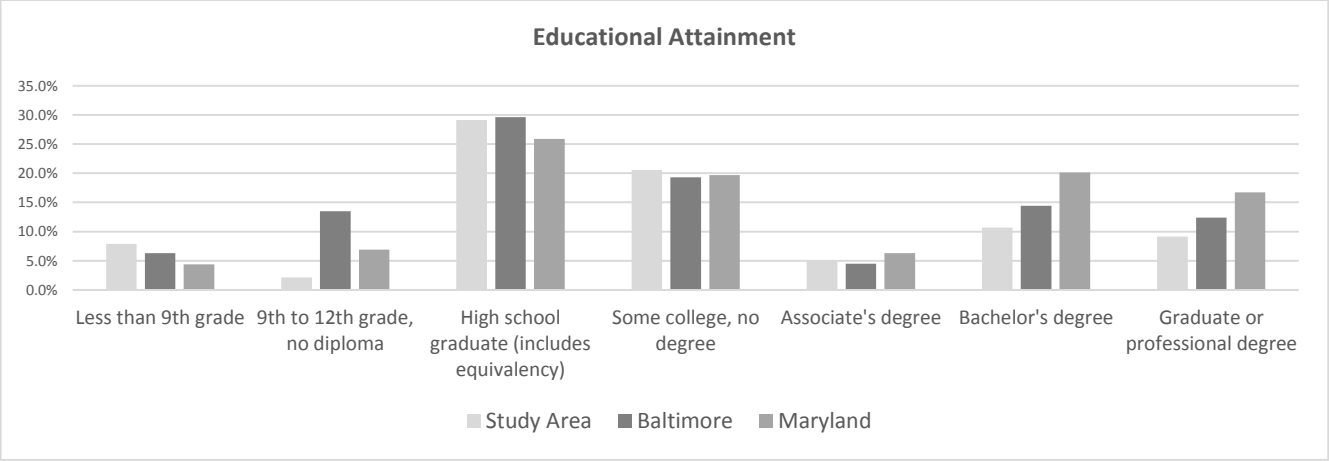
Category	Maryland	Baltimore City	Study Area
Total Population	5,834,299	621,445	65,762
White Alone	3,406,243 (58.4%)	174,590 (28.0%)	8,400 (12.8%)
African American or Black Alone	1,717,582 (29.4%)	389,758 (63.0%)	53,407 (81.2%)
Asian Alone	332,620 (5.7%)	14,822 (2.0%)	1,515 (2.3%)
Other[1] Alone	215,749 (3.7%)	1,362 (0.0%)	163 (0.2%)
Two or More Races Alone	162,105 (2.8%)	12,400 (2.0%)	1,317 (2.0%)
Total Hispanic or Latino	493,310 (8.5%)	26,772 (4.0%)	844 (1.3%)

Source: US Census Bureau, American Community Survey, 2009 – 2013, Five year estimates (US Census Bureau, 2013a).
[1] Other includes American Indian and Alaska Native alone, Native Hawaiian and Other Pacific Islander alone and some other race alone.

c. Educational Level

Figure V-3 shows the highest level of educational attainment of the Study Area, Baltimore City and Maryland for the population 25 years and over. Approximately 30.0 percent of the Study Area have a high school degree as their highest educational attainment, similar to Baltimore City, whereas 25.9 percent of the population statewide have a high school degree as their highest educational level. Of note, approximately eight percent of the Study Area have less than a 9th grade education, substantially more than Baltimore City and statewide (6.3 percent and 4.4 percent respectively) The percentage of people who have a Bachelor's degree as the highest level of education is lower within the Study Area (10.7 percent), than in Baltimore City (14.4 percent) and approximately half that of Maryland (20.1 percent). Graduate or professional degree attainment as the highest level of education is generally lower within the Study Area, relative to Baltimore City and Maryland (9.2 percent, 12.4 percent and 16.7 percent respectively).

Figure V-3: Educational Level of the Study Area



Source: US Census Bureau, American Community Survey, 2009 – 2013, Five year estimates (US Census Bureau, 2013a).

d. Poverty

The US Census Bureau Poverty Threshold for 2013 was an annual median household income of $23,834 for a family of four. In 2013, the percent of the Study Area population for whom poverty status was determined with income in the past 12 months below the poverty level was 30.6 percent, compared to 23.8 percent in Baltimore City and 9.8 percent for Maryland. Census Tract 1402 Block Group 4, located in the Upton neighborhood and Census Tract 1702 Block Group 1, which spans the Upton and Madison Park neighborhoods, had the most households below poverty level (216 and 217 respectively). Poverty status is further assessed in **Section V.A.8**.

e. Linguistic Isolation

A "limited English-speaking household" is defined by the US Census Bureau as: "…one in which no member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English 'very well.' In other words, all members 14 years old and over have at least some difficulty with English."

According to the US Census 2013 ACS data, there are approximately 422 limited English-speaking households in the Study Area block groups, or 1.6 percent of the total households. This is proportionately somewhat lower than Baltimore City (2.2 percent) or statewide (3.1 percent).

Block Groups in the Study Area range from zero limited English-speaking households to approximately 15 percent (Block group 1206.003). **Figure V-9** depicts the Study Area block groups analyzed. **Appendix E** provides the information on individual block groups along with Baltimore City and Maryland.

f. Commute (Journey to Work)

According to the US Census Bureau, Commute (or Journey to Work) refers to a worker's travel from home to work. Place of work refers to the geographic location of the worker's job. **Appendix E** depicts the commute time and mode of residents in the Study Area, Baltimore City, and statewide. Most people within the Study Area use an automobile (car, truck, or van) to get to work (59 percent), although it is a lower percentage than the population that takes an automobile within Baltimore (73 percent) and significantly lower in Maryland (87 percent). Census Block Groups 1101.001 and 1102.001, located in the Mount Vernon and Midtown Belvedere neighborhoods have the largest number of people who use an automobile to commute to work (829). Census Block Group 1101.001 also has the largest number of people who commute via public transportation (377). Eight percent within the Study Area walk to work and two percent use other modes (includes taxi cab, motorcycle, or bicycle). Eighteen percent have a commute that is less than 15 minutes to work, similar to Baltimore City and Maryland.

2. Housing

Housing types, tenure, vacancy, and ownership rates are useful in understanding the availability of suitable housing in areas where residential property displacements could occur as a result of the Project.

The number of housing units and occupancy within the Study Area is summarized in **Table V-2**. In 2013, there were 38,059 housing units within the Study Area, representing 12.8 percent of the total housing units within Baltimore City and 1.6 percent of statewide housing units (US Census Bureau, 2013a). Approximately 69.3 percent of these housing units were occupied, which is lower than the proportion of occupied housing in Baltimore City (81.5 percent) and Maryland (89.9 percent). Based on field-verified data, rowhouses are the most common residential buildings in the Study Area.

Table V-2: 2013 Housing Units and Occupancy Characteristics

Geographic Area	Total Housing Units	Occupied Housing Units	Owner Occupied Housing Units (Percent)	Average People/Occupied Housing Unit
Maryland	2,387,285	2,146,240	67.6	2.8
Baltimore City	296,256	241,455	48.3	2.6
Study Area	**38,059**	**26,358**	**30.9**	**2.8**

Source: US Census Bureau (US Census Bureau, 2013a).

According to the ACS, about 30.9 percent of the occupied housing units within the Study Area Block Groups were owner-occupied in 2013. Comparatively, the percentage of owner-occupied housing units within Baltimore City and Maryland was 48.3 and 67.6 percent, respectively. The average number of people per occupied housing unit for the Study Area Block Groups was 2.5, similar to the Baltimore City average of 2.6, and Maryland at 2.8 people.

The Study Area currently contains six publicly-owned housing developments, with a total of 2,467 units (accounting for roughly 3% of all publicly-owned housing in Baltimore City), dispersed throughout the Study Area. There are also 22 affordable housing apartment developments with a total of 3,111 units (representing roughly 5% of all affordable housing apartment developments in the city). Seven of these developments provide family housing, 12 serve the elderly, and two provide disabled housing. One development is not classified (HABC, Accessed 2014).

3. Minority Race and Ethnicity and Low-Income Populations

The terms "minority" and "low-income" are defined in the USDOT Order on Environmental Justice. The following definitions have been used in this analysis:

- Minority Individual: A minority individual belongs to one of the following groups: American Indian or Alaskan Native, Asian American, Native Hawaiian or Other Pacific Islander, Black (not of Hispanic origin), and Hispanic or Latino.
- Minority Populations: Any readily identifiable groups of minority people who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient people (such as migrant workers or Native Americans) who would be similarly affected by a proposed USDOT program, policy, or activity.
- Low-Income Individual: The Order definition is a person whose median household income is at or below the US Health and Human Services (HHS) poverty guidelines. In 2014, the official poverty threshold for a family/household of four was an annual median household income of $23,850 (USDHHS, Accessed 2014). Because of slight differences in the length of time encompassed by datasets, the US Census Bureau's 2014 poverty threshold for a household of four (no children) was $24,418.
- Low-Income Population: Any readily identifiable group of low-income people who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient people (such as migrant workers or Native Americans) who would be similarly affected by a proposed DOT program, policy, or activity.

The following data were used to identify minority and low-income populations:

- Minority Populations: ACS 2009-2013 5-year estimate (US Census Bureau, 2013a), at the Census Block Group level, provided the basis for identifying minority populations in the Study Area.
- Low-Income Populations: Poverty data was obtained from the ACS 2009-2013 five-year estimate at the Census Block Group level. The dataset is the most current dataset based on US Census Bureau thresholds of poverty. It is typically used for statistical analyses and its thresholds are not substantially different from HHS guidelines; therefore, poverty level is used to indicate low-income populations.
- Data sources to confirm the location of minority and low-income populations include the National Center for Educational Statistics (NCES), government-assisted housing programs, historical references, city officials, field visits, community meetings, and a review of revitalization efforts in the Study Area.

Census Block Groups have populations between 600 and 3,000 people. They vary in size depending on an area's population density. They are the smallest geographical unit for which reliable data is available; they can generally be thought of as representing neighborhoods.

The Study Area includes all or parts of 77 Census Block Groups in Baltimore City. In 2013, the total population of the Study Area by Census Tract was 65,762 people (US Census Bureau, 2013a). For those people with race or ethnicity status identified in the Study Area in the ACS 2009-2013 dataset, 57,362 (87.2 percent) were identified as minorities, which was higher than Baltimore City's average of 72.0 percent. **Table V-3** details minority race and ethnicity data for the Study Area. **Figure V-4** shows the analyzed Census Block Groups.

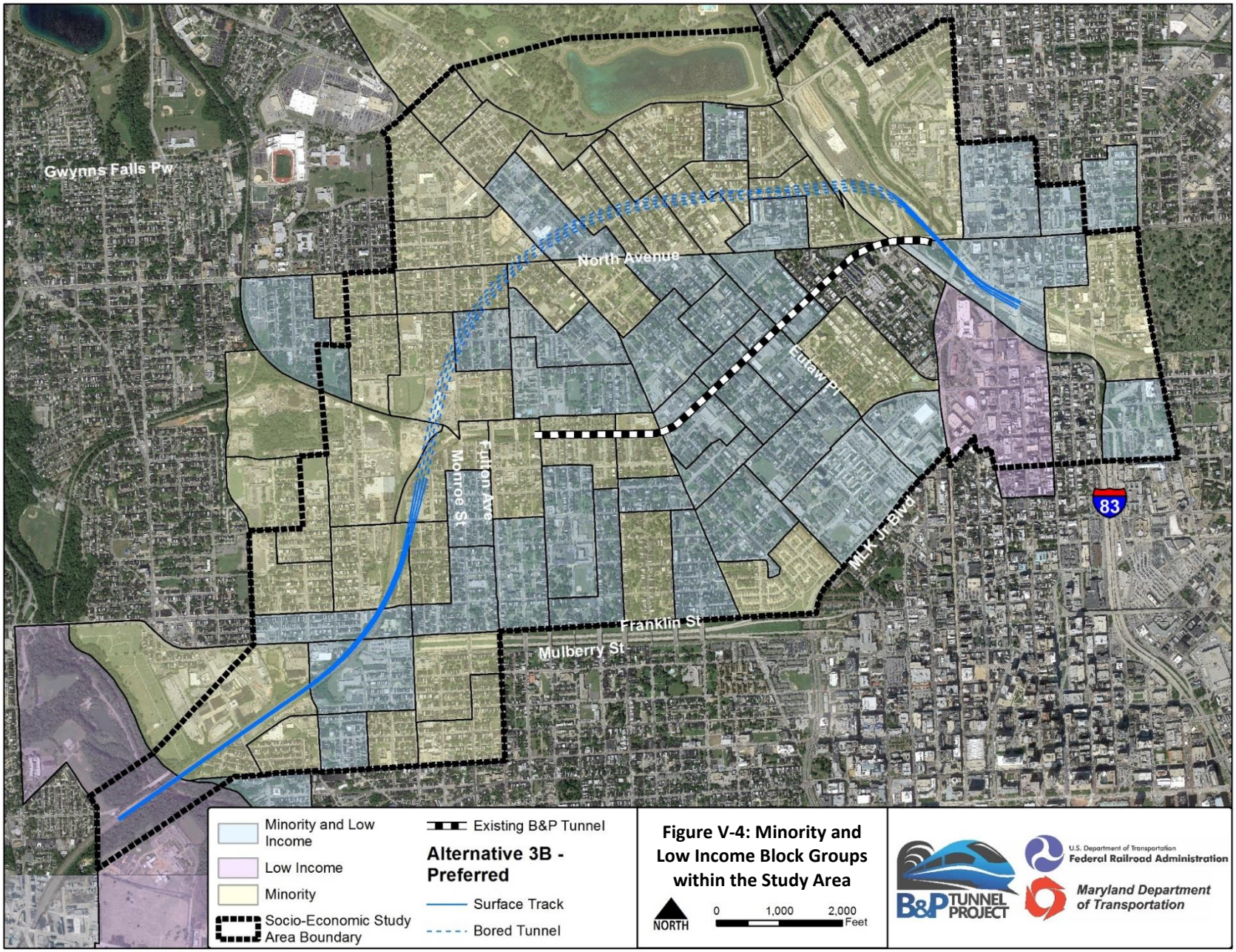


Figure V-4: Minority and Low Income Block Groups within the Study Area

Of the 26,358 households for which income was calculated in the Study Area, 8,812 households (33.4 percent) had income at or below the federal poverty level, which indicates a low-income population for the purposes of this study. The ACS data showed Study Area Census Block Groups contained a percentage of low-income households that was substantially higher (33.4 percent) than Baltimore City's average of 22.0 percent.

Other information sources useful in identifying minority and low-income populations include public housing and assistance programs, area revitalization programs, and community outreach. According to the Housing Authority of Baltimore City, there are six publicly-owned housing developments in the Study Area that provide 2,467 individual units (**Table V-4**) (HABC, Accessed 2014). The developments range from 75 to 970 units. Two are family developments, two are mixed-population housing, and two contain both mixed populations as well as family housing. The housing developments are widely dispersed throughout the Study Area and are located within minority race and/or ethnicity and low-income populations, with the exception of the J. Van Story Branch Apartments. Residents of the housing developments must meet income limits of $33,200 for a family of four, along with other qualifying criteria, in order to be eligible for the Public Housing Program.

Table V-3: Population and Minority Statistics in Maryland, Baltimore City, and the Study Area by Block Group

Category	Maryland	Baltimore City	Study Area
Total Population	5,834,299	621,445	65,762
White Alone	3,406,243 (58.4%)	174,590 (28.0%)	8,400 (12.8%)
Black Alone	1,717,582 (29.4%)	389,758 (63.0%)	53,407 (81.2%)
Asian Alone	332,620 (5.7%)	14,822 (2.0%)	1,515 (2.3%)
American Indian and Alaska Native Alone	17,535 0.30%	1,563 (0.0%)	82 (0.1%)
Native Hawaiian and Other Pacific Islander Alone	2,570 0.04%	178 (0.0%)	34 (0.1%)
Other Race Alone	215,749 (3.7%)	1,362 (0.0%)	163 (0.2%)
Two or More Races	162,105 (2.8%)	12,400 (2.0%)	1,317 (2.0%)
Total Hispanic or Latino	493,310 (8.5%)	26,772 (4.0%)	844 (1.3%)
Total Minority	2,921,366 (50.1%)	446,855 (72.0%)	57,362 (87.2%)

Source: US Census Bureau (US Census Bureau, 2013a).
Hispanic or Latino people may identify as any race.
[1]Does not include Hispanic or Latino population.
[2]Two or more races do not include people who identify as Hispanic or Latino.
[3]All people who identify as non-White, non-Hispanic or Latino, and all people who identify as Hispanic or Latino, regardless of race.

Affordable housing information was obtained from the HUD Affordable Apartment search that identifies lower cost housing supported by grant programs. There are 22 affordable housing apartment developments, with a total of 3,111 units in the Study Area. Developments range from 12 to 521 units; where seven provide family housing, 12 serve the elderly, and two provide housing for people with disabilities. One of the apartment developments is not classified. Fourteen affordable housing apartment complexes are located within minority

race and/or ethnicity and low-income populations, and six are located in areas with only minority race and/or ethnicity populations; the remaining two public housing complexes are located outside of minority race and/or ethnicity and low-income areas. In order to be eligible for these apartments, residents cannot earn more than the income limit specified by the apartment complex.

Table V-4: Study Area Public Housing

Name	Address	Housing Units	Residence Type
Heritage Crossing (Hope VI)	600 Brune Street, Baltimore, MD 21201	75	Family
Gilmor Homes	640 Balmor Court, Baltimore, MD 21217	571	Family
Chase House	1020 Cathedral Street, Baltimore, MD 21201	189	Mixed Population
J. Van Story Branch Apartments	11 W. 20th Street, Baltimore, MD 21218	357	Mixed Population
Lakeview Towers/Lakeview Extension & Oswego Mall	717 Druid Park Lake Drive, Baltimore, MD 21217	305	Mixed Population and Family Housing
McCulloh Homes & Extension/Albert Spencer Gardens	501 Dolphin Street, Baltimore, MD 21217	970	Mixed Population and Family Housing

Source: Baltimore Housing (HABC, Accessed 2014).

In 2014, 28 out of the 29 Census Tracts in the Study Area were qualified Low-Income Housing Tax Credit (LIHTC) program tracts (HUDuser, 2014). Census Tract 1101, located in the Mount Vernon neighborhood, is the only Census Tract in the Study Area that is not a LIHTC tract. In order to qualify for the LIHTC, a proposed housing development must be in a Census Tract having either 1) a poverty rate of at least 25 percent or 2) 50 percent or more of its households have incomes below 60 percent of the metropolitan or non-metropolitan area median household income (SBA, Accessed 2015).

The median monthly housing cost for 25 out of 29 Census Tracts in the Study Area is below that of Baltimore City ($1,005) (US Census Bureau, 2013a). Census Tracts 1101 (Mount Vernon), 1204 (Barclay), 1207 (Remington), and 1303 (Penn North) all had median housing costs above Baltimore City.

According to ACS poverty data from 2013, 6,113 households with incomes below the poverty level in the Study Area received federal food stamps and/or Supplemental Nutrition Assistance Program benefits the prior year. Another 4,316 of similar households in poverty did not receive these benefits, suggesting more needs could be met (US Census Bureau, 2013a). During the 2011 to 2012 school year, the majority of Kindergarten through 12th grade students in the Study Area received free or reduced-cost school lunches, as did the majority of citywide grade-school students (76.2 percent) (DataMind, 2012).

The majority of the Study Area also has existing urban renewal plans. These plans focus on addressing urban blight and providing employment opportunities for residents, while improving community services and conditions supporting property values.

4. Land Use and Zoning

a. Land Use

This section describes existing land use within the Study Area, Baltimore City, and Maryland. Land use data were obtained from Baltimore City (Baltimore City, 2008) and the Maryland Department of Planning (MDP, 2010).

Land use in the Study Area is mostly residential and dispersed fairly evenly. Other land uses in the Study Area include institutional, primarily west of Baltimore Penn Station; transportation-related; open space, scattered throughout the Study Area as small neighborhood parks, playgrounds, and athletic courts, with the largest area being Druid Hill Park in the northeast; commercial, located primarily along the major roads of North Avenue, Pennsylvania Avenue, and West Lafayette Avenue; industrial, concentrated along the NEC in the southwest and near the MTA North Avenue Light Rail Yard in the northeast; and mixed-use. **Figure V-5** displays the existing land use within the Study Area.

Table V-5 summarizes land use in the Study Area, Baltimore City, and Maryland. Because of different classifications, the latest state land use data (MDP, 2010) are not broadly comparable to Baltimore City data (2008), except for residential, commercial, and industrial land uses.

The Study Area encompasses approximately five percent of the total land in Baltimore City. Most land use is residential, both in the Study Area and Baltimore City (49.3 and 44.2, respectively). Institutional use represents the next greatest percentage (14.2 percent) in the Study Area; in Baltimore City, institutional land use represents 12.7 percent of the land area. In the Study Area, transportation is the next most prevalent land use at 11.2 percent; this percentage is nearly twice that of Baltimore City (6.3 percent). Less of the Study Area is open space (9.6 percent) and industrial (6.9 percent) compared to Baltimore City at 14.2 percent and 15.7 percent, respectively. More land is commercial (7.7 percent) and mixed-use (1.1 percent) in the Study Area than in Baltimore City (6.2 percent and 0.7 percent, respectively).

Table V-5: Land Use Summary

Land Use Type	Study Area (Acres)	Study Area (Percent)	Baltimore City (Acres)	Baltimore City (Percent)
Residential	1,327.9	49.3	23,915.8	44.2
Institutional	382.0	14.2	6,899.8	12.7
Transportation	301.3	11.2	3,390.5	6.3
Open Space	259.9	9.6	7,699.7	14.2
Commercial	208.1	7.7	3,339.6	6.2
Industrial	185.6	6.9	8,509.7	15.7
Mixed	28.8	1.1	390.1	0.7
Total	2,693.6	100.0	54,145.2	100.0

Source: State of Maryland Land Use and Shapefile (MDP, 2010; Baltimore City, 2008).

b. Zoning

Zoning in the Study Area is generally consistent with citywide land use (**Table V-6** and **Figure V-6**). Open space constitutes nearly 10 percent of land use in the Study Area; however, no land in the Study Area is actually zoned as open space.

Study Area zoning is comparable to citywide zoning in most categories, except more properties are zoned proportionately as Community Businesses, Central Commercial, Community Commercial, and Office-Residences. Substantially less acreage is zoned as industrial in the Study Area compared to citywide. The right-of-way for the existing B&P Tunnel and approach tracks are zoned as industrial and/or "approved conditional use" through other zoning such as residential and commercial. According to current zoning, no railroad yards or shops are identified outside industrial zoning.

5. Transportation

a. Northeast Corridor (NEC)

The NEC runs from South Station in Boston through Pennsylvania Station in New York City and terminates at Union Station in Washington, DC. The NEC in the Study Area is shared by Amtrak Northeast Regional and Acela Express intercity passenger, MARC commuter, and NS freight operations. Amtrak NEC service and some MARC Penn line trains are powered by electric overhead catenary wires, while other MARC and freight trains are powered by diesel electric locomotives. The existing B&P Tunnel currently has Plate C clearance, which only allows conventional box cars, flats, gondolas, and coal hopper cars to run through the tunnel.

The NEC moves 365 million passengers and 14 million car-miles of freight per year. A total of 145 daily trains, with a peak of 35 trains during the four-hour afternoon peak period, traverse the existing B&P Tunnel. Over the course of a year, 11.6 million passengers on Amtrak's Northeast Regional and Acela Express Services travel through the Tunnel (FRA, 2015). The NEC accommodates Amtrak Northeast Regional and Acela Express passenger trains; MARC commuter rail service; and NS freight service.

b. MARC Commuter Rail Service

MARC is a commuter rail system providing service between Baltimore City and Washington, DC. MARC Train service has two stations in the Study Area: Baltimore Penn Station and West Baltimore station. The service has a 20-minute headway during peak hours and a one-hour headway during non-peak hours. In 2012, the two stations served over 28,400 passenger trips daily (MTA, 2013). In December 2013, the MARC Penn Line began providing weekend service to Washington, DC. Fifty-seven (57) MARC trains currently use the existing B&P Tunnel each day; approximately 60 percent of these are diesel locomotives and 40 percent are electric. MTA plans to increase the number of MARC-diesel locomotives by 2019 as part of a separate undertaking by MTA.

c. Light Rail

Light Rail is a 30-mile alignment with 32 stations. In 2014, it carried over 8.1 million passengers (Maryland Department of Transportation, 2015). The Light Rail follows a north-south alignment from Hunt Valley in Baltimore County to Baltimore/Washington International Thurgood Marshall Airport (BWI) and Glen Burnie in Anne Arundel County. Light Rail connects to Amtrak, MARC, and local bus service, operated by MTA. The North Avenue Light Rail Station and Maintenance Facility is located within the study area.

d. Metro Subway

The Baltimore Metro subway is a 15.5-mile heavy rail system serving Baltimore City and Baltimore County, from Johns Hopkins Hospital in the southeast to Owings Mills in the northwest. Metro has a headway of 8 to 10 minutes and end-to-end travel time of approximately 30 minutes. Metro provides connections to the local bus service and Light Rail. In fiscal year (FY) 2016, the Metro transported 14.6 million passengers (Maryland Department of Transportation, 2015). The underground Metro tunnel is located within the Study Area.

Table V-6: Zoning Districts

Zoning District	District Description	Study Area (Acres)	Study Area (Percent)	Baltimore City (Acres)	Baltimore City (Percent)
Residential	Includes both single-family and general residential districts	1,667.6	64.1	34,976.8	65.3
Office-Residence	Primarily accommodates office and residential use in appropriate areas and locations	102.9	4.0	582.8	1.1
Neighborhood Business	Shopping convenience for people residing in nearby areas	22.1	0.8	163.3	0.3
Community Business	Designed to accommodate the needs of a large consumer population served by a neighborhood business district	205.6	7.9	2,125.3	4.0
Central Business	Provides for a great variety of large retail stores, offices, and related activities characteristic of major business streets of the downtown area and that serve the metropolitan region	24.7	0.9	290.2	0.5
Central Commercial	Provides for uses and activities in the central business district of the City	124.4	4.8	538.5	1.0
Community Commercial	Designed primarily to accommodate business, service, and commercial uses of a highway-oriented nature	116.2	4.5	1,354.6	2.5
Industrial	Intended to permit light manufacturing, warehousing and service uses, suitable for industrial and related activities.	338.6	13.0	13,436.6	25.1
Total		**2,602.1**	**100.0**	**53,468.1**	**100.0**

Source: Land Use Shapefile (Baltimore City, 2008). Table does not include parcels zoned 'Open Space.'

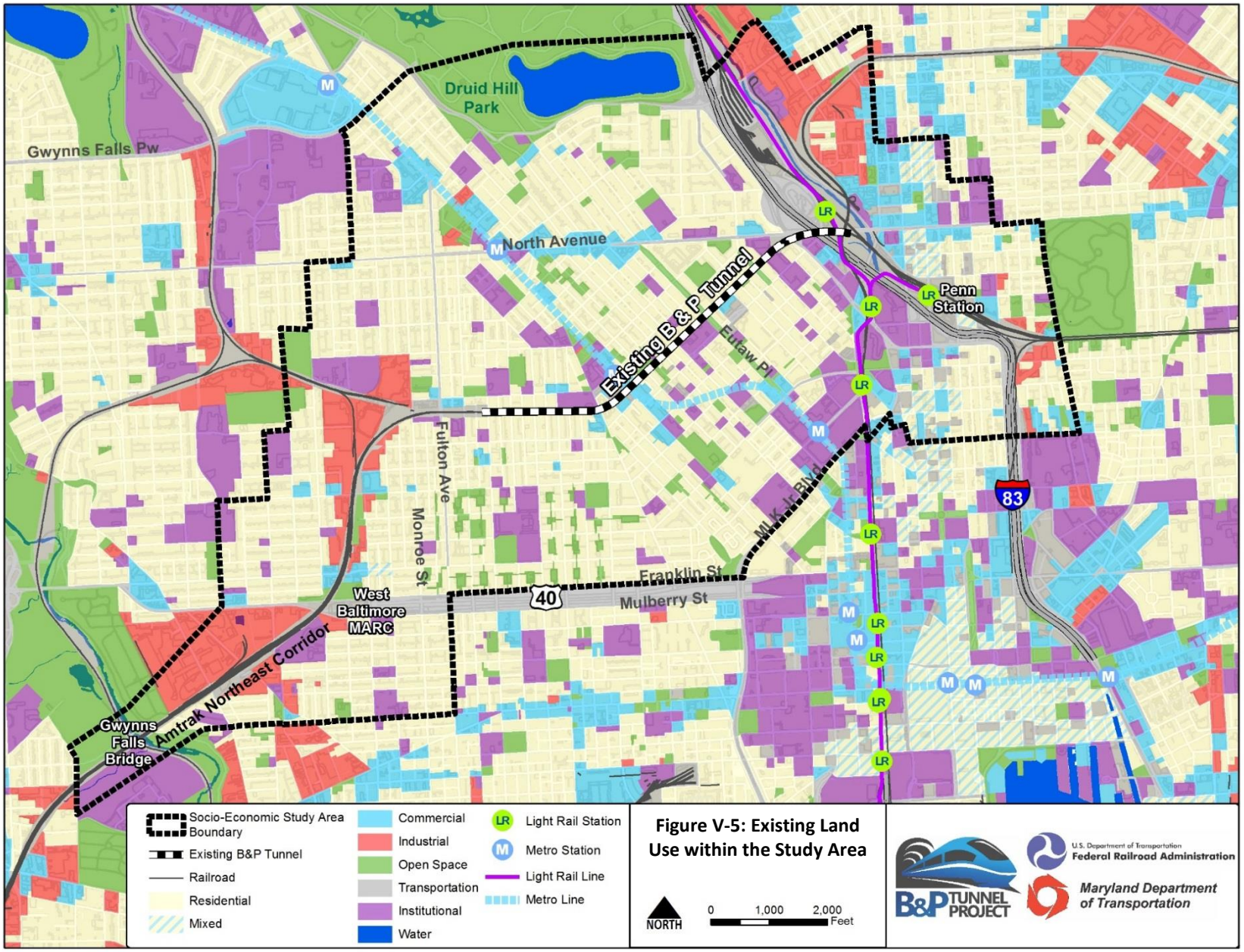


Figure V-5: Existing Land Use within the Study Area

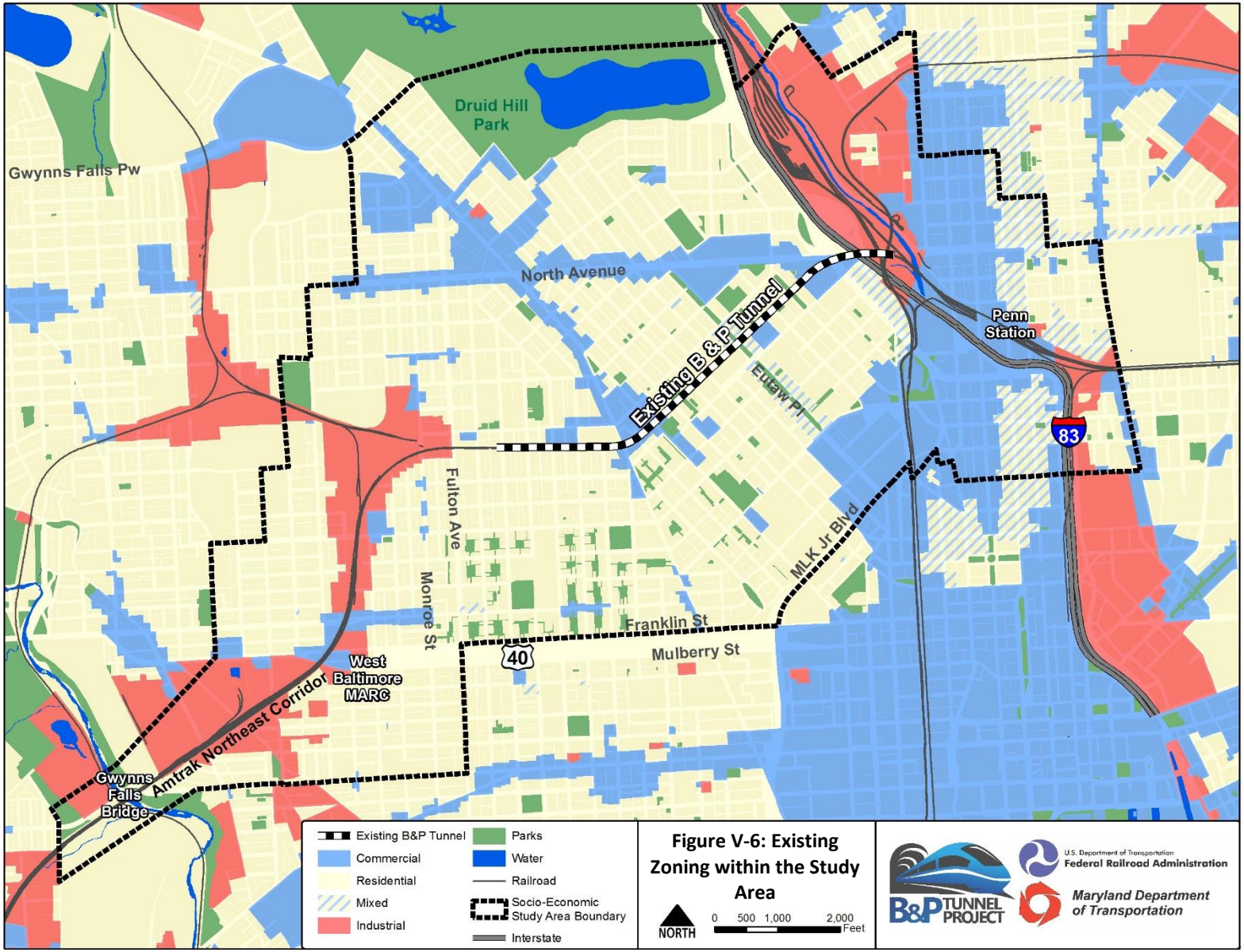


Figure V-6: Existing Zoning within the Study Area

e. Roadway Network

The major arterials that pass through the Study Area include North Avenue, West Franklin, and West Mulberry Street, which run east to west; and Pennsylvania Avenue, which runs northwest to southeast. These arterials provide connections throughout Baltimore City and facilitate short intra-city trips between residential, commercial, and employment destinations. The regional connectors in the Study Area include Martin Luther King Junior Boulevard, which provides connections to Interstate 95 (I-95) and Interstate 295 (I-295); Interstate 83 (I-83), which runs from the northern suburbs of Baltimore to downtown; and US Route 40, which connects to the west.

f. Bus Service

The Study Area is served by MTA's local bus service and Baltimore City's Charm City Circulator (CCC). MTA buses provide transit service along 57 local, limited stop, and express bus routes throughout the region. It has an average daily ridership of 242,000 and an average headway of approximately 20 minutes during peak hours and 30 minutes during non-peak hours. Within the Study Area, MTA local bus service provides connections to Amtrak, MARC, Light Rail, Metro, and the CCC.

The CCC is a free shuttle service provided by the Baltimore City Department of Transportation (DOT), with one route, the Purple Route, that passes through the Study Area. The Purple Route travels north-south through the eastern edge of the Study Area from Baltimore Penn Station in Mount Vernon to Federal Hill in south Baltimore. The service has a 15-minute headway and operates during peak and off-peak hours on weekdays and weekends, connecting with other transit services. In FY 2014, the Purple Route transported approximately 150,000 riders per month (Baltimore City, 2014).

g. Freight

Currently, cargo to/from specific railroad customers of the freight trains that pass through the B&P Tunnel include vegetable oil, plastic pellets, paper, lumber, and produce. However, there are no regulations or restrictions which would preclude other forms of freight cargo on these trains, providing the material is moved in accordance with federal transportation rules.

Norfolk Southern Corporation (NS) and CSX Corporation have rights to operate on the NEC per "trackage-rights agreements" that date back to Amtrak's acquisition of the NEC on April 1, 1976 as part of the Railroad Revitalization and Regulatory Reform Act of 1976. Per these agreements, Amtrak must make reasonable efforts to accommodate freight rail operations on the NEC, and freight rail companies must be equally accommodating in accepting off-hour track assignments for the movement of goods (nights and weekends), when passenger trains operate less frequently and the insertion of freight trains will not cause delay. While these agreements guarantee private rail freight companies access to the NEC, these rail freight companies have other route options around Baltimore that make the B&P Tunnel route less attractive as a major through route across or around the city.

Because of these alternate route options, there are currently no "through" freight trains operating through Baltimore on the NEC. For the past several years, only one local NS freight train has been operating through the B&P Tunnel daily, serving customers south of the B&P Tunnel between Baltimore and Washington, DC. The train originates at Bayview Yard in Eastern Baltimore (north of Baltimore Penn Station), travels through the Station and the Tunnel, and delivers and/or picks up cars at various sidings, and then returns to Bayview Yard.

NS has no plans to increase or change its B&P Tunnel freight operation in the near future. NS has, however, restated its contractual right to increase freight operations in the future should it see value in doing so. In addition, the agreements provide that Amtrak cannot take any action that may restrict future growth in freight traffic through the B&P Tunnel.

Amtrak's first priority is to its passenger services. Therefore, although Amtrak must accommodate requests from NS or other freight operators with trackage rights agreements for additional train moves on the NEC, Amtrak need only schedule such moves as space between passenger trains can be made available. Where the freight operator and Amtrak have a dispute about scheduling of freight moves, the Surface Transportation Board (STB) adjudicates trackage rights agreements.

6. Economy

a. Employment

The labor force includes the civilian and US Armed Forces population over 16 years of age working as paid employees, people who are self-employed (including farmers), or who worked 15 hours or more as unpaid workers for a family farm/business. Excluded from the labor force are those over 16 years of age who are students, homemakers, unpaid volunteers, retirees, institutionalized, or worked less than 15 hours a week as unpaid workers for a family farm/business.

The unemployed are defined as those over 16 years of age and not currently working, but actively looking for work and generally available to work. As shown in **Table V-7**, the unemployed population of the Study Area in 2013 was 20.4 percent, which was about 6.5 percent higher than Baltimore City and about 12.2 percent higher than the statewide rate (US Census Bureau, 2013a).

Table V-7: Labor Force Characteristics

Geographic Area	Population	
	Residents in Labor Force	Unemployed Residents in Labor Force (Percent)
Study Area	36,055	20.4
Maryland	3,214,633	8.2
Baltimore City	312,986	13.9

Source: US Census Bureau (US Census Bureau, 2013a).

The percent of residents employed in each occupation category of the ACS in 2013, detailed in **Appendix E,** is similar for the Study Area Block Groups, Baltimore City, and Maryland (see **Table V-8**). Most workers residing in the Study Area (about 33.2 percent) work in management, business, science, and arts. Approximately one quarter (25.1 percent) work in a service capacity, and 25.2 percent are sales and office staff. The remaining workers are in natural resources, construction, and maintenance sectors (4.4 percent), or are laborers in production, transportation, or material-moving jobs (12.0 percent).

The highest percent of Study Area workers in the management, business, science, and art professions (82.2 percent) reside in the Bolton Hill neighborhood (Block Group 1401.004). For the other analyzed occupation types in the Study Area, the majority (67.4 percent) work in sales and office occupations and reside in the Midtown-Edmondson neighborhood (Block group 1605.002). The majority of Study Area residents working in services (53.7 percent) reside in the Sandtown-Winchester neighborhood (Block Group 1501.003). The highest percentage of people whose occupations are in natural resources, construction, and maintenance (28.6 percent) reside in the Mondawmin neighborhood (Block Group 1504.001), and the highest proportion of working residents in production, transport, and material moving jobs (44.1. percent) reside in in the Penrose/Fayette neighborhood (Block Group 2002.002). Major employers in the Study Area include Bon Secours Hospital and the University of Baltimore (US Census Bureau, 2013e).

Table V-8: Summary of Resident Occupations

Geographic Area/Census Block Group	Management, Business, Science, and Arts (Percent)	Service (Percent)	Sales and Office (Percent)	Natural Resources, Construction, and Maintenance (Percent)	Production, Transportation, and Material-Moving (Percent)
Maryland	44.2	16.9	23.2	7.9	7.7
Baltimore City	38.4	21.6	23.5	6.1	10.5
Study Area Total Block Groups	33.2	25.1	25.2	54.4	12.0

Source: US Census Bureau (US Census Bureau, 2013a).

b. Business

The US Census Bureau's 2013 Annual Economic Survey provides certain business characteristics data by North American Industry Classification System (NAICS) code and ZIP code (US Census Bureau, 2013c), which is the smallest available analysis unit for businesses in the Study Area. The ZIP code boundaries encompassed in all or part of the Study Area include: 21201, 21202, 21216, 21217, 21223, and 21229 (**Figure V-7**).

Table V-9 shows a total of 4,185 businesses are located in the Study Area ZIP codes with the majority in the easternmost portion that extends south (21202), encompassing Baltimore Harbor (US Census Bureau, 2013c). The top five sectors in the Study Area ZIP codes are professional, scientific, and technical services (17.3 percent); retail trade (15.0 percent); accommodation and food services (13.0 percent); health care and social assistance (12.0 percent); and other services (11.1 percent). A total of 2,137 establishments (51.1 percent) have one to four employees with the largest 12 establishments having 1,000 or more employees (0.3 percent). In comparison, in 2013, Baltimore City had 12,280 establishments of which 386 had 100 or more employees (3.1 percent) and statewide 135,421 establishments had 3,375 had 100 or more employees (2.5 percent). (US Census Bureau, 2013f). In 2013, annual payroll was distributed in the following ZIP codes (US Census Bureau, 2013d):

- 21201: $2.2 billion
- 21202: $3.8 billion
- 21216: $0.3 billion
- 21217: $0.1 billion
- 21223: $0.2 billion
- 21229: $0.3 billion

Annual 2013 payroll in Baltimore City was approximately $16 billion (US Census Bureau, 2013c) and $108 billion statewide (US Census Bureau, 2013e).

The largest business in the immediate vicinity of the south portal, P. Flanigan & Sons (F&S) Inc., is located at 1300 North Monroe Street, intersecting ZIP codes 21216 and 21217 within the Study Area. It is the only Maryland State Highway Administration-approved recycled concrete aggregate base manufacturer in Maryland and has been in operation since 1885. It has an advantageous location for material transportation, which utilizes the CSX freight line spur to transport stockpiles of aggregate up to three times per week, and it is in close proximity to several major highways and facilities, including I-95, I-695, I-70, US Route 1, US Route 40, MD-295, the Port of Baltimore, and BWI Airport. This location employs approximately 50 people, some of whom reside in adjacent communities, making this business one of the economic drivers of the community.

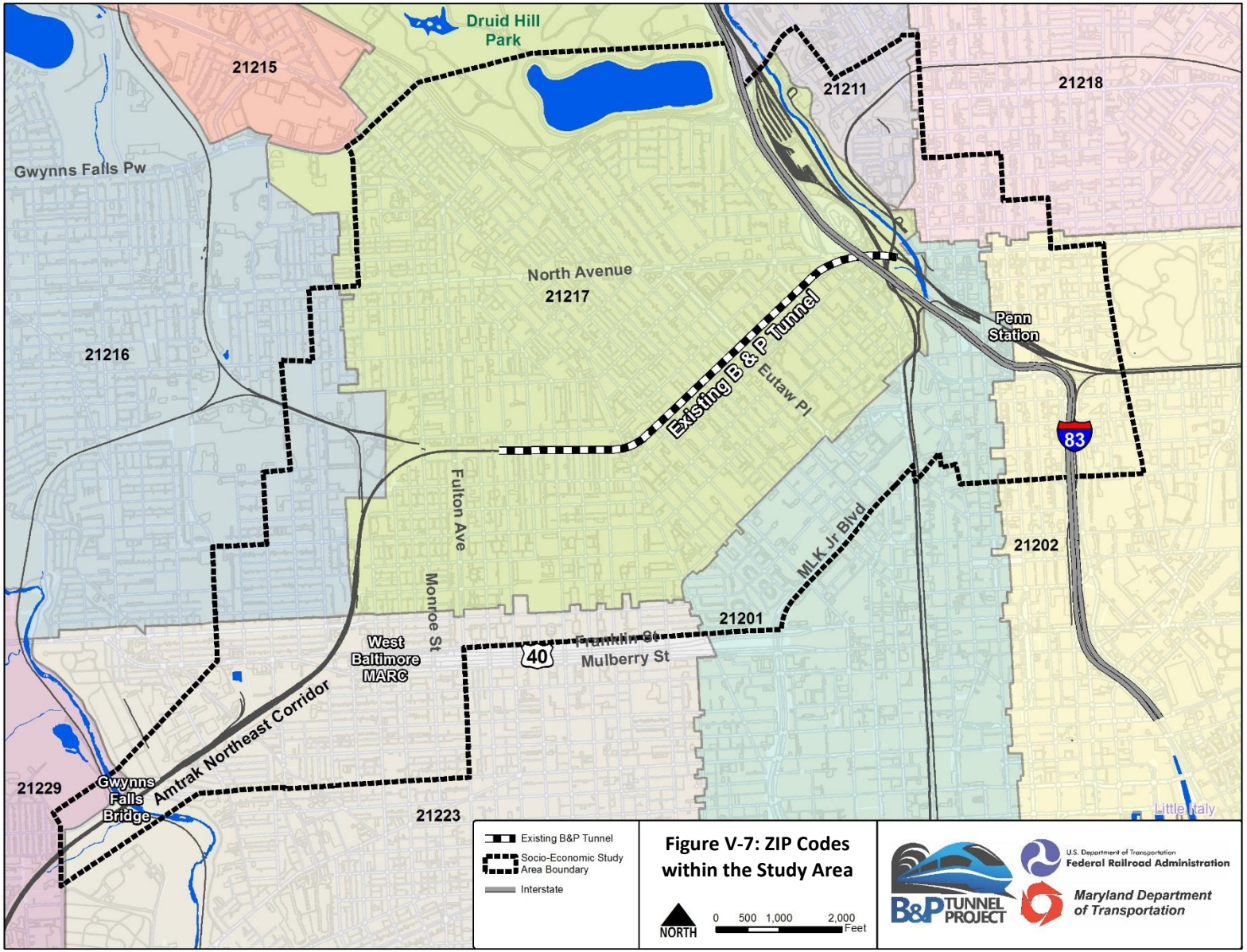


Figure V-7: ZIP Codes within the Study Area

Table V-9: Number of Business Establishments per NAICS Business Sector by ZIP Code

NAICS Business Sector[1]	ZIP Code						Total Number by Business Sector
	21201	21202	21216	21217	21223	21229	
Accommodation and Food Services	195	202	17	36	50	44	**544**
Administrative, Support, Waste Management, and Remediation Services	59	97	4	10	12	15	**197**
Arts, Entertainment, and Recreation	19	27	0	9	4	2	**61**
Construction	23	22	7	12	17	29	**110**
Educational Services	17	26	3	5	5	8	**64**
Finance and Insurance	86	166	4	6	7	13	**282**
Health Care and Social Assistance	146	117	53	57	29	101	**503**
Information	35	46	0	2	3	3	**89**
Management of Companies and Enterprises	17	19	0	0	0	0	**36**
Manufacturing	7	14	2	5	32	6	**66**
Other Services (Except Public Administration)	126	142	29	69	49	51	**466**
Professional, Scientific, and Technical Services	316	359	1	19	14	16	**725**
Real Estate and Rental and Leasing	59	78	10	23	29	13	**212**
Retail Trade	141	143	56	91	114	81	**626**
Transportation and Warehousing	8	12	10	5	11	10	**56**
Utilities	2	8	0	0	0	0	**10**
Wholesale Trade	25	44	4	8	32	22	**135**
Industries Not Classified	0	0	0	2	0	1	**3**
ZIP Code Total Number of Establishments	**1,281**	**1,522**	**200**	**359**	**408**	**415**	**4,185**

Source: US Census Bureau Economic Survey (US Census Bureau, 2012).
[1]North American Industry Classification System.

c. Property Taxes

Both Baltimore City and Maryland real property tax rates have remained constant since 2008, at $2.268 and $0.112 per $100 assessed value, respectively (Baltimore City, 2013). Based on parcel tax data, 2014 Baltimore City real property taxes in the Study Area totaled approximately $34.8 million, compared to $763 million levied citywide in 2013 (Baltimore City, 2013; Baltimore City, 2014). The State collected approximately $738 million in real property taxes in 2013 (Maryland State Archives, 2015).

d. Income and Wages

Table V-10 summarizes 2013 inflation-adjusted median household income of people residing in the Study Area, Baltimore City, and Maryland. The median household income of the 77 Study Area Blocks Groups ranged from $8,643 to $78,365. The average median household income of the Study Area Block Groups was $29,474 — approximately $12,000 (29 percent) less than that of Baltimore City and $44,000 (60 percent) less than the statewide average.

Table V-10: Median Household Income

Geographic Area	Median Household Income (US Dollars)[1]
Maryland	$73,538
Baltimore City	$41,385
Study Area	**$29,474**

Source: US Census Bureau (US Census Bureau, 2013a).
[1]2013 inflation-adjusted dollars.

7. Neighborhoods and Community Facilities

Neighborhoods and facilities were identified based on site visits and a review of Geographic Information Systems (GIS) data. Thirty residential neighborhoods were identified within, and/or intersecting with, the Study Area.

Community facilities within the Study Area include educational, religious, law enforcement, fire and rescue, parks and recreation facilities, and cemeteries.

a. Neighborhoods

The Study Area neighborhoods (**Figure V-8, Table V-11**) are typical of older, established urban areas, with historic architecture, highly trafficked pedestrian spaces, busy thoroughfares, and quieter residential roads. The neighborhoods are primarily residential, composed mainly of single-family attached rowhomes and several garden apartment complexes. The Study Area features a variety of commercial and industrial businesses, such as convenience stores, bars/restaurants, clothing retail, and automotive care, located along the main thoroughfares of North Avenue and Pennsylvania Avenue. Residential and commercial areas alike are characterized by frequent pedestrian activity.

In some neighborhoods, the residential character/cohesion has been impacted by previous construction of substantial linear infrastructure. The existing B&P Tunnel rail alignment traverses from Gwynn's Falls as surface tracks (i.e., daylighted) through the Carroll-South Hilton, Penrose/Fayette Street Outreach, Rosemont Homeowners/Tenants, Evergreen Lawn, Midtown-Edmondson, and Bridgeview/Greenlawn neighborhoods. Since it was constructed in 1873, the railroad has been a physical barrier to the neighborhoods, except in nine locations where the railroad is subterranean, there is an overpass, or it is crossed by local roads. Land adjacent to the rail corridor is primarily commercial and industrial, which acts as a buffer between the railway and residential land uses.

The residential character of neighborhoods has also been impacted by wide multilane roads such as US 40, which bisects neighborhoods to the southwest of the Study Area; North Avenue, a major east-west thoroughfare in the north of the Study Area; Martin Luther King Junior Boulevard, which leads to I-95 and I-295 in the southeast of the Study Area; and I-83 to the east. The Jones Falls Area neighborhood is the least residential as it has heavy transportation land use where I-83, the MTA North Avenue Light Rail Yard, and Baltimore Penn Station are located. Neighborhoods in the Study Area east of the Jones Falls Area connect to the neighborhoods west or south via 11 overpasses at nearly all major intersecting streets, ensuring neighborhood access.

Table V-11: Neighborhoods within the Study Area

Neighborhood	Location within Study Area
Barclay	East
Bolton Hill	Central
Bridgeview/Greenlawn	West
Coppin Heights/Ash-Co-East	North
Druid Heights	North
Easterwood	West
Evergreen Lawn	Southwest
Franklin Square	South west
Greenmount West	East
Harlem Park	South
Heritage Crossing	South
Johnston Square	East
Madison Park	Central
Mid-Town Belvedere	East
Midtown-Edmondson	Southwest
Penrose/Fayette Street Outreach	Southwest
Rosemont Homeowners/Tenants	Southwest
Sandtown-Winchester	Central
Upton	Central
Carroll-South Hilton	Southwest
Shipley Hill	Southwest
Mondawmin	Northwest
Parkview/Woodbrook	Northwest
Penn North	North
Reservoir Hill	North
Jones Falls Area	Northeast
Charles North	Northeast
Charles Village	Northeast
Druid Hill Park Area	North
Remington	Northeast

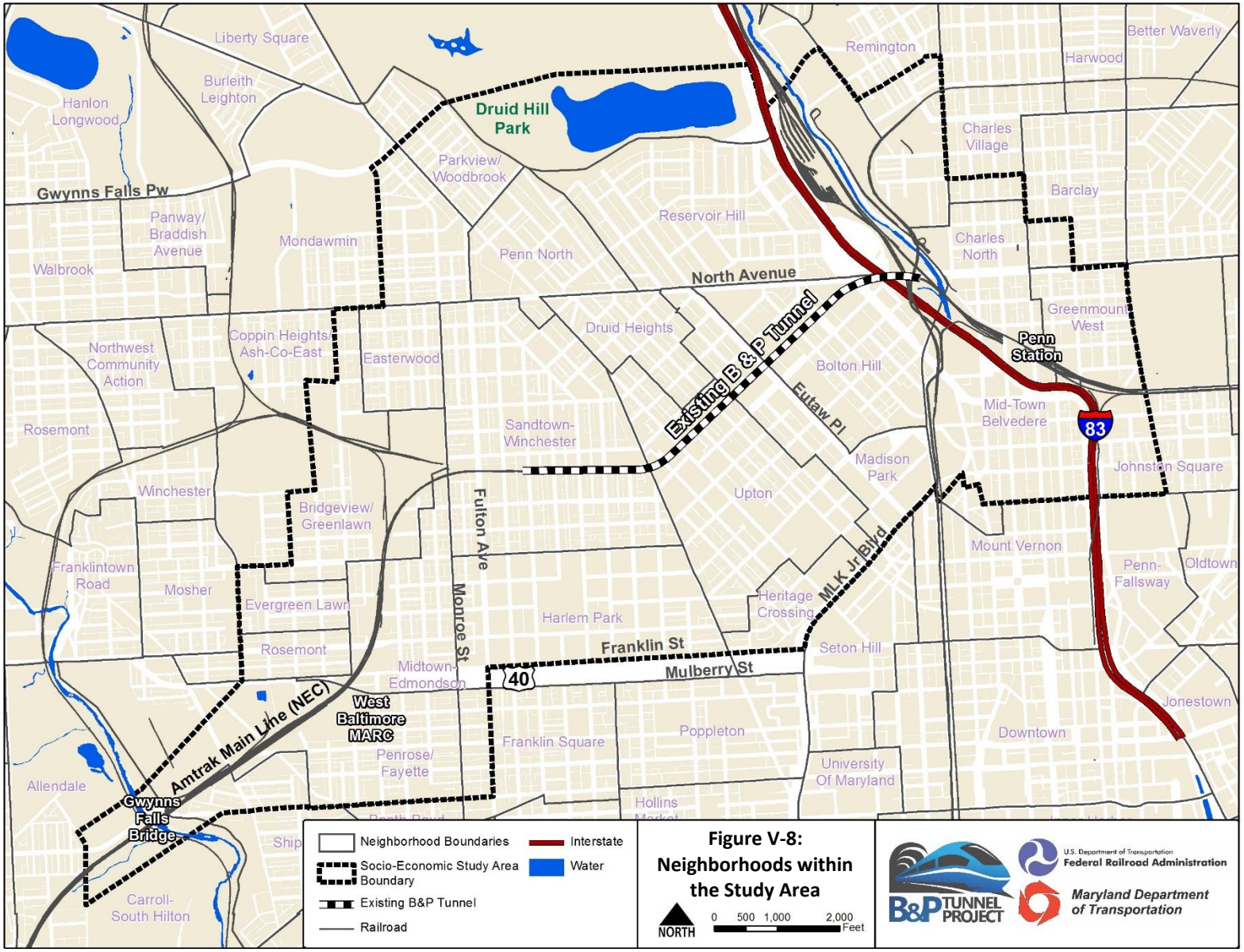


Figure V-8: Neighborhoods within the Study Area

b. Community Facilities

The Study Area contains a wide range of community facilities and public services that are locally oriented and serve the region, including places of worship, recreation centers, cemeteries, schools, libraries, parks, and a healthcare facility. **Figure V-9** shows the community facilities within the Study Area. These facilities are an integral part of the communities in which they serve, as resident participation contributes to community cohesion.

i. *Educational Facilities*

There are 26 educational institutions within the Study Area, including four elementary/middle schools, two middle schools, and three high schools. Carver Vocational Technical High School is the only vocational school within the Study Area. The University of Baltimore and Maryland Institute College of Art are higher-education institution in the Study Area (**Table V-12)**.

Table V-12: Schools within the Study Area

Name	Location
Eutaw-Mashburn Elementary School	1624 Eutaw Place
Westside Elementary School	2235 N Fulton Avenue
Matthew A. Henson Elementary School	1600 N Payson Street
Harlem Park Elementary/Middle School	1401 W Lafayette Street
Dallas F. Nicholas Sr. Elementary School	201 E 21st Street
John Eager Howard Elementary School	2011 Linden Avenue
Mount Royal Elementary Middle School	121 McMechen Street
Gilmor Elementary School	1311 N Gilmor Street
Samuel Coleridge-Taylor Elementary School	507 W Preston Street
Furman L. Templeton Elementary School	1200 N Pennsylvania Avenue
Booker T. Washington Middle School	1301 McCulloh Street
James Mosher Elementary School	2400 W Mosher Street
Mary Ann Winterling Elementary School	220 N Bentalou Street
Lockerman Bundy Elementary School	301 N Pulaski Street
Empowerment Academy Elementary/Middle School	851 Braddish Avenue
Midtown Academy	1398 Mount Royal Avenue
New Song Academy Elementary/Middle School	1530 Presstman Street
Baltimore Montessori Public Charter School	1600 Guilford Avenue
New Hope Academy middle/high school	900 Druid Hill Avenue
Augusta Fells Savage Institute of Visual Arts	1500 Harlem Avenue
Baltimore Talent Development High School	1500 Harlem Avenue
Baltimore Renaissance Academy HS	1301 McCulloh Street
Carver Vocational Technical High School	2201 Presstman Street
Monarch Academy Public Charter School	1200 North Freemont Avenue
University of Baltimore	1420 N. Charles Street
Maryland Institute College of Art	1300 W Mount Royal Avenue

Source: Baltimore City, 2010.

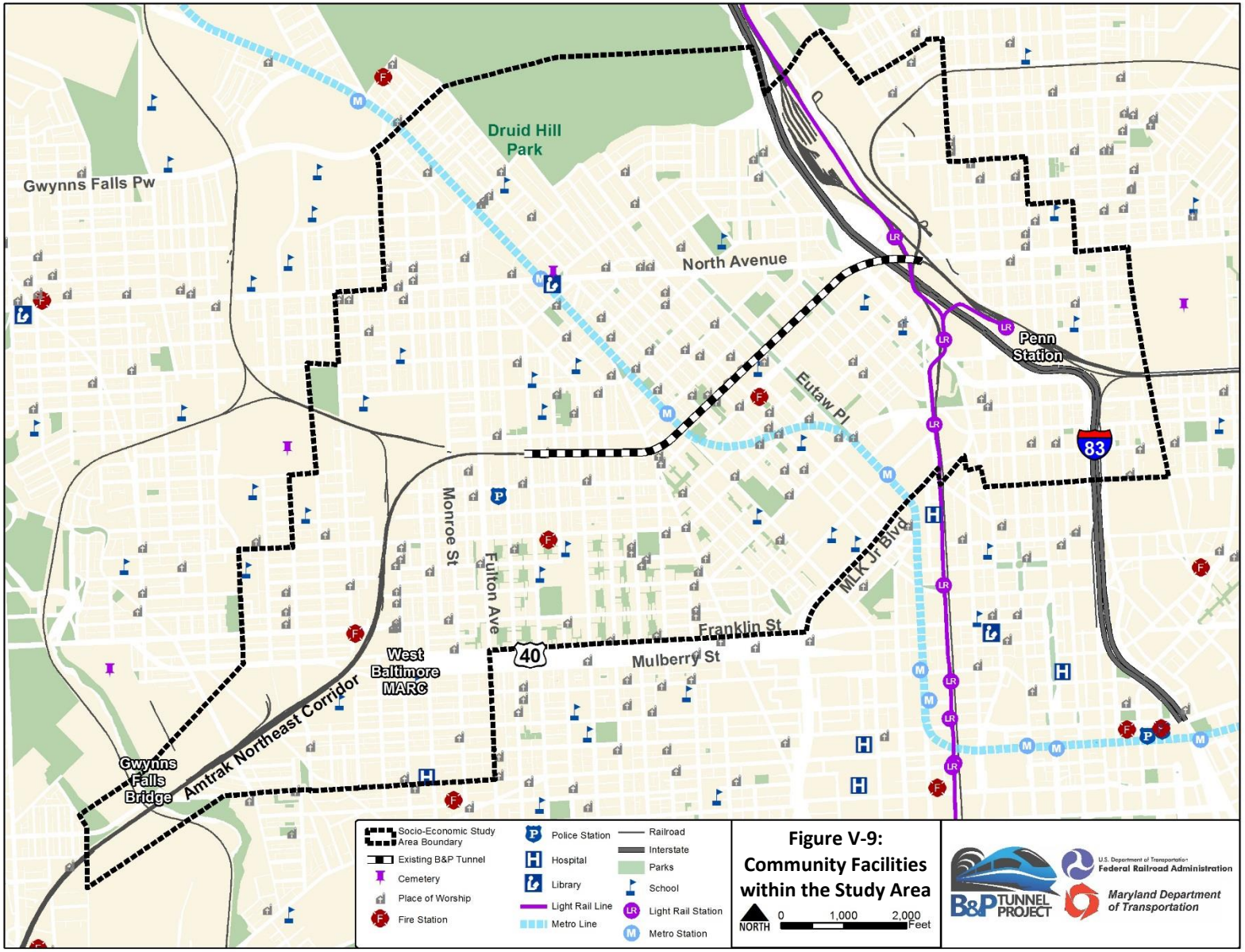


Figure V-9: Community Facilities within the Study Area

ii. *Places of Worship*

Thirty-seven places of worship are located within the Study Area and are listed in **Table V-13**.

Table V-13: Places of Worship within the Study Area

Name	Location
Perkins Square Baptist Church	2500 Edmondson Avenue
Faith Christian Worship Center	700 N Pulaski Street
Wayside Baptist Church	1318 Riggs Avenue
New Bethlehem Baptist Church	1370 N Carey Street
Transformation Baptist Church	815 N Mount Street
St Peter Claver Roman Catholic Church	1524 N Fremont Avenue
St Katherine's Episcopal Church	2001 Division Street
The Old Time Way Church of Deliverance	2100 W Lanvale Street
Trinity Baptist Church	1601 Druid Hill Avenue
Sanctuary Church	800 N Fulton Avenue
McKinney Memorial Holy Church	1334 N Calhoun Street
Holy Temple Pentecostal Church	574 Presstman Street
Refuge Church of Deliverance	2101 Edmondson Avenue
Berea Seventh Day Adventist Church	1901 Madison Avenue
World Deliverance Church	1700 McCulloh Street
Central Congregation of Jehovah's Witnesses	1107 N Fremont Avenue
Church of Christ	664 Pitcher Street
New Porters Tabernacle Church	2105 Edmondson Avenue
Bethel United Apostolic Church	631 Whitelock Street
All New Satellite Baptist Church	101 N Warwick Avenue
New Metropolitan Baptist Church	1501 McCulloh Street
Freedom Church & Ministries	813 N Pulaski Street
St Luke's United Methodist Church	1100 N Gilmor Street
All Saints Baptist Church	1300 N Mount Street
Payne African Methodist Episcopal Church	1714 Madison Avenue
St Matthew Lutheran Church	1909 Druid Hill Avenue
Triumph Church of God	1501 Myrtle Avenue
Open Door Baptist Church	1700 Madison Avenue
New Life Fellowship Church of Christ	559 Robert Street
First Emmanuel Baptist Church	2203 Park Avenue
Beth Am Congregation	2501 Eutaw Place
Strawbridge United Methodist Church	1624 Eutaw Place
Masjid ul-Haqq	514 Islamic Way
New Mount Joy Missionary Baptist Church	1725 Division Street
Life Celebration Center Church	2100 Edmondson Avenue
Christ Apostolic Church	2206 Park Avenue
Tabernacle of God Church Outreach	1520 Winchester Street

Source: United States Geological Survey Geographic Names Information System, 2012/RKK.

iii. *Law Enforcement Facilities*

The Study Area is served by the North, Central, East, West, and Southwest police districts of Baltimore City. There is one police station located at 1034 North Mount Street, in the West District.

iv. *Fire and Rescue Facilities*

The Baltimore City Fire Department provides fire protection and emergency medical services to Baltimore City. The Study Area is served by the second and third Battalions of the Baltimore City Fire Department, which contain three fire stations (see **Table V-14**).

Table V-14: Fire and Rescue Facilities within the Study Area

Name	Location
Second Battalion Smokestack Hardy Fire Station Engine Company 13, Truck Company 16, Medic 4	405 McMechen Street
Third Battalion Charles R. Thomas Fire Station Engine Company 36	2249 Edmondson Avenue
Third Battalion Engine Company 8, Truck Company 10, Medic 15	1503 W Lafayette Avenue

Source: Baltimore City (2010).

v. *Parks and Recreational Facilities*

There are 103 parks in the Study Area, including city parks, neighborhood parks, and community pocket parks. Park services are provided by the Baltimore City Department of Recreation and Parks. Druid Hill Park, in the northeast Study Area, is the largest park within the Study Area, encompassing approximately 615 acres. Small neighborhood and community pocket parks are prevalent throughout the Study Area.

Two parcels not occupied by buildings are located at the intersection of Whitelock Street and Brookfield Avenue. These parcels are owned by Baltimore City Mayor and City Council and are managed by the Reservoir Hill Association through the Adopt-A-Lot Program. Per the Baltimore City Department of Housing and Community Development, and confirmed through discussions with neighborhood residents at various B&P Tunnel Project Community Meetings, a community garden (Whitelock Farm) is maintained and utilized by residents at these parcels, with additional potential uses for the parcels proposed by the community. The community garden and existing use of these parcels as community gathering spaces are considered integral to the neighborhood character of Reservoir Hill by its residents.

Baltimore City Department of Recreation and Parks manages 41 recreation centers throughout Baltimore City, seven of which are located within the Study Area (see **Table V-15**). These centers offer programs for children and adults, including cooking classes, arts and crafts, as well as gym activities.

Table V-15: Public Recreation Centers within the Study Area

Name	Location
Bentalou Recreation Center	222 N Bentalou Street
John Eager Howard Recreation Center	2100 Brookfield Avenue
Lillian S. Jones Recreation Center	1310 N Stricker Street
Mount Royal Recreation Center	120 W Mosher Street
Parkview Recreation Center	2610 Francis Street
Robert C. Marshall Recreation Center	1201 Pennsylvania Avenue
Upton Boxing Center	1901 Pennsylvania Avenue

Source: Baltimore City Department of Recreation and Parks.

There are three public swimming facilities in the Study Area: one park pool, located in Druid Hill Park; and one neighborhood pool and wading pool, both located in the Sandtown-Winchester neighborhood (see **Table V-16**).

Table V-16: Public Pools within the Study Area

Swimming Facility	Name	Location
Park Pool	Druid Hill Park	800 Wyman Park Drive
Walk-to Pool	William McAbee	1323 N Gilmor Street
Wading Pool	Lillian S. Jones Recreation Center	1310 N Stricker Street

Source: Baltimore City Department of Recreation and Parks.

vi. *Cemeteries*

The Etting Family Cemetery at 1510 West North Avenue is the only cemetery located in the Study Area. It is the oldest Jewish cemetery in Baltimore.

8. Visual and Aesthetic Resources

FRA Procedures for Considering Environmental Impacts (FRA, 1999) and guidance from the Federal Highway Administration (FHWA) Visual Impact Assessment for Highway Projects (FHWA, 1981) were used to identify visual and aesthetic quality within the Study Area. The discussion of visual and aesthetic resources in this chapter focuses on existing conditions in the Study Area. For more information regarding methodology, please see **Chapter VI, Section A**.

The Study Area includes four viewsheds along the general Project corridor. The existing B&P Tunnel is present in several portions of the existing viewsheds. These viewsheds are:

1) the location proposed for the north portal and North Ventilation Facility in the east Jones Falls area;

2) the location proposed for the Intermediate Ventilation Facility in the Reservoir Hill neighborhood;

3) the location proposed for the south portal and South Ventilation Facility in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods; and

4) the transportation right-of-way surrounding the trackway located railroad south of the proposed south portal location.

The viewshed at the location proposed for the north portal and North Ventilation Facility is in the east Jones Falls area. The landscape is characterized by transportation uses, including trackway, a warehouse facility, and a storage yard, as it is the site of the MTA Light Rail Maintenance Facility and North Avenue Light Rail Station. The Jones Falls Expressway (I-83) and North Avenue also cross the site. The landscape features trackway from the existing B&P Tunnel, a warehouse facility, a storage yard, parking lots, and roadway overpasses. The primary viewer group is transitory, and includes people who only travel through the Project area to another location.

The preferred Intermediate Ventilation Facility site would be in the Reservoir Hill neighborhood along North Avenue. The 900-940 West North Avenue site contains seven businesses including retail, office, and health care services. The Madison Park North Housing Complex is located to its immediate east, which is currently vacant. The Intermediate Ventilation Facility would be in an urban commercial area, adjacent to North Avenue, a major thoroughfare in Baltimore City. The landscape is characterized by multi-family housing, commercial storefronts, and institutional buildings. The primary viewer groups are permanent, including residents and nearby business employees, as well as transitory, and includes people who only travel through the Project area to other locations.

The viewshed at the location proposed for the south portal and south portal ventilation facility is in the Bridgeview/Greenlawn, Midtown-Edmondson, and Rosemont neighborhoods. These areas are established urban neighborhoods surrounding main roadway thoroughfares such as West Lafayette Avenue, Edmondson

Avenue, and West Franklin Street/West Mulberry Street. The landscape is characterized by a mix of historic residential rowhouses, commercial storefronts, institutional buildings, industrial buildings, and transportation uses such as roadways, bridges, and the existing B&P Tunnel trackway. The primary viewer group is permanent and limited exposure, including residents and nearby business employees.

The viewshed for the transportation right-of-way surrounding the trackway located railroad south of the proposed south portal location includes the transportation uses such as roadways, bridges, and the existing B&P Tunnel trackway. The primary viewer group is transitory, and includes people who only travel through the Project area to another location.

B. Public Health and Safety

This section provides a brief discussion of resources within the Study Area that contribute to public health and that may be affected by the Preferred Alternative, Alternative 3A, and Alternative 3C. Resources that contribute to public health for the B&P Tunnel Project include air quality, noise, hazardous material, and safety (disposition of the existing B&P Tunnel).

1. Air Quality

Air quality is important to human health. Research has linked air pollutants such as ozone and particulate matter (PM) to lung disease, heart disease, and other health problems. As described in **Section V.H**, Air Quality, the Study Area is presently designated by the EPA as a moderate nonattainment area for the eight-hour ozone and a maintenance area for $PM_{2.5.}$ Although a portion of Baltimore City is designated as a maintenance area for CO, the B&P Tunnel project is located outside of the maintenance area.

2. Noise

Health impacts associated with noise include sleep disturbances, annoyance responses, and adverse social behavior. The methodology for assessing existing noise conditions is described in detail in **Section I.** Noise measurements in the Study Area included rail traffic and motor vehicle traffic along surface streets. Measured peak-hour noise levels near the south portal ranged from 64.3 dBA to 70.3 dBA and the day-night noise levels range from 63.2 dBA to 64.7 dBA. Noise levels near the north portal are 60.0 dBA for both the peak-hour and day-night noise levels.

3. Hazardous Materials

Hazardous material and waste have the potential to threaten human health or the environment through exposure to toxic chemicals, carcinogenic components, or other harmful materials. A Preliminary Screening Assessment (PSA) to identify potential sites of environmental concern was conducted throughout the Study Area. The Study Area has a history of industrial activity, including dry-cleaning, rail maintenance, gas stations, and automotive repair. Current and historical hazardous materials used within the Study Area include, but are not limited to, petroleum, solvents, and other industrial contaminants. Please see **Section F** for more information regarding hazardous materials.

4. Safety

For this assessment, safety is related to the disposition of the existing B&P Tunnel and materials transported through the proposed new tunnel by freight rail. Despite the existing B&P Tunnel being more than 140 years old and approaching the end of its useful life due to structural deficiencies and obsolescence, the tunnel remains safe for rail transportation. In addition, Amtrak operates on the B&P Tunnel in accordance with proven safety approaches, performance-based safety measures, and adherence to best practices.

The existing B&P Tunnel predates certain standards and therefore lacks the comprehensive life safety approach contained in the National Fire Protection Association's (NFPA) Standard for Fixed Guideway Transit and Passenger Rail Systems—NFPA 130. This standard was developed and is maintained by a committee of industry professionals, regulators, and subject matter experts. The committee's primary responsibility is to set the standard for fire safety requirements in underground, surface, and elevated fixed guideway transit and passenger rail systems, including stations and tunnels. The standard prescriptively outlines the requirements for emergency ventilation systems, emergency procedures, communication and control systems, and for life safety from fire through infrastructure design and fire protection system attributes.

The railroads that use the B&P Tunnel have a Common Carrier Obligation, which prohibits them from refusing reasonable requests for their service, including transportation of hazardous materials. Hazardous materials can be transported along the Northeast Corridor and through the B&P Tunnel, but are subject to regulations from the US Department of Transportation. FRA requires a range of measures that minimize the risk to the public, including container labeling, container durability standards, emergency response information, and safety and security plans. In addition, local first responders receive training in hazardous materials incidents for specific facilities, including the B&P Tunnel.

Currently, Norfolk Southern (NS) operates the only freight trains that run through the existing B&P Tunnel. One train runs through the tunnel twice daily (once in each direction), and does not operate during the four-hour peak evening period. Cargos of the freight train that passes through the B&P Tunnel includes vegetable oil; plastic pellets; paper; lumber; and produce. Although not currently transported over the Northeast Corridor through Baltimore, hazardous and flammable/explosive materials and wastes can be transported by train along the Northeast Corridor and through the B&P Tunnel; there are no regulations or restrictions which preclude other forms of freight cargo on these trains, providing the material is moved in accordance with federal transportation regulations.

5. Children's Health

US Environmental Protection Agency Executive Order 13045 – *Protection of Children from Environmental Health Risks and Safety Risks* applies to economically-significant rules under EO 12866 that concern an environmental health or safety risk that may disproportionately affect children. Environmental health risks or safety risks refer to risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest (such as the air we breathe, the food we eat, the water we drink or use for recreation, the soil we live on, and the products we are exposed to). According to EPA research, children may suffer disproportionately from environmental health and safety risks because children generally eat more food, drink more water, and breathe more air relative to their size than adults. Contaminants may affect children disproportionately because their immune system defenses are not fully developed. (US Environmental Protection Agency, 2006). Children may be more or less sensitive than adults when confronted with an equivalent level of exposure to an environmental pollutant. This section assesses the existing environment which could have potential impacts to children's health.

a. Air Quality

The regulatory framework in which air quality is measured is described in detail in **Section H**. The Clean Air Act (CAA) requires EPA to set National Ambient Air Quality Standards (NAAQS) (40 CFR part 50) for pollutants considered harmful to public health and the environment. The CAA identifies Primary Standards to provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Air quality is important to children's health as pollution can retard lung growth and exacerbate respiratory diseases. The most likely locations of potential effects on children, other than in residential areas, would be at schools where there are outdoor activities for children.

There are 26 educational facilities located within the Study Area. Twelve (12) are elementary schools and four are elementary/middle schools, included in **Table V-12**. As mentioned above, the Study Area is presently designated by the EPA as a moderate nonattainment area for the eight-hour ozone, and a maintenance area for CO and $PM_{2.5}$.

b. Water

Infants' immune systems are not as strong as those of healthy adults, so they are less able to fight off emerging microbial threats in drinking water. As described in **Chapter VI, Section E**, a sole source aquifer (SSA) is the primary source of drinking water for an area. No SSA, water supply reservoirs, wells, or recreational waters are located near the existing B&P Tunnel.

c. Soils and Hazardous Material

Several factors may cause children to suffer disproportionately from exposure to soils and hazardous material: children's behavior can expose them to more chemicals and organisms; children's skin and other body tissues may absorb some harmful substances more easily; and children's bodies are not yet fully developed. As a result, exposure to toxic substances may affect their growth and development.

The methodology used to assess hazardous material in the Study Area has been described above under **Public Health and Safety**.

C. Cultural Resources

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA) (54 U.S.C. 306108), and the Advisory Council on Historic Preservation's (ACHP) implementing regulations (36 CFR Part 800), FRA has taken into account the effects of the Project on historic properties (36 CFR Part 800.1(a)). A historic property, is defined in the NHPA as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register of Historic Places (NRHP)." Eligibility criteria for listing a property in the NRHP are found in 36 CFR Part 60, and are defined as "the quality of significance in American history, architecture, archeology, engineering, and culture [that] is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
b) that are associated with the lives of significant persons in our past; or
c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
d) that have yielded, or may be likely to yield, information important in prehistory or history."

If a property is determined to possess historic significance, its integrity is evaluated by applying the Seven Aspects of Integrity to determine the property's ability to convey its significance. These include: Location, Design, Setting, Materials, Workmanship, Feeling, and Association.

Historic architectural and archaeological research material from the Maryland Historical Trust (MHT) Library, the MHT GIS database, the Maryland Environmental Resources and Land Information Network (MERLIN), and Medusa were used to ascertain previously-identified historic properties and archaeological sites, and gather cultural resources reports from the Study Area (36 CFR Part 800.4(a)(2)). Additional information on historic properties was identified through the Section 106 process, including input from consulting parties, the public, and field investigations (36 CFR Part 800.4(a)(3)).

1. Area of Potential Effects

The Area of Potential Effects (APE) is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties" (36 CFR Part 800.16(d)). Indirect effects could be caused by visual, atmospheric, and audible elements of the undertaking. The historic architectural APE was determined and documented (36 CFR Part 800.4(a)(1)) using information gathered from field visits, and from studying historic and current maps and aerial imagery. See **Figure V-18** for a map of the historic architectural APE. Since most construction activities along the proposed tunnel route build alternatives would be well beneath the surface, with little to no potential for effects to historic properties, these areas were not included within the APE. The historic architectural APE was delineated as a 200-foot radius around the outer boundaries of the north and south portal areas. Some of the south portal limits of disturbance are within the right-of-way of existing roadways, and in some cases, this work is associated with bridges. Due to the temporary nature of the roadway right-of-way work, the APE is defined as a 100-foot radius from the limits of disturbance in these areas. The exceptions to these APE limits are at the ends of the portal areas where the undertaking is confined to track work within the existing railroad right-of-way. The initial 100-foot radius APE around the Intermediate Ventilation Facility's potential location was extended to a 200-foot radius once specific potential sites were selected. The archaeological APE has not been formally delineated, but is assumed to be confined to the physical Project limits of disturbance.

2. Historic Architecture

FRA has identified architectural historic properties within the APE (36 CFR Part 800.4(b)) for the Preferred Alternative, Alternative 3A, and Alternative 3C. In total, there are 19 architectural historic properties within the APE that are either listed in or eligible for listing in the NRHP. These properties are listed in **Table V-17** and depicted in **Figure V-18**, and include industrial and residential buildings, bridges, and districts. For more information on the eligibility of each historic property, see the *Architectural Historic Properties Survey* technical report, and the 13 additional MHT Determination of Eligibility (DOE) Forms subsequently completed. FRA also prepared a technical memorandum in July 2016 containing updates to the identified list of historic properties. The document includes a clarification to the B&P Railroad historic district boundary. Two additional resources, the Union Railroad and Bolton Hill Historic District, have been added to the list of architectural historic properties following the publication of the DEIS. The Carver Vocational-Technical High School and Western Maryland Railroad, Owings Mills Division are not located within the APE for the Preferred Alternative.

Table V-17: Architectural Historic Properties within the APE

#	Historic Property	MIHP Identification Number
1	Baltimore and Ohio Railroad Baltimore Belt Line	B-5287
2	Baltimore and Ohio Railroad Baltimore Belt Line Bridge over Jones Falls Valley	B-5288
3	Baltimore & Potomac Railroad (Philadelphia, Baltimore and Washington Railroad)	B-5164
4	Union Railroad	B-5163
5	Howard Street Bridge (BC1405)	B-4529
6	North Avenue Bridge (BC 1208)	B-4521
7	Reservoir Hill Historic District	B-1379
8	Carver Vocational-Technical High School	B-5294
9	Western Maryland Railroad, Owings Mills Division	B-5293
10	Bolton Hill Historic District	B-64
11	Midtown-Edmondson Historic District	(none)
12	Bridge BC 2410 (Lafayette Avenue over Amtrak)	B-4553
13	Atlas Safe Deposit and Storage Company Warehouse Complex	B-5188-2

#	Historic Property	MIHP Identification Number
14	American Ice Company	B-1040
15	Greater Rosemont Historic District	B-5112
16	Edmondson Avenue Historic District	B-5187
17	Ward Baking Company	B-5112-2
18	Fire Department Engine House No. 36	B-5112-4
19	Pennsylvania Railroad Viaduct	B-5064

1) Baltimore and Ohio Railroad Baltimore Belt Line (MIHP #B-5287)

This 7.2-mile, double-tracked freight line was constructed between 1891 and 1895 to connect the Baltimore and Ohio's (B&O's) main line terminus at Camden Station in downtown Baltimore to Bay View Junction. This property is eligible for the NRHP under Criterion A for its association with the transportation industry. Specifically, it is nationally significant as the first electric railway in the United States and for its role in providing the B&O Railroad with an all-rail route from Washington, DC to Philadelphia, thereby allowing it to more effectively compete with the Pennsylvania Railroad. It is also eligible under Criterion C because it embodies distinctive characteristics of a late nineteenth- to early twentieth-century railroad, including resources that are individually notable for their architecture and/or engineering, and for its association with noted architect E. Francis Baldwin. The estimated period of significance is from 1891 to circa 1950.

Figure V-10: Baltimore and Ohio Railroad Baltimore Belt Line Bridge over Jones Falls Valley

2) Baltimore and Ohio Railroad Baltimore Belt Line Bridge over Jones Falls Valley (MIHP #B-5288)

The B&O Railroad Baltimore Belt Line Bridge over Jones Falls Valley is a six-span, through-plate and deck-plate girder bridge constructed between 1896 and 1899 to carry the B&O Railroad Baltimore Belt Line over the Jones Falls Valley (**Figure V-10**). It is located immediately north of the North Avenue bridge over the Jones Falls Valley. The bridge is eligible for the NRHP under Criterion A for its association with the transportation industry. It is eligible under Criterion C because it embodies distinctive characteristics of a late nineteenth-century, steel-plate girder railroad bridge.

3) Baltimore and Potomac Railroad (Philadelphia, Baltimore and Washington Railroad) (MIHP #B-5164)

The B&P Railroad, completed in 1873, extends from the Baltimore City/County Line to Baltimore Penn Station. It includes the three-part brick and stone B&P Tunnel, bridges, a circa 1910 brick railroad station on Edmondson Avenue, a brick tower at Gwynn Junction, and circa 1935 overhead catenary lines. The bridges over the alignment include the NRHP-eligible Vincent Street Bridge and Fulton Avenue over Amtrak Bridge, both built in 1873 along with the B&P Railroad and tunnel segments. The railroad is eligible for the NRHP under Criterion A as a critical component of the B&P Railroad alignment that established a reliable connection between Baltimore and Washington, DC, and ultimately to Philadelphia and New York, for the Pennsylvania Railroad. It is also eligible under Criterion C for being distinctive enough to be considered a true representative of railroad construction. In particular, the three-part 1873 tunnel is a significant product of engineering; it is 7,499-foot long, extending from west Baltimore to Pennsylvania Station. The period of significance is from 1872 to 1976.

4) Union Railroad (MIHP #B-5163)

Completed in 1873, the Union Railroad's current boundary extends from the B&P Railroad Tunnel portal at the North Avenue bridge to Boston Street in the Canton section of Baltimore City. This includes a short segment of the former Northern Central Railroad between North Avenue and Guilford Avenue. Contributing elements include Pennsylvania Station (B-3727), Union Tunnel, tracks, the roadbed, buildings, retaining walls, interlocking towers, signs, the catenary system, and the 1930s signal system. The railroad is eligible for the NRHP under Criterion A in the areas of transportation, industry, commerce, and community planning and development for its contribution to the development of industry and commerce in Baltimore. The railroad is also a catalyst for increased settlement, and has a role in connecting the B&P Railroad with the Philadelphia, Wilmington & Baltimore Railroad, providing a continuous all-rail line between Philadelphia and Washington DC. The railroad is also eligible under Criterion C for its engineering merit and as a significant and distinguishable entity. The estimated period of significance is from 1873 to 1960.

5) Howard Street Bridge (BC1405) (MIHP #B-4529)

The Howard Street Bridge was completed in 1938 and carries Howard Street over I-83, Amtrak, and Jones Falls. The bridge is a double-steel arch, seven-span structure that is 979 feet long. Built in 1938 and rehabilitated in 1981, it carries Howard Street over I-83, Amtrak, and Jones Falls. It is assumed this bridge may have significance under Criterion A, but this needs to be further studied. The bridge is eligible under Criterion C because it is a significant example of a metal arch bridge. There are only two metal arch bridges in Baltimore, namely this bridge and the Guilford Avenue Bridge. The latter has been significantly altered, eliminating one of its original arches, while the Howard Street Bridge retains its original two arches. Few metal arch bridges remain in Maryland. The bridge also appears to be a significant example of the work of the J. E. Greiner Company.

6) North Avenue Bridge (BC1208) (MIHP #B-4521)

The North Avenue Bridge is a seven-span stone/brick arch structure that is 888 feet in length. Built between 1891 and 1896, it carries North Avenue over Amtrak, CSX Railroad, Light Rail, and Falls Road. The deck was altered in 1976-1977. The bridge is eligible under Criterion A because construction of this bridge facilitated use of a number of railroad lines, which were instrumental in connecting Baltimore with Washington, Philadelphia, and New York. Additionally, the bridge promoted growth along the North Avenue corridor and encouraged transportation within the City of Baltimore as a whole. Criterion C for being a uniquely significant example of a multiple-span stone arch bridge. It is an unusual engineering solution to spanning a wide valley and transportation corridors.

7) Reservoir Hill Historic District (MIHP #B-1379)

The Reservoir Hill Historic District contains 32 blocks of mostly late nineteenth- to early twentieth-century rowhouses (**Figure V-11**). It is bounded by North Avenue, Mount Royal Avenue, Druid Park Lake Drive, and Madison Avenue. Mansions, apartment buildings, religious buildings, and commercial buildings are also located in the district. Reservoir Hill is listed on the NRHP under Criterion A for its association with the development of the City's Jewish community in the early twentieth century. It is also listed under Criterion C for being an architecturally significant example of a type of urban development which characterized Baltimore throughout the nineteenth and early twentieth century. Its period of significance is from 1790 to 1941.

Figure V-11: Reservoir Hill Historic District

8) Carver Vocational-Technical High School (MIHP #B-5294)

This African-American vocational and technical school campus was constructed between 1953 and 1955 and is located on a 13-acre site. Consisting of a main school building and athletic field, the property is eligible for the NRHP under Criterion A because it is significant in the areas of education, ethnic heritage (Black), and social history for being the culmination of the work of Baltimore local civil rights organizations and others to bring equal vocational education to African-American students in racially segregated Baltimore City. The property is also eligible under Criterion C for embodying the distinctive form, method of construction, and appearance of a mid-twentieth century vocational school building in the International Style with elements of Stripped Classicism.

9) Western Maryland Railroad, Owings Mills Division (MIHP #B-5293)

This is a former passenger and freight line constructed in 1873 to provide an independent line for the Western Maryland Railroad main line into the heart of Baltimore City. The evaluated alignment includes five steel and concrete under-grade bridges, five at-grade road crossings, one building, one structure, and associated cuts and fills. It is currently operated by CSX Railroad. The linear resource is eligible for the NRHP under Criterion A in the area of transportation as the final link in the railroad's larger push to build an independent line into the City of Baltimore, allowing it to compete effectively with rival railroads, contribute to the wider economic growth and development of the city, and achieve the original intent of the largely city-sponsored civic engineering project. The railroad is also eligible under Criterion C in the area of engineering for its intact fills, cuts, and collection of twentieth century under-grade railroad bridges, and as a significant and distinguishable entity whose components lack individual distinction. The period of significance is from 1873 to 1960.

10) Bolton Hill Historic District (MIHP #B-64)

The Bolton Hill Historic District extends southwest of Mt. Royal Avenue, south of North Avenue, northeast of Madison Avenue, north of Dolphin Street, and west of Cathedral Street. The district consists of twenty blocks of residential buildings, primarily dating to the second half of the nineteenth century, but also into the early part of the twentieth century. The district is listed under Criterion A for developing as part of the ever continuing northward movement of Baltimore's residential neighborhoods, gaining full momentum during the second half of the nineteenth century, made easier by the proximity of railroad and street car lines. The district is listed for Criterion C as a residential neighborhood giving modern Baltimore an image of its nineteenth century heritage. The district is characterized by continuous blocks of row houses, similar and dignified; tree shaded streets; and handsome squares featuring sculptural monuments. The estimated period of significance is from 1850 to pre-World War I.

11) Midtown-Edmondson Historic District

The Midtown-Edmondson Historic District is roughly bounded by Kirby Lane on the east, West Franklin Street on the south, an irregular line west of the Amtrak NEC and Winchester Street to the north. The district is characterized as a mixed-use area of rowhouses, warehouses, and commercial buildings primarily constructed between the 1880s and 1910s (**Figure V-12**). The district is eligible for the NRHP under Criterion A for its association with the growth of West Baltimore and for its association with the post-World War II racial transition of West Baltimore from European American to predominantly African American by the 1950s. It is also eligible under Criterion C for being an example of a late nineteenth-century and early twentieth-century suburb with a diverse range of rowhouse designs. The period of significance is from 1888 to 1965.

Figure V-12: Midtown-Edmondson Historic District

12) Bridge BC 2410 (Lafayette Avenue over Amtrak) (MIHP #B-4553)

Bridge 2410 (Lafayette Avenue over Amtrak) is a fourteen-span plate-girder bridge with a rolled I-beam deck structure built in 1931. It is 640 feet-long and carries Lafayette Avenue over Amtrak's NEC. This bridge is eligible for the NRHP under Criterion C for being a significant variation of a common bridge construction type. Steel girder bridges were built prolifically across Maryland from the late nineteenth century to the present day. There is often little variation in many of these bridges, and this bridge shows a unique juxtaposition of old and new elements. These differences set this structure apart from other bridges of this type.

13) Atlas Safe Deposit and Storage Company Warehouse Complex (MIHP #B-5188-2)

The Atlas Safe Deposit and Storage Company Warehouse Complex is a three-building complex located at 2126 Edmondson Avenue and adjoining the Amtrak NEC (**Figure V-13**). The buildings were constructed in 1925, 1946, and 1948, respectively. The property is eligible for NRHP listing under Criterion A in the area of industry as a well-preserved example of a storage warehouse associated with the railroad. It is also eligible under Criterion C in the area of architecture as an excellent example of an early-twentieth century warehouse complex built in direct association with and response to the railroad using specialized industrial building techniques of fireproof reinforced concrete columns and beamless slab floor construction.

Figure V-13: Atlas Safe Deposit and Storage Company Warehouse Complex

14) American Ice Company (MIHP #B-1040)

The American Ice Company building is located at 2100 West Franklin Street and adjacent to Amtrak's NEC. It is a two-story brick building built in 1911, with a boiler room and engine room on the west side of the building, and a long, narrow extension attached to the powerhouse at the east end that was the tank house (**Figure V-14**). Additions from the 1950s and 1970s were destroyed by a 2004 fire. The building alone is listed on the NRHP under Criterion A for its role in the history of the ice industry in Baltimore. The plant successfully served the growing community of residents and businesses in Baltimore, and used the adjoining railroad line to transport ice to cities that included New York and Washington, DC. It is also listed under Criterion C as an intact example of a purpose-built ice-manufacturing plant. The rhythmic façade, arched window openings, and use of decorative brickwork are all characteristic of industrial architecture from the early twentieth century.

Figure V-14: American Ice Company

15) Greater Rosemont Historic District (MIHP #B-5112)

The Greater Rosemont Historic District is a primarily residential area roughly bounded by West Franklin Street, Edmondson Avenue, and the Western Maryland and Pennsylvania Railroad tracks. The district dates to the late nineteenth- and early twentieth-centuries, and includes numerous commercial and industrial buildings, churches, and government buildings. Architectural styles include Colonial Revival, Spanish Revival, Craftsman, and Art Deco. The district is eligible under Criterion A for being one of a few city neighborhoods that illustrates the rapid speculative development of streetcar suburbs and the evolution of Baltimore row housing from the late Victorian period until the 1950s. It is also eligible under Criterion C for having virtually every type of attached dwelling popular during the late Victorian period to the 1950s, and for its overall level of distinctiveness and good architectural integrity. The estimated period of significance is from the late nineteenth century to the 1950s.

16) Edmondson Avenue Historic District (MIHP #B-5187)

Figure V-15: Edmondson Avenue Historic District

The Edmondson Avenue Historic District contains over 1,600 buildings, most of which are late nineteenth to mid-twentieth century residences with some commercial and light industrial buildings (**Figure V-15**). It is roughly bounded by West Franklin Street to the south, Bentalou Street on the west, Braddish Avenue on the east, and Winchester Street to the north. The district is listed under Criterion A for its association with the growth of West Baltimore, the post-World War II racial transition of West Baltimore, and the role of the new African-American residents in establishing enduring community institutions. It is also listed under Criterion C for being architecturally significant as an example of an early twentieth-century streetcar suburb with a diverse range of rowhouse designs. The period of significance is from 1885 to 1960.

17) Ward Baking Company (MIHP #B-5112-2)

Figure V-16: Ward Baking Company

The Ward Baking Company property, located at 2140 Edmondson Avenue, has a historical industrial baking factory and delivery truck repair shop built between 1925 and 1927 for the country's largest and oldest baking company (**Figure V-16**). The facility utilized standard construction techniques and exterior ornamentation. The property is eligible for the NRHP under Criterion A in the area of industry as an important baking factory associated with Baltimore's industrial development.

18) Fire Department Engine House No. 36 (MIHP #B-5112-4)

Fire Department Engine House No. 36 consists of a 1910 two-story brick and stone Tudor Revival fire house located at 2249 Edmondson Avenue (**Figure V-17**). The property is eligible for listing on the NRHP under Criterion A in the areas of social history and black heritage for its associations with the expansion and professionalization of Baltimore's fire protection services during the early twentieth century, and for its role in the racial integration of the Baltimore City Fire Department in 1953. It is also eligible under Criterion C in the area of architecture as a well-preserved example of the rare and early use of the Tudor Revival style in twentieth century Baltimore fire houses, and for embodying the distinctive characteristics of the Tudor Revival style.

Figure V-17: Fire Department Engine House No. 36

19) Pennsylvania Railroad Viaduct (MIHP #B-5064)

The Pennsylvania Railroad Viaduct is part of the Amtrak NEC over Gwynns Falls, bounded on the northeast by West Baltimore Street and the southwest by the CSX Railroad right-of-way. This is a 1914 four-span, reinforced concrete ribbed and open-spandrel arch structure with concrete stringers and floor beams supporting a solid reinforced concrete slab deck, concrete newels, and a three-pipe pedestrian railing. The structure is eligible under Criterion A in the areas of transportation and community planning and development as a well-preserved expression of early twentieth century urban planning efforts and as a response to improved locomotive size and technology. The viaduct is eligible for Criterion C in the areas of engineering and landscape architecture as an excellent example of reinforced open spandrel arch bridge design created in response to urban park planning efforts by the landscape architecture firm of Olmstead Brothers.

3. Archaeology

The *Phase IA Archeological Study* of the Study Area consisted of background research on the prehistory and history of the area, including historical maps and aerial imagery, and previously identified archaeological sites within a one-mile radius of the Study Area. The results of the background research were then integrated with archaeological predictive models to define areas of high, low, and no potential to contain archaeological deposits throughout the Study Area.

Documentary research conducted at MHT revealed that no previous archaeological studies have been performed within the Study Areas of any of the build alternatives for the B&P Tunnel Project. However, according to the most recent MHT GIS database, over the last 33 years, 22 archaeological studies have been conducted within a one-mile radius of the Study Area. According to the archaeological site files maintained by MHT, no previously recorded archaeological sites are located in the Study Area; however, 38 sites are present within a one-mile radius of the Study Area. Site 18BC177 (known as "AOS #1") is the only archaeological site within a one-mile radius of the Study Area that contains a prehistoric component.

The remaining 37 previously documented archaeological sites within a one-mile radius of the Study Area were historic and exhibit occupation from the eighteenth through early twentieth centuries. These sites include eighteenth- to nineteenth-century pottery kilns, late eighteenth- to early nineteenth-century rowhouses, nineteenth- to early twentieth-century rowhouses, mills and mill worker housing, an African-American church, portions of a nineteenth-century African-American neighborhood, a jail, a sugar refinery, and a Civil War Union Army camp and hospital.

The results of the *Phase IA Archeological Study* suggest that, from a regional perspective, the Study Area falls within a portion of Maryland that has considerable potential for containing prehistoric archaeological sites. Although the general region is considered to have a high probability for containing archaeological resources, establishing the overall archaeological sensitivity of the Study Area is complicated by the fact that while pre-contact populations may have once occupied the general region, the extent of modern urbanization must be taken into consideration when assessing the likelihood of discovering such archaeological remains in urban settings. The results of the *Phase IA Archeological Study* clearly reveal that, while the locations of the build alternatives have the potential to contain archaeological resources, landscapes within the Study Area have been subjected to considerable repeated alteration since the late eighteenth century. These alterations have included urban expansion north of the city center in the early nineteenth century, transportation improvements, and modern urbanization and suburbanization. During documentary reviews and field inspections, it became clear that remains of the region's pre-contact natural landscapes are limited within the Study Area. Given the severity and extent of past disturbance, most of the land within the Study Area is considered to have a low probability for containing any intact prehistoric archaeological resources.

While the subsurface integrity of most sites in the Study Area is probably poor, an occasional intact archaeological site could be encountered. It is anticipated that the Study Area would have a higher potential for containing post-contact sites than pre-contact sites. Suppositions are based on previous discoveries of intact archaeological sites in and around the Study Area, as well as the land use history of this portion of Baltimore City.

Due to the preliminary design stage of the B&P Tunnel Project, the potential size and configuration of the archaeological APE, as well as the uncertainty of Project variables pertaining to anticipated ground disturbance (e.g., cut-and-cover locations, cut locations, and ventilation shaft locations), detailed archaeological identification and effects studies will be undertaken at a later date as described in the Section 106 Programmatic Agreement (PA).

4. Section 106 Consultation

Section 106 requires consultation with MHT, which serves as the Maryland State Historic Preservation Officer (SHPO); federally recognized Native American tribes with an interest in the area; local governments; and other consulting and interested parties (36 CFR Part 800.2(c)). The themes of consultation to date have been to discuss the following:

- Methodology in developing the APE;
- Identification of historic properties listed or determined eligible for listing in the NRHP;
- Assessment of effects; and
- Avoidance, minimization, or mitigation efforts that may be needed to resolve any adverse effects on historic properties.

FRA initiated Section 106 review with the SHPO and other agencies by letter on June 11, 2014. In 2015, after consulting with MHT, FRA invited identified potential consulting parties to participate in the Section 106 process (36 CFR Part 800.2(c) and 36 CFR Part 800.3(f)). The following parties, including two federally-recognized tribes, agreed to consult:

- Delaware Tribe of Indians
- Shawnee Tribe
- Baltimore City Commission for Historical and Architectural Preservation
- Baltimore City Department of Transportation
- Baltimore City Planning Department
- Baltimore Heritage
- Baltimore Heritage Area Association, Inc.

- Historic Mount Royal Terrace Association
- Maryland Commission on Indian Affairs
- Maryland Department of Transportation
- Maryland Transit Administration
- Midtown-Edmondson Improvement Association
- Mount Royal Improvement Association
- Preservation Maryland

To date, the consulting-parties have met six times. The first consulting parties meeting was held on July 16, 2015, and provided an overview of the Project, the build alternatives under consideration, identified historic properties, and preliminary potential effects. A second consulting parties meeting, held on August 5, 2015, provided updated alternatives and historic properties information, and continued discussions from the first meeting. A third consulting parties meeting was held on September 28, 2015. This meeting included a tour of the Study Area, alternatives updates, recent additional NRHP evaluations, and a discussion of potential effects to historic properties. The fourth consulting parties meeting was held on October 29, 2015, and included a discussion of Project updates, the assessment of effects to historic properties, possible solutions for resolving adverse effects, and opinions on a Preferred Alternative. Project updates, including refinements to the build alternatives, and potential mitigation ideas were discussed at a fifth meeting on March 23, 2016. The views of consulting parties on the appropriate agreement document (Memorandum of Agreement or PA) were also considered at this meeting. At the sixth meeting on May 20, 2016, FRA provided Project and Section 106 updates, and continued discussing the PA. Consultation is continuing with the consulting parties to develop and implement the Section 106 PA. Correspondence between FRA, Amtrak, MDOT, SHPO, and other consulting parties can be found in **Appendix B.**

D. Section 4(f) Properties

Section 4(f) of the US Department of Transportation Act of 1966 (49 USC 303(c)) is a federal law that protects publicly-owned parks, recreation areas, wildlife and/or waterfowl refuges, or any significant historic sites, whether privately or publicly owned. Section 4(f) requirements apply to all transportation projects that require funding or other approvals by the USDOT. As a USDOT agency, FRA must comply with Section 4(f).

The Section 4(f) evaluation in this document follows established FRA Environmental Procedures and uses 23 CFR Part 774 and the 2012 Section 4(f) Policy Paper prepared by the FHWA as guidance.

Seventeen historic properties eligible for Section 4(f) protection have been identified in the Section 106 APE, as described above. Two park properties eligible for Section 4(f) protection have been identified adjacent to the proposed south portals of the build alternatives, described below. Additional information on historic properties is located in the *Architectural Historic Properties Survey* technical report, and the 13 additional MHT DOE Forms subsequently completed. FRA also prepared a technical memorandum containing updates to the identified list of historic properties. Concurrence from the SHPO regarding the eligibility of the historic properties is located in **Appendix B**. For more information on Section 4(f) properties, including maps of the historic properties, see **Section V.C**, **Section VI.C,** and **Section VI.D**.

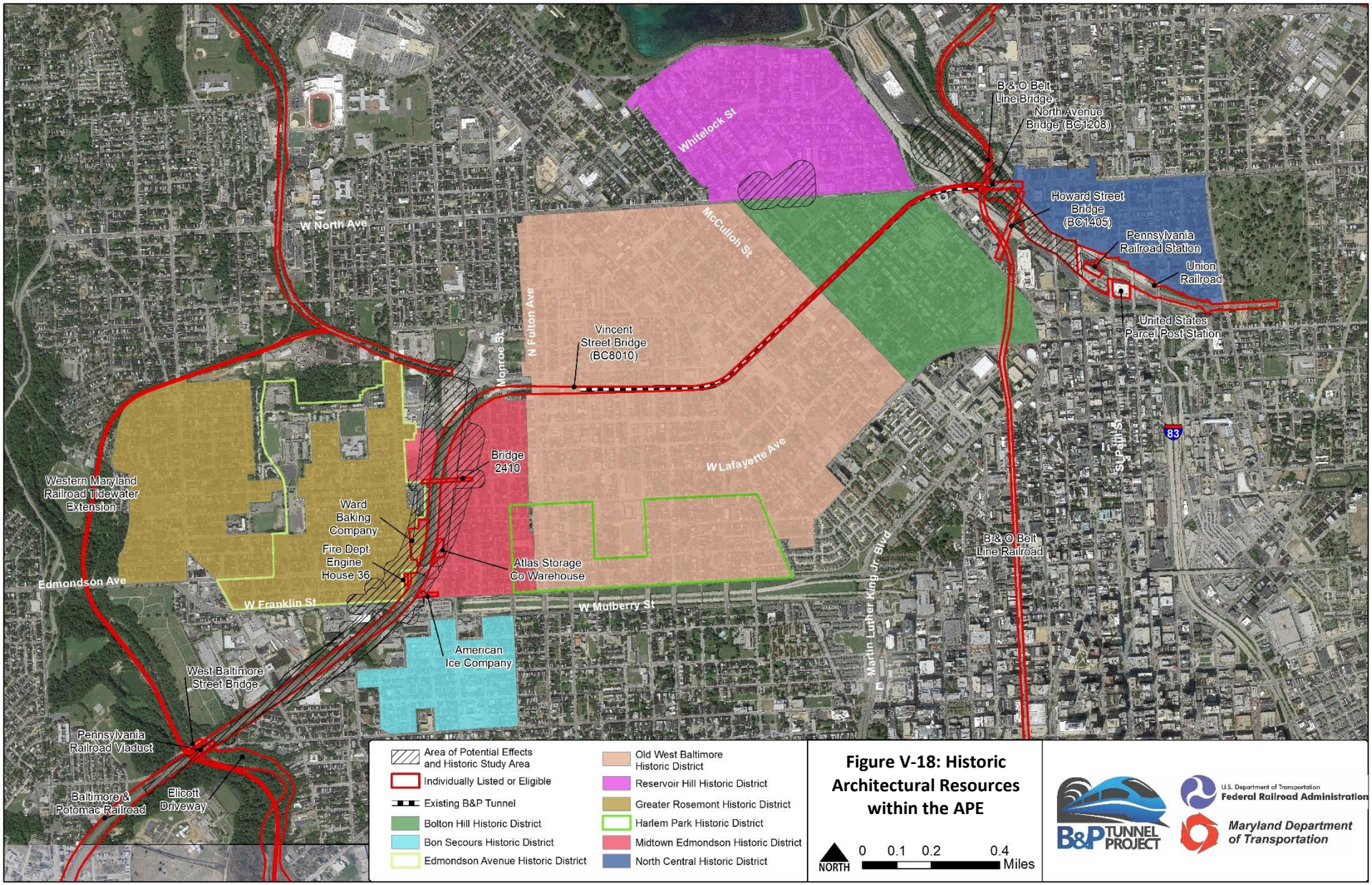


Figure V-18: Historic Architectural Resources within the APE

1. Public Parks and Recreation Areas

Winterling Elementary School Recreational Facilities (Bentalou Recreation Center)

The recreational facilities at Winterling Elementary, also known as the Bentalou Recreation Center, is a significant public park in the Project Area for providing recreational opportunity to students of Winterling Elementary School and other members of the surrounding community. The school property is located at 220 North Bentalou Street. Recreational facilities include basketball courts, playground, an indoor gym, and game rooms. The facility is owned by the City of Baltimore and administered by the Baltimore City Department of Recreation and Parks and Baltimore City Public Schools.

According to the 2012 FHWA Section 4(f) Policy Paper, which is used by FRA as guidance, "When a public school playground is open to the public and serves either organized or substantial walk-on recreational purposes that are determined to be significant, it will be subject to the requirements of Section 4(f)" (Question 14). The FHWA guidance also clarifies, "The term playground refers to the area of the school property developed and/or used for public park or recreation purposes such as baseball diamonds, soccer fields, tennis courts, track and field facilities, and other features such as jungle gyms or swing sets. This can also include open space or practice fields if those areas serve a park or recreation function" (Question 14). Based on this guidance, the Winterling Elementary School Recreational Facilities are considered a Section 4(f) resource.

Lafayette and Payson Park

Lafayette and Payson Park, located at the corner of Lafayette Avenue and North Payson Street, is an approximately 0.25-acre park owned by the City of Baltimore and administered by the Department of Recreation and Parks. The park includes a basketball court and playground facilities.

2. Historic Properties

The historic properties qualifying for Section 4(f) protection are described in **Section V.C.2,** above.

E. Natural Resources

Natural resources in the Study Area were preliminarily identified based on a review of existing scientific literature, watershed reports, GIS databases, and mapping. The *Natural Resources Technical Report* contains detailed information.

An investigation of available mapped information identified topography, geology, hydrology, vegetative cover, extents of the 100-year floodplain, and soils information from the following agency resources:

- United States Department of Agriculture, Natural Resource Conservation Service (USDA-NRCS) Web Soil Survey (WSS) for Baltimore, Maryland
- United States Geologic Survey (USGS) GIS Quadrangle Mapping
- Maryland Geological Survey
- Federal Emergency Management Agency (FEMA) GIS data
- National Wetlands Inventory (NWI) GIS data
- Maryland Department of Natural Resources (DNR) wetlands and waters GIS data
- Baltimore City GIS data

The Study Area, which included the areas of potential above-ground construction for each of the B&P Tunnel build alternatives, including the existing B&P Tunnel, was assessed in May 2015. These areas include portal and ventilation facility locations for Alternatives 3A, 3B, and 3C. The assessed areas were determined based on limits of disturbance developed in preliminary engineering. All natural resources found within these potential construction areas were inventoried. These resources are shown in detail in the *Natural Resources Technical Report* and **Figure V-19**.

The Study Area will experience more frequent heat waves and heavy precipitation events as a result of climate change (U.S. Global Change Research Program, n.d.). In Maryland, most of the state has warmed one to two degrees Fahrenheit over the last century, and rising temperatures and shifting rainfall patterns are likely to increase the intensity of both floods and droughts (U.S. Environmental Protection Agency, 2016). Sea level rise will impact the state and, specifically, Baltimore City. According to the Maryland Commission on Climate Change, sea level at Baltimore rose by one foot during the 20th century, and will continue to rise, independent of local subsidence (Maryland Commission on Climate Change, 2008). As a result of sea level rise, without adaptation measures, land will become inundated, and coastal areas will be at greater risk of storm surge and flooding during storm events. As a result of climate change, the Project may be impacted by flooding; however, this flooding is not expected to have bearing on the Project. For more information regarding flooding and flood hazards, please see **Section E.3** of this chapter.

1. Soils

The WSS for Baltimore City was used to identify 16 soil units within the Study Area, shown on **Figure V-19** and described in **Table V-18**. Two of the soil types, Keyport-Urban land complex and Urban land-Udorthents complex, are predominantly non-hydric, with hydric ratings of five and three percent, respectively. A hydric soil is formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the soil layers closest to the surface.

Table V-18: Soil Units within the Study Area

Map Unit Symbol	Map Unit Name	Hydric Rating (%)
13UB	Joppa-Urban land complex, 0 to 8 percent slopes	0
14UB	Urban land-Joppa complex, 0 to 8 percent slopes	0
15UB	Keyport-Urban land complex, 0 to 8 percent slopes	5
16UB	Urban land-keyport complex, 0 to 8 percent slopes	0
17C	Legore loam, 8 to 15 percent slopes	0
17E	Legore loam, 15 to 45 percent slopes	0
18UC	Legore-Urban land complex, 8 to 15 percent slopes	0
19UC	Urban land-Legore complex, 8 to 15 percent slopes	0
22UB	Manor-Urban land complex, 0 to 8 percent slopes	0
24UB	Matapeake-Urban land complex, 0 to 8 percent slopes	0
29UB	Sassafras-Urban land complex, 0 to 8 percent slopes	0
31UB	Urban land-Sassafras complex, 0 to 8 percent slopes	0
40C	Udorthents, loamy, very deep, 8 to 15 percent slopes	0
42E	Udorthents, smoothed, 0 to 35 percent slopes	0
43U	Urban land-Udorthents complex, occasionally flooded	3
44UC	Urban land, 0 to 15 percent slopes	0

Hydric rating indicates the percentage of the soil unit that is hydric:

- Hydric: 100 percent
- Predominantly hydric: less than 100 percent to 66 percent
- Partially hydric: less than 66 percent to 33 percent
- Predominantly non-hydric: less than 33 percent to greater than zero percent
- Non-hydric: zero percent

The majority of the soils within the Study Area are non-hydric. No hydric soils were found in the Study Area. Further soil analysis can be found in the *Natural Resources Technical Report*.

2. Topography, Geology, Aquifers, and Groundwater

The information that follows is preliminary and based on available mapping, some of which was published in 1935. Borings, and possibly geophysical exploration studies, will be necessary to develop more accurate evaluations. Borings that have not yet been completed will be undertaken during final design.

a. Topography

The Study Area is located in the Perry Hall Upland District of the Fall Zone Region within the Piedmont Plateau Physiographic Province of Maryland, which is within the Baltimore East and Baltimore West USGS quadrangles (7.5-minute series, 2014). The elevation is between 100 and 200 feet above mean sea level. The area is a geologic transition zone, where the sediments of the Coastal Plain Physiographic Province overlay the residual soils and basement rocks of the Piedmont Physiographic Province. The Coastal Plain deposits are found mostly in the higher elevations, whereas the soils and rock of the Piedmont are found mostly in the lower elevations of the Jones Falls Valley and the western portion of the Study Area where the sediments have been eroded, typically west of Fulton Avenue.

b. Geology

The geology of the Piedmont Plateau Province is characterized by meta-igneous and meta-sedimentary rock with igneous intrusions of pegmatite--a very hard rock with thin injection seams of quartzite--and smaller amounts of sedimentary rock interspersed (Maryland Geological Survey). Natural soils are residual soils, which have formed in place through weathering of the parent bedrock. Residual soils typically form a profile characterized by the progression from soil to decomposed rock, or saprolite to rock with increasing depths below the ground surface. In the eastern portion of the Study Area, east of Mount Royal Avenue and Callow Avenue, parent materials are mapped as the Carroll Gneiss Member of the James Run Formation. The western portion of the Study Area, primarily west of Fulton Avenue, is also mapped as Carroll Gneiss Member to the south of Laurens Street and Jones Falls Schist to the north. The Jones Falls Schist in this area is included in the Pegmatite Injection Complex where less than 50 percent of the bedrock consists of pegmatite.

Most rock within the Study Area has very low permeability, with little pore space to transmit water; groundwater is conveyed through joints, fractures, and other discontinuities (Trapp, H. and M.A. Horn, 1997). Piedmont rock is between 1.2 billion to 196 million years old, formed from the Precambrian through the Jurassic periods (Trapp, H. and M.A. Horn, 1997). The main types of crystalline rock found in this region are coarse-grained gneisses and schists that have undergone several periods of metamorphism (Trapp, H. and M.A. Horn, 1997). Much of the consolidated rock is overlain with unconsolidated material known as regolith, which is formed by the weathering of rock and consists of saprolite, colluvium, alluvium, fill, and natural soil (Trapp, H. and M.A. Horn, 1997).

c. Aquifers

The Study Area overlies the Piedmont Crystalline Rock Aquifer, an underground layer of water-bearing rock. Groundwater recharge is highly variable in this region, which is almost entirely dependent on precipitation and local runoff absorbed through the regolith into rock fractures (Trapp, H. and M.A. Horn, 1997).

A sole source aquifer (SSA) is the primary source of drinking water for an area; it supplies a minimum of 50 percent of the drinking water overlying the aquifer (EPA, 2015). These areas may have no alternative drinking water sources that could "physically, legally, and economically supply" those dependent on the aquifer for drinking water (EPA, 2015). No SSA, water supply reservoirs, or wells are located near the existing B&P Tunnel. Surface water from rainfall and snowmelt is the source of the Baltimore City drinking water supply. Liberty Reservoir, Loch Raven Reservoir, Prettyboy Reservoir, and the Susquehanna River contribute to Baltimore's water supply. None of these drinking water sources would be affected by the B&P Tunnel Project.

The closest USGS groundwater well is in East Baltimore, within the Patuxent Formation Aquifer of the Lower Cretaceous age in the Coastal Plain Province. The groundwater characteristics of the well will have little bearing on the Study Area, since this aquifer is in a different physiologic province.

d. Groundwater

Groundwater typically flows along the contacts of the clay and sand facies of the Patuxent Formation, at the junction of the Coastal Plain, and Piedmont Provinces. It continues through the decomposed rock in fractures and other discontinuities.

3. Water Resources

a. Streams and Navigable Waterways

The desktop investigation identified three waterways within the B&P Tunnel Study Area: Jones Falls, Gwynns Falls, and a tributary to the Gwynns Falls (see **Figure V-19**).

The Jones Falls is a perennial, traditionally navigable waterway that flows through the northeastern portion of the Study Area. The waterway is considered a Navigable Water under Section 10 of the US Rivers and Harbors Act. The Jones Falls mainstem, below Lake Roland, is a Maryland Department of Environment (MDE)-Designated Use I Waterway for Water Contact Recreation and Protection of Warm Water Nontidal Aquatic Life. Tributaries that drain to the Jones Falls include Moores Branch, Roland Run, Towson Run, Western Run, and Stony Run. There are no high-quality, Tier II, stream segments located within the Jones Falls Watershed. The Jones Falls channel and its banks also have been highly altered; its deeply incised nature and overlay of crystalline bedrock is typical of rivers of the region (Reger, J.P. and E.T. Cleaves, 2008).

The Gwynns Falls is another perennial, traditionally-navigable water located in the southwest portion of the Study Area. This part of the Gwynns Falls is an MDE-Designated Use I Waterway. The stream flows for 25 miles through Baltimore County and Baltimore City before emptying into the tidal Patapsco River.

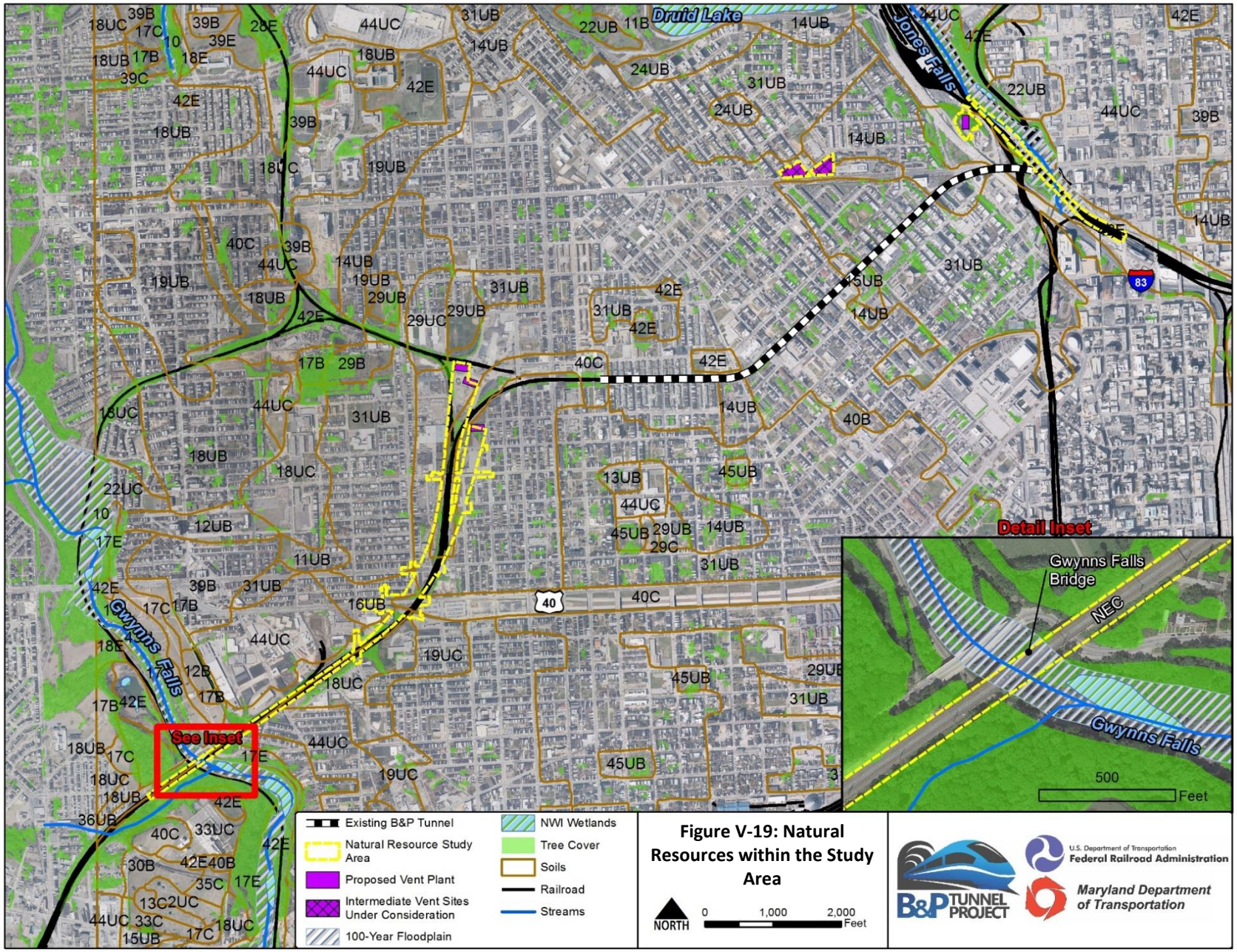


Figure V-19: Natural Resources within the Study Area

b. Wetlands

Wetlands investigations were conducted in accordance with the US Army Corps of Engineers, *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region Version 2.0* (Ed. Berkowitz, 2012).

Routine wetland determination methods, with onsite inspection, were used to determine the presence of wetlands in the Study Area. Waters of the US, other than wetlands, were delineated using the limits defined in 33 CFR Part 328—Definition of Waters of the United States. The boundaries of nontidal waters of the US other than wetlands were set at the ordinary high water mark (OHW). The OHW is determined in the field using physical characteristics established by the fluctuations of water (e.g., change in plant community, changes in the soil character, and shelving) in accordance with US Army Corps of Engineers Regulatory Guidance Letter No. 05-05.

The Study Area was assessed for wetland areas in May 2015. No wetlands were identified within the Study Area. Two NWI wetlands were identified nearby; one within the 100-year floodplain of the Jones Falls (classified as riverine) and one within the 100-year floodplain of the Gwynns Falls (classified as freshwater pond) (see **Figure V-19**). These wetlands would not be impacted directly or indirectly by any of the potential B&P Tunnel alignments.

c. Water Quality

i. *Jones Falls Water Quality*

Waters of the Jones Falls watershed are considered impaired waters under the Clean Water Act (CWA), and were first identified on Maryland's 303(d) List of Impaired Waters in 1996. The stream was listed as impaired by nutrients, sediment, copper, lead, zinc (1996), fecal bacteria (2002), and impacts to biological communities (2002, 2004, and 2006).

A Water Quality Analysis (WQA) for zinc contamination in the Jones Falls was submitted by the Maryland Department of the Environment (MDE) to the Environmental Protection Agency (EPA) in 2002. According to this analysis, the aquatic life criteria and designated uses associated with zinc are being met in the Jones Falls and the waterway does not require a Total Maximum Daily Load (TMDL) to achieve water quality standards (MDE, 2002). A WQA of copper and lead for the Jones Falls was submitted to the EPA in 2004; a TMDL is not required for the entire 8-digit basin of the Jones Falls, but is required for its lower-most 12-digit basin (basin code 02-13-09-04-10-32), which was found to be impaired by copper in the WQA. The copper and lead WQA concluded further monitoring within the 12-digit basin is required to identify the source of impairment and determine whether a TMDL will be required (EPA, 2004).

In 2009, a WQA of eutrophication for the Jones Falls Watershed in Baltimore City and Baltimore County, Maryland was submitted to the EPA. The study indicated the Jones Falls Watershed is not impaired by nutrients based on a biological stressor identification (BSID) analysis and recent water quality data analysis conducted by MDE. The WQA indicates no TMDL is required for eutrophication in the Jones Falls Watershed (MDE, 2009).

A proposed TMDL of fecal bacteria for the nontidal Jones Falls Basin in Baltimore City and Baltimore County, Maryland was submitted to EPA in 2006; the TMDL was established at 860 billion most probable number (MPN) of *E. coli* per day. The sources of fecal bacteria were estimated at five representative stations within the Jones Falls Watershed, based on one year of bacterial sampling. Multiple antibiotic-resistance analysis was used to determine the bacterial source and human waste was determined to be the source of the majority of the bacteria in the Jones Falls (MDE, 2006).

A proposed TMDL of sediment in the Jones Falls Watershed in Baltimore City and Baltimore County, Maryland, was submitted to EPA in 2011. A TMDL of combined nonpoint source, stormwater, and processed wastewater allocations was established to ensure sediment loads and their effects would support the Use I, II, and IV designations and protect against sediment-related impacts to aquatic health.

The Jones Falls average annual TMDL of sediment/total suspended solids (TSS) was established at 7,109.3 tons per year. The average annual TMDL is a total load allocation for nonpoint sources, regulated stormwater, and process water waste combined. The load allocation for nonpoint sources is 1,022.0 tons per year; National Pollutant Discharge Elimination System (NPDES) regulated stormwater load allocation is 6,084.9 tons per year; Process Water Waste Load Allocation is 2.4 tons per year. Load allocations were set based on a BSID methodology, which concluded biological communities in the Jones Falls Watershed are impaired due to flow and sediment-related stressors. Stressors affecting the biological community of the Jones Falls were identified as channelization, channel alteration, poor epifaunal substrate, poor bank stability, and high embeddedness. The sediment TMDL will not completely resolve the biological impairment of the Jones Falls Watershed since other potential stressors to biological communities were identified during the BSID analysis and other biological monitoring, including of chlorides and sulfate. Further analyses will be conducted by MDE to establish TMDLs for all impairing substances in the watershed (MDE, 2011).

i. *Gwynns Falls Water Quality*

Waters of the Gwynns Falls Watershed are considered impaired under the CWA and were first identified on Maryland's 303(d) List of Impaired Waters in 1996. The stream was listed as impaired by nutrients, sediments (1996), fecal bacteria, and impacts to biological communities (2002).

A WQA of eutrophication for the Gwynns Falls Watershed in Baltimore County and Baltimore City, Maryland was submitted by MDE in 2009 and approved by the EPA in 2010. According to this analysis, a TMDL for nutrients is not necessary to achieve water quality standards. EPA approved TMDLs for nitrogen and phosphorous in the Baltimore Harbor in 2007. The Gwynns Falls drains into the Baltimore Harbor, so best management practices (BMPs) to improve water quality in the Harbor will require nutrient reductions in the Gwynns Falls. The nutrient WQA supports a revision of the phosphorous listing for the Gwynns Falls watershed from an impaired Category 5 waterbody to a Category 2 waterbody, indicating that it meets some water quality standards, but that there is insufficient data for all impairments to be assessed (MDE, 2009).

A proposed TMDL of fecal bacteria for the nontidal Gwynns Falls Basin in Baltimore City and Baltimore County, Maryland, was submitted to EPA in 2006 and approved in 2007, establishing a TMDL at 917.4 billion *E. coli* MPN per day. USGS daily flow monitoring data was collected at four representative monitoring stations in the Gwynns Falls Watershed for one year. Multiple antibiotic resistance analysis was used to determine the bacterial source and human waste was found to be source of the majority of the bacteria in the Gwynns Falls.

A proposed TMDL of sediment in the Gwynns Falls Watershed in Baltimore City and Baltimore County, Maryland, was submitted to EPA in 2009 and approved in 2010. MDE used BSID methodology to determine whether elevated sediment loads were negatively impacting the stream environment. This analysis determined biological communities of the Gwynns Falls Watershed are impaired by flow and sediment-related stressors, including channelization, channel alteration, and bar formation. A reference watershed approach was used to quantify the negative impact of sediment-related stressors on the biological communities and a sediment-loading threshold established. The threshold was used to determine a TMDL for the Gwynns Falls Watershed. The Gwynns Falls average annual TMDL of TSS is 13,996.2 tons per year. This TMDL ensures the watershed can meet its use class criteria with no negative impacts from sediment loads.

d. Floodplains and Flood Hazards

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with construction and modification of floodplains. USDOT Order 5650.2 guides the USDOT's implementation of EO 11988 and requires the detailed consideration of impacts to floodplains, as well as avoidance and minimization.

Data from the FEMA Flood Insurance Rate Maps (FIRM) was obtained and overlaid on GIS mapping of the B&P Tunnel potential alignments to identify regulated floodplains within the Study Area (see **Figure V-19** and Project mapping in the *Natural Resources Technical Report)*. See **Section VI.E.4** for information on Project floodplain impacts. Floodplains are also regulated at the state level and any construction in the nontidal floodplain will require a Waterway Construction Permit from MDE. There are two 100-year floodplains within the Study Area: one associated with the Jones Falls and one with the Gwynns Falls (see **Figure V-19**).

4. Coastal Zones

The Study Area is within the Maryland Coastal Zone. The Maryland Coastal Zone extends from three miles out in the Atlantic Ocean to the inland boundaries of the 16 counties and Baltimore City that border the Atlantic Ocean, Chesapeake Bay, and Potomac River up to the District of Columbia. The Maryland Department of the Environment issues a Federally Mandated State Authorization for Coastal Zone Consistency as part of its Wetlands and Waters Authorization. This Authorization constitutes official notification that authorized activities are consistent with the Maryland Coastal Zone Management Program, as required by Section 307 of the Federal Coastal Zone Management Act of 1972, as amended.

5. Wildlife and Habitat

Wildlife habitat within the Study Area is limited due to high levels of urbanization. Potential wildlife habitat in the region includes the Jones Falls, street trees, residential yards, landscaped areas around buildings, and hedgerows and forested areas around the I-83 interchange and Baltimore City parks, including: Druid Hill Park, Madison & Whitelock Park, John E. Howard Park, Brookfield Park, Pauline Founteroy Park, William Mcabee Park, Lafayette & Payson Park, Harlem Inner Block Park, Cumberlands and Carey Park, Eutaw Place Median Park, Pennsylvania Triangle Park, Reverend Quille Park, Saint Katherine's Park, North & Woodbrook Park, Druid Hill & Baker Park, Park Avenue Median Park, Reservoir Hill Park, Maple Leaf Park, Mount Royal Terrace Park, Newington Avenue Park, and Whitelock & Park Avenue Park.

Some of the wildlife species known to inhabit Baltimore City include songbirds such as mockingbirds (*Mimus polyglottos*) and robins (*Turdus migratorius*), rock doves (*Columba livia*), mourning doves (*Zenaida macroura*), Eastern gray squirrels (*Sciurus carolinensis*), Eastern chipmunks (*Tamias striatus*), house mice (*Mus musculus*), Norway rats (*Rattus norvegicus*), Virginia opossums (*Didelphis virginiana*), raccoons (*Procyon lotor*), red foxes (*Vulpes vulpes*), American toads (*Anaxyrus americanus*), and white-tailed deer (*Odocoileus virginianus*). The Study Area likely supports populations of many of these species. Some of the fish species commonly found in the lower Jones Falls include: white sucker (*Catostomus commersoni*), yellow bullhead (*Ameiurus natalis*), satinfin shiner (*Cyprinella analostana*), redbreast sunfish (*Lepomis auritus*), longnose dace (*Rhinichthys cataractae*), green sunfish (*Lepomis cyanellus*), and American eel (*Anguilla rostrata*). (For discussion of invasive species, see **Section V.E.5.c,** below.)

a. Aquatic Habitat

The Jones Falls watershed is listed on the Maryland list of water quality limited (WQLs) segments as impaired for impacts to biological communities. Maryland DNR conducts a quantitative assessment of the health of biologic communities within stream systems called the Index of Biological Integrity (IBI). The percentage of stream miles with an IBI of less than three is calculated and compared to a reference stream less than 10 percent

degraded to determine the relative biological health of the stream. The Code of Maryland Regulations (COMAR) requires the Jones Falls support a minimum Use I designation for water contact recreation and protection of nontidal warmwater aquatic life. The Jones Falls is not attaining the designated use of supporting aquatic life since it is biologically impaired. Biological impairment is evaluated by assessing the Benthic and Fish Indices of Biological Integrity (BIBI/FIBI), developed by the Maryland Biological Stream Survey. Biological impairment is assessed using a BSID that determines the main causes of reduced biological function.

A Watershed Report for Biological Impairment of the Gwynns Falls Watershed in Baltimore City and Baltimore County and BSID results and interpretation were submitted to EPA in 2009 and approved in 2010. The BSID data suggests degradation of biological communities of the Gwynns Falls is due in large part to the impacts of urban land use and related impacts of altered hydrology, elevated ammonia levels, chlorides, and conductivity. It also suggests biological communities of the Gwynns Falls are likely degraded by flow and sediment-related stressors and anthropogenic channelization of streams.

There is no National Marine Fisheries Service (NMFS)-designated essential fish habitat in the Study Area.

b. Terrestrial Habitat

A desktop assessment was conducted prior to the initiation of field work to approximate the potential boundaries of existing forest stands through review of current aerial photography in GIS (see **Figure V-19**). Areas of above ground disturbance were identified along the entire length of the existing B&P Tunnel corridor and at proposed ventilation shafts and tunnel portals. Reconstructing and modernizing the existing B&P Tunnel would require cut-and-cover construction in existing tunnel right-of-way and therefore the entire length of the alignment was investigated. A field survey of natural resources was conducted in these areas in May 2015 to identify any forest/street tree resources that may be impacted by proposed construction. The *Natural Resources Technical Report* contains a list of potential impacts.

The Maryland Department of Natural Resources (MDNR) defines a forest as follows:

- Biological community dominated by trees and other woody plants covering a land area of 10,000 square feet or larger and at least 35-feet wide.
- Areas with at least 100 trees per acre with at least 50 percent having a two-inch or greater diameter at breast height (dbh).
- Areas that have been cut, but not cleared.
- Does not include orchards.

MDNR defines specimen trees as having a dbh of 30 inches or greater, or trees with 75 percent or more dbh of the current state champion of that species.

The Maryland Forest Conservation Act applies to any activity requiring application for subdivision, grading permit, or sediment control permit for an area 40,000 square feet or greater. Applicants following the Forest Conservation Act are required to submit a Forest Stand Delineation (FSD) and a Forest Conservation Plan (FCP), prepared by a Maryland-qualified forest professional, to MDNR or the local reviewing agency for review and approval. A FSD is an inventory of existing forest/trees and other environmental site features. It provides a basis for determination of the most suitable forest and resource protection areas during the early stages of site development planning.

A FCP is prepared during the latter stages of site design and details the limits of disturbance; amount of forest that would be retained, removed, reforested, and afforested during site development; locations of specimen trees for retention and removal; types and locations of tree/forest protection devices and supplemental tree care; maintenance and monitoring parameters; and long-term protection measures. The State Forest

Conservation Technical Manual (Manual), Third Edition outlines the requirements for FSD and FCP preparation and submittal (Howell, G.P. and T. Ericson, 1997).

The Maryland Roadside Tree Law was passed in 1914 to ensure that roadside trees were properly protected and cared for and to ensure compatibility with public utilities. A Roadside Tree Care Permit must be obtained from MDNR prior to pruning, fertilizing, removing, planting, or caring for any roadside tree. A roadside tree grows all or in part within a public road right-of-way. Any work (including removal) conducted on a roadside tree that is 20 feet or higher must be performed by a Maryland licensed tree expert. A Roadside Tree Permit applies to trees within the public right-of-way that are not within forest stands. Most street trees occur along roadways either between the road and a sidewalk or within a center island between two roadways. Specimen tree removals would require a variance in compliance with the 2009 Maryland Forest Conservation Act amendment, No Net Loss of Forest Policy (Senate Bill 666), which would be coordinated with MDNR during final design.

The majority of the trees are identified as planted street trees.

c. Invasive Species

The Study Area is located in residential, industrial, and railroad areas. The majority of the species identified during the field investigation were planted street trees. None of the alternatives intersect forested areas. A full characterization of plant species was not conducted in this preliminary field investigation, although some invasive species were identified within the rail facilities, including Princess tree (*Paulownia tomentosa*), Tree of Heaven (*Ailanthus altissima*), Norway maple (*Acer platanoides*), multiflora rose (Rosa multiflora), Oriental Bittersweet (*Celastrus orbiculatus*), and Japanese honeysuckle (*Lonicera japonica*).

6. Rare, Threatened and Endangered Species

Based on agency correspondence received to date, no state- or Federally-listed threatened or endangered species are known to exist within the Study Area. The MDNR Project Review Division (PRD) response from June 29, 2015 indicates no threatened or endangered species are located in the Study Area. The United States Fish and Wildlife Service (USFWS) response, dated September 8, 2015 also indicated no threatened or endangered species in the Study Area; however, several transient species of migratory birds may traverse the Study Area. The B&P Tunnel Project will comply with the provisions of the Migratory Bird Treaty Act to implement appropriate conservation measures for all project activities.

Correspondence with the USFWS regarding the Northern Long-eared Bat indicates that the USFWS has refined its original critical habitat area for the bat to exclude major cities and some Maryland counties. The *Information for Planning and Conservation* (IPaC) species list for the B&P Tunnel does not include the Northern Long-eared Bat within the Study Area (USFWS, 2015).

F. Hazardous Materials

The Resource Conservation and Recovery Act (RCRA), implemented by the US Environmental Protection Agency (US EPA), is the primary federal regulatory framework for monitoring and tracking the generation and disposal of hazardous wastes in the United States, while the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a framework for remediation and site clean-up. The Toxic Substances Control Act (TSCA) also provides guidance on the disposal of asbestos, lead-based paint, and PCBs. Other Federal agencies with responsibilities for protecting human health and the environment from the impact of hazardous wastes or contaminants include, but are not limited to, the US Department of Labor (USDOL) Occupational Safety and Health Administration (OSHA); US Department of Health and Human Services, and the US Department of Transportation (USDOT). For the state of Maryland, MDE is the primary regulatory authority, under Title 26 of COMAR. MDE enforces federal and state hazardous material and contamination requirements through its Land Redevelopment Program (LRP) and Oil Control Program (OCP). Maryland Occupational Safety and Health (MOSH) is authorized under OSHA to develop its own health and safety programs for protect workers from

hazardous material exposures. by the federal regulatory agencies covering occupational The complete list of reviewed Federal and state regulatory databases is included in the *Hazardous Materials Assessment Technical Report*.

A Preliminary Screening Assessment (PSA) to identify potential sites of environmental concern during construction was conducted throughout the Study Area. The assessment includes the evaluation of sites with historical operations associated with contaminants or hazardous materials that may have migrated into the proposed limits of disturbance and could be impacted (i.e., mobilized) during tunnel construction activities (see **Figure V-20**).

As part of the PSA evaluation, federal and state environmental database records were reviewed in an effort to evaluate historical environmental incidents in the vicinity of each proposed alternative that could impact local communities or the surrounding environment if contamination is encountered during construction. The federal and state regulatory databases have been researched and reported in accordance with the search radii specified by ASTM Standard E 1527-13.

Sites in proximity to the Preferred Alternative with environmental concerns were ranked as low, medium, or high priority in accordance with the criteria outlined below.

The following criteria provide general guidelines for priority ranking; with each site evaluated using a weight of evidence approach to create a final priority ranking based on the risk associated with the contaminant and probability of mobilization during construction.

Sites were not included in the PSA if**:**

- No history of contamination or spills; and
- Down or cross gradient from the alignment; and
- Greater than 500 feet from the alignment.

A site was considered a low priority if:

- No history of contamination or spills from regulatory files, Sanborn maps, etc.; or
- MDE cases are closed with good information on cleanup; and
- Down or cross gradient and greater than 250 feet, but less than 500 feet from the alignment; or
- Small quantity generator; or
- Contains single heating oil tank or a historical or operable Above-ground Storage Tank (AST) or Underground Storage Tank (UST) less than 550-gallon in volume.

A site was considered a medium priority if:

- History of contamination, dumping and/or spills; and
- MDE cases are closed with insufficient information regarding resolution; and
- Greater than 500 feet upgradient of the alignment; or
- Down or cross gradient and greater than 100 feet, but less than 250 feet from the alignment; or
- Only listed as historical dry cleaner or gasoline/auto station in regulatory files or Sanborn maps; or
- Large quantity generator; or

- Single historical or operable AST/UST greater than 550-gallons in volume;
- Multiple historical or operable ASTs/USTs; or
- Hazardous waste disposal or storage onsite; or
- Violation notices.

A site was considered a high priority if:

- History of contamination, dumping and/or spills, as identified in regulatory files or Sanborn maps; and
- MDE cases are open; and
- Less than 500 feet upgradient of the alignment; or
- Down or cross gradient and less than 100 feet from the alignment; or
- Multiple historical or operable ASTs/USTs; or
- Voluntary Cleanup Program (VCP) or Superfund site.

The priority ranking system provides a basis for further site investigations. Residential properties have the least potential risk for environmental concern due to storage of relatively small quantities of hazardous materials or hazardous waste. Releases or spills are normally minor unless improperly stored or used in large quantities.

In addition to a review of regulatory database information, Sanborn Fire Insurance maps were reviewed to identify the presence of historical industrial or hazardous materials handling sites that may have released contaminants that could be present within the proposed construction limits of disturbance. The Sanborn maps provide detailed historical information for property development and use areas dating back to the late 1800's and provide property information prior to the initiation of environmental regulatory database listings in the 1970's. The Sanborn findings were incorporated into the PSA sheets and site priority rankings.

As a final step in the PSA review, a visual, noninvasive reconnaissance of high and medium priority sites and properties adjacent to each alternative was performed. No buildings or sites were entered during the reconnaissance. The B&P Tunnel Project hazardous material personnel performed site reconnaissance to verify existing onsite conditions and map visible environmental conditions, including: stained soil/pavement; dumping/burning areas; oil and gas-fuel dispenser, surface sheen; roads/tracks; transformers; drum storage; and above ground storage tanks. Visual observations were conducted for high and medium priority sites within a 500-foot distance from each alternative.

Throughout the investigation area there is a history of industrial activity, including dry-cleaning, rail maintenance, gas stations, and automotive repair. Current and historical hazardous materials used within the Study Area include, but are not limited to, petroleum, solvents, and industrial contaminants.

The PSA identified 71 potential hazardous material or contaminated sites proximal to the existing B&P Tunnel. There were 36 sites with a low-priority ranking (**Table V-19**), 24 sites with a medium-priority ranking (**Table V-20**), and 11 sites with a high-priority ranking (**Table V-21**).

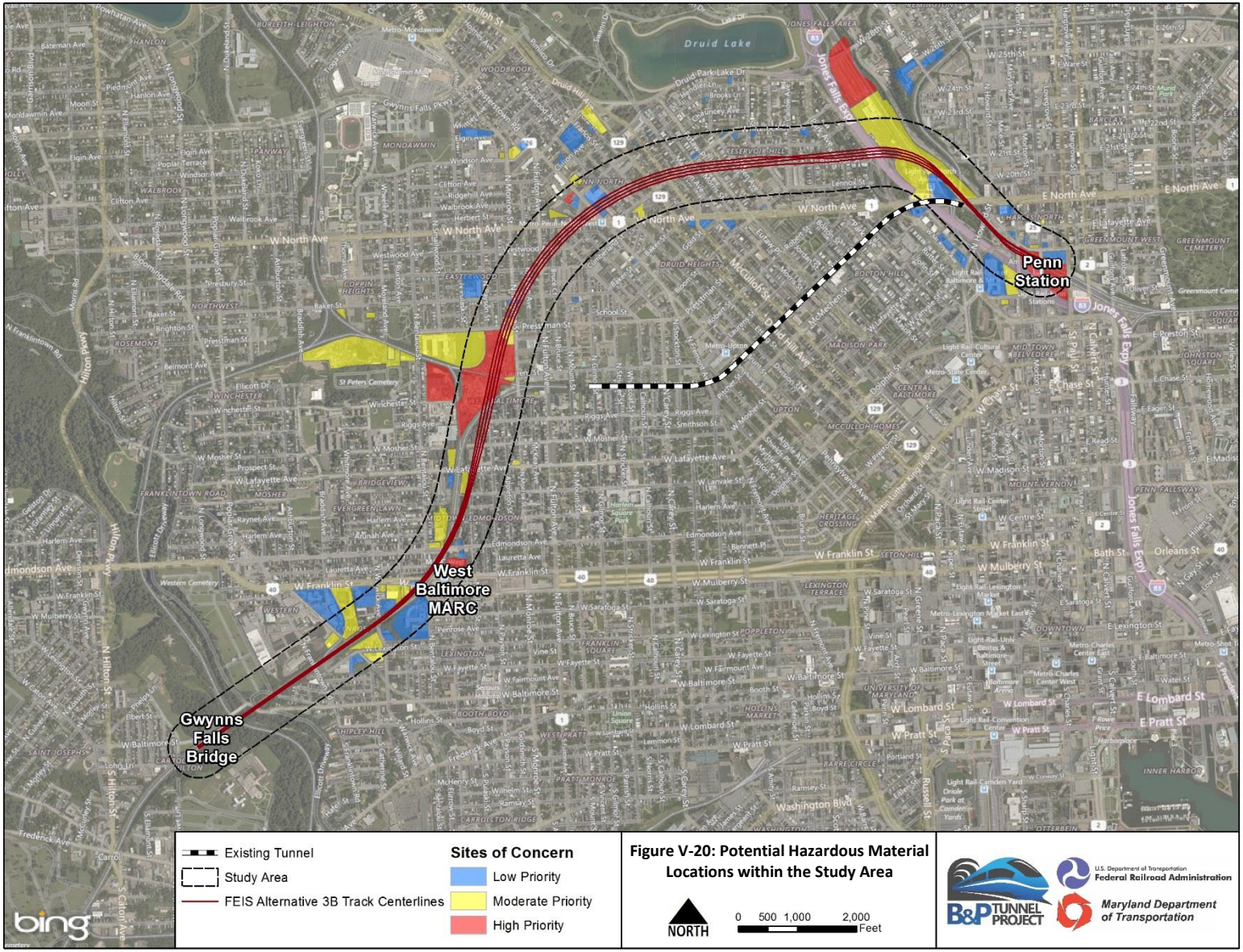


Figure V-20: Potential Hazardous Material Locations within the Study Area

Table V-19: Low Priority Hazardous Material Sites near the Existing B&P Tunnel

Site ID #	Property Description	Address	Hazard Type
BP-078	William R Lockhart residence	1803 Riggs Avenue	Petroleum release
BP-098	Gilmor Homes, Baltimore Housing Authority	1601 Vincent Court	Petroleum release
BP-103	Gilmor Homes	1640 Balmor Court	Petroleum use
BP-123	Sharon Baptist Church, Inc.	1373 North Stricker Street	Petroleum use
BP-128	Baltimore City	2311 Pennsylvania Avenue	Petroleum release
BP-132	Cearney's Radiator Service	1204 North Calhoun Street	Automotive history
BP-136	Baltimore City	1301 Laurens Street	Petroleum use
BP-140	Empire Laundry & Dry Cleaners	1201 North Carey Street	Dry-cleaning history
BP-143	William Pinderhughes Elementary School	1200 North Fremont Avenue	Automotive history
BP-144	Modern Junk & Salvage Co.	1423 North Fremont Avenue	Industrial history
BP-148	Lieu Yaw Laundry	1220 North Fremont Avenue	Dry-cleaning history
BP-149	Ernest Arjone	1208 North Fremont Avenue	Automotive history
BP-150	K & L Auto Service	1206 North Fremont Avenue	Automotive history
BP-151	Fremont Service Station	1202 North Fremont Avenue	Automotive history
BP-152	United States Post Office	1832 Pennsylvania Avenue	Petroleum use
BP-154	Inland Oil Co.	1126 North Fremont Avenue	Automotive history
BP-162	St. James Terrace Apartments	827 North Arlington Avenue	Petroleum release
BP-166	Talk Dirty Laundry	1729 Pennsylvania Avenue	Dry-cleaning history
BP-171	Goldenberg's Bargain Outlet	1705 Pennsylvania Avenue	Petroleum use
BP-173	Jason H Tilbillman	545 Wilson Street	Dry-cleaning history
BP-176	Wilson & Etting Park	1709 Division Street	Automotive history
BP-177	Jim's Auto Repair	528 Wilson Street	Automotive history
BP-179	Minor's Cleaners	1800 Linden Avenue	Dry-cleaning history
BP-182	Ernest Brooks	1711 Druid Hill Avenue	Dry-cleaning history
BP-183	Mitchell Cleaners & Dyers	414 Wilson Street	Dry-cleaning history
BP-187	Total Health Care	1501 Division Street	Petroleum use

Site ID #	Property Description	Address	Hazard Type
BP-204	Mount Royal Elementary School	121 McMechen Street	Petroleum use
BP-210	Lincoln Motor	410 West North Avenue	Automotive history
BP-211	AAA Mid-Atlantic Inc.	1401 West Mount Royal Avenue	Petroleum use
BP-213	Bolton Yard	80 West Oliver Street	VCP action
BP-214	Amtrak/Jones Falls Substation	151 West Oliver Street	Petroleum release
BP-217	Baltimore Postal Service Vehicle Maintenance	60 West Oliver Street	Petroleum release
BP-218	Penn Esso Station	1716 Maryland Avenue	Automotive history
BP-220	Atlantic Automobile Repairs	6 West Lanvale Street	Automotive history
BP-222	Binswanger, Sylvan W	2 East Lanvale Street	Automotive history
BP-225	National Auto Radiator and Fender Company Inc.	9 East Lanvale Street	Automotive history

Table V-20: Medium Priority Hazardous Material Sites near the Existing B&P Tunnel

Site ID #	Property Description	Address	Hazard Type
BP-050	Matrix Metals	2045 Winchester Street	VCP action, Petroleum use
BP-056	The Baltimore Asphalt Paving Co. (P. Flanigan & Sons, Inc., Pen Mar Company, Inc.)	1320 North Monroe Street	Petroleum use, Industrial history
BP-090	Sandtown Winchester Community Center	1114 North Mount Street	Petroleum use
BP-117	Harvey Johnson Towers	1510 West Mosher Street	Petroleum release
BP-120	Baltimore City Fire Department #8	1503 West Lafayette Avenue	Petroleum release
BP-138	Whitaker Citgo and Fuel Co.	920 North Carey Street	Petroleum release
BP-139	St. Peter Claver Catholic Church	1542 North Fremont Avenue	Petroleum release
BP-146	William G Brown Community Funeral Home	1308 North Fremont Avenue	Petroleum release
BP-156	Amoco Station	1101 West North Avenue	Petroleum release
BP-159	Lafayette Market	1700 Pennsylvania Avenue	Petroleum use
BP-164	Ball property and alleyway	634 Pitcher Street	Petroleum use
BP-186	Druid Heights Community Development Corp.	1711 McCulloh Street	Petroleum use
BP-191	Valentine residence	1513 Druid Hill Avenue	Petroleum release

Site ID #	Property Description	Address	Hazard Type
BP-196	Baltimore City Fire Station #13	405 McMechen Street	Petroleum release
BP-200	B & E Properties	1631 Park Avenue	Petroleum release
BP-202	Bolton House North Apartments	1600 West Mount Royal Avenue	Petroleum use
BP-203	MTA Light Rail Maintenance Facility	344 West North Avenue	Petroleum use, Railway history
BP-206	Baltimore City DPW Highway Maintenance Garage	560 West North Avenue	Petroleum use
BP-207	Golden Touch Care Center	140 West Lafayette Avenue	Petroleum release
BP-208	Baltimore Fire Department, Aerial Tower 111	401 West North Avenue	Petroleum use
BP-212	Maryland Institute College of Art - Fox Building	1341 Dickson Street	Petroleum use
BP-219	Maryland Community Resource Center/Sterling Auto Radiator Works	1731 Maryland Avenue	Petroleum release
BP-221	Metro Laundry & Cleaners/La La Auto Repair Inc./Atlantic Auto Service	1700 North Charles Street	Dry-cleaning history, Petroleum use
BP-223	Vincent Gulf Service Station/Hess	1801 North Charles Street	Petroleum release

Table V-21: High Priority Hazardous Material Sites near the Existing B&P Tunnel

Site ID #	Property Description	Address	Hazard Type
BP-077	JJ Adams Fuel Oil Company	1810 Winchester Street	Petroleum use
BP-091	Western District Police Station	1034 North Mount Street	Petroleum release
BP-118	Gilmor Elementary School #107	1311 North Gilmor Street	Petroleum release
BP-157	Bank of America	1808 Pennsylvania Avenue	Petroleum release
BP-178	Lafayette Center	1915 Madison Avenue	Petroleum remediation
BP-184	Midtown Development Corporation	1820 Eutaw Place	Petroleum release
BP-185	Conor residence	1815 Madison Avenue	Petroleum release
BP-195	Eutaw-Marshburn Elementary School	1624 Eutaw Place	Petroleum use
BP-201	Ditch Bowers & Taylor, Inc.	415 West North Avenue	Petroleum release, Railway history
BP-224	Amtrak Pennsylvania Station	1500 North Charles Street	Petroleum release, Railway history
BP-226	Norfolk Railway Yard	340 West North Avenue	Petroleum release, Railway history

a. Field Samples

Soil cuttings associated with an ongoing geotechnical field investigation were screened for various volatile, semi-volatile petroleum, and metals constituents across the build alternatives. The updated evaluation reviewed sampling data collected between March 2014 and May 2016. A total of 36 soil samples were collected from 24 boring locations within three depths of interest: shallow surficial soils, water-table and tunnel construction up to auger refusal (see **Figure V-21, Figure V-22, and Figure V-23**).

Shallow soils were cleared to a depth of 5 to 10 feet below ground surface (bgs) at all locations using an air lance and vacuum extraction system. All borings were installed by a truck-mounted drill rig with hollow-stemmed augers. The drill rig borings were installed to depths ranging from 2.5 to 74 feet below ground surface, based on the anticipated limits of disturbance. All soil cuttings were screened with a photoionization detector (PID) for potential volatile organic compounds (VOCs). Upon completion of the soil borings, all full depths of the borings were backfilled and grouted.

Laboratory analysis found contaminant concentrations of all soil samples at levels below MDE non-residential cleanup standards for non-residential development, except for sampled concentrations of arsenic at 16 locations and lead at one location. Of the 16 reported arsenic exceedances, only three exceeded the anticipated typical concentration for arsenic in central Maryland of 4.9 mg/kg, and all were within an order of magnitude of the screening limit of 1.9 mg/kg. The arsenic concentrations should be further evaluated during final design and construction for toxicity characteristic leaching procedure (TCLP) arsenic levels and addressed as a hazard if concentrations exceed the 40 CFR 261.24 hazardous waste toxicity threshold limits to determine if soils excavated from this area should be handled as hazardous waste. The lead concentration of 1,130 mg/kg at TA-P2-3 (10-10.5 ft. bgs) exceeds the MDE non-residential clean-up standard of 1,000 mg/kg and no obvious source has been identified in the area (see **Figure V-23**). No surface features are proposed for this area, but should surface-construction work proceed in the vicinity of TA-P2-3, soil screening should include testing for TCLP lead to determine if concentrations in soils excavated from this area should be handled as hazardous waste.

b. Surface Installations

The location of Intermediate Ventilation Facility, portal ventilation facilities and the tunnel portals were not defined during the DEIS hazardous materials assessment. Due to the anticipated depths and large quantity of surface material that will be disturbed during construction, these construction areas are of particular concern when evaluating potential human health, environmental, and community risks.

The preferred Intermediate Ventilation Facility site (for all build alternatives) would be located approximately 2,300-feet west of the Penn Station portal (see **Figure V-23**). Eight low-priority sites are located within 500-feet of the proposed Intermediate Ventilation Facility, including: Wonder Cleaners & Tailors (BP-163), Lee Sun F (BP-165), Crown Station (Quest Station) (BP-168), Cove One Hour Cleaners (BP-169), Snow White Self Service Laundry (BP-170), Fish Dry Cleaning & Laundry Co. (BP-172), VI Contracting Site (BP-174), and Minor's Cleaners (BP-179). Three of the sites, Minor's Cleaners, Cove One Hour Cleaners, and Fish Dry Cleaning & Laundry Co. are collocated within the proposed Intermediate Ventilation Facility site boundaries. Based on the historical presence of several dry cleaning facilities, heating oil tanks, and a gas station, excavated soil and groundwater from the Intermediate Ventilation Facility should be screened for chlorinated solvents, halogenated solvents, and petroleum constituents during final design and construction using a combination of field screening techniques and laboratory analysis.

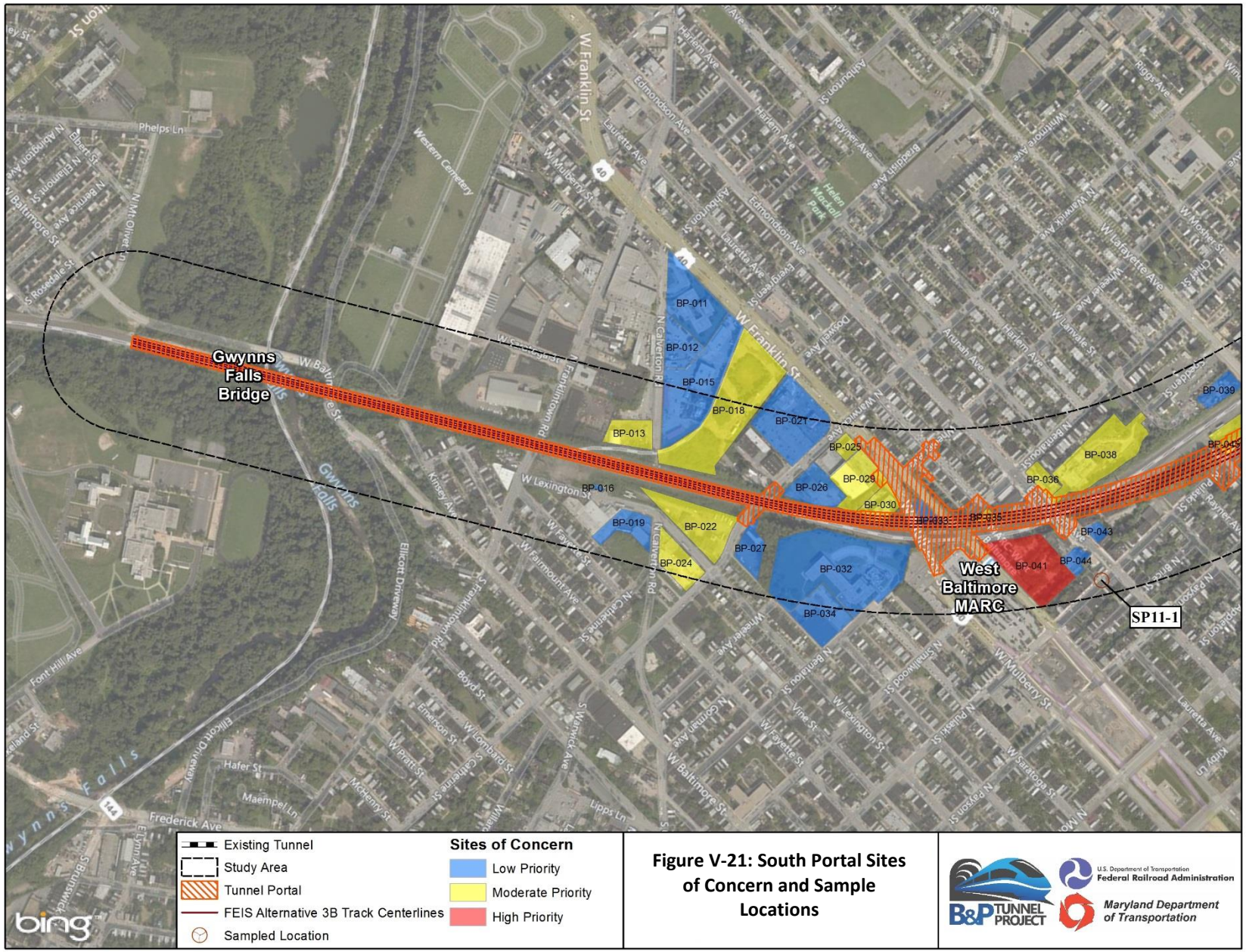


Figure V-21: South Portal Sites of Concern and Sample Locations

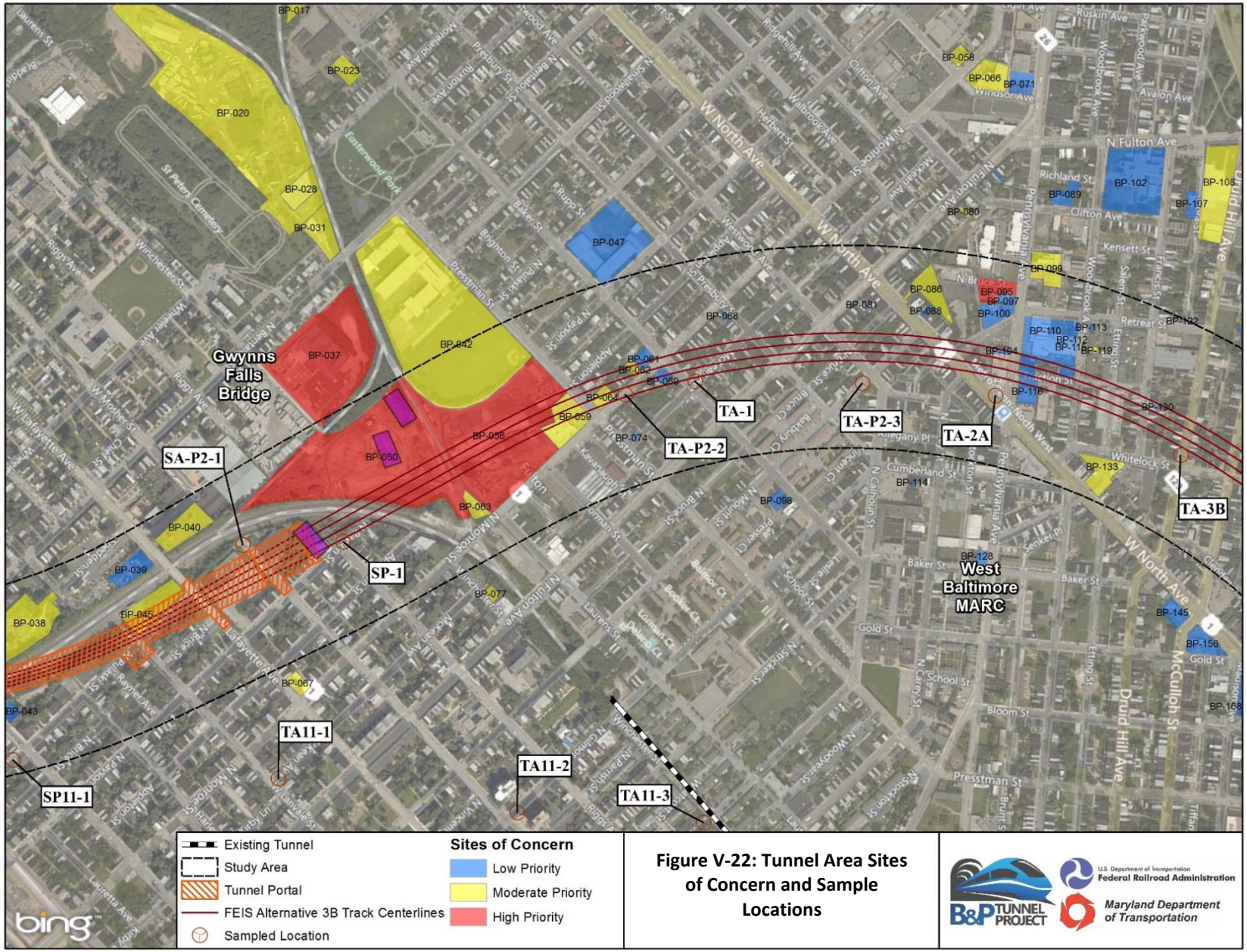


Figure V-22: Tunnel Area Sites of Concern and Sample Locations

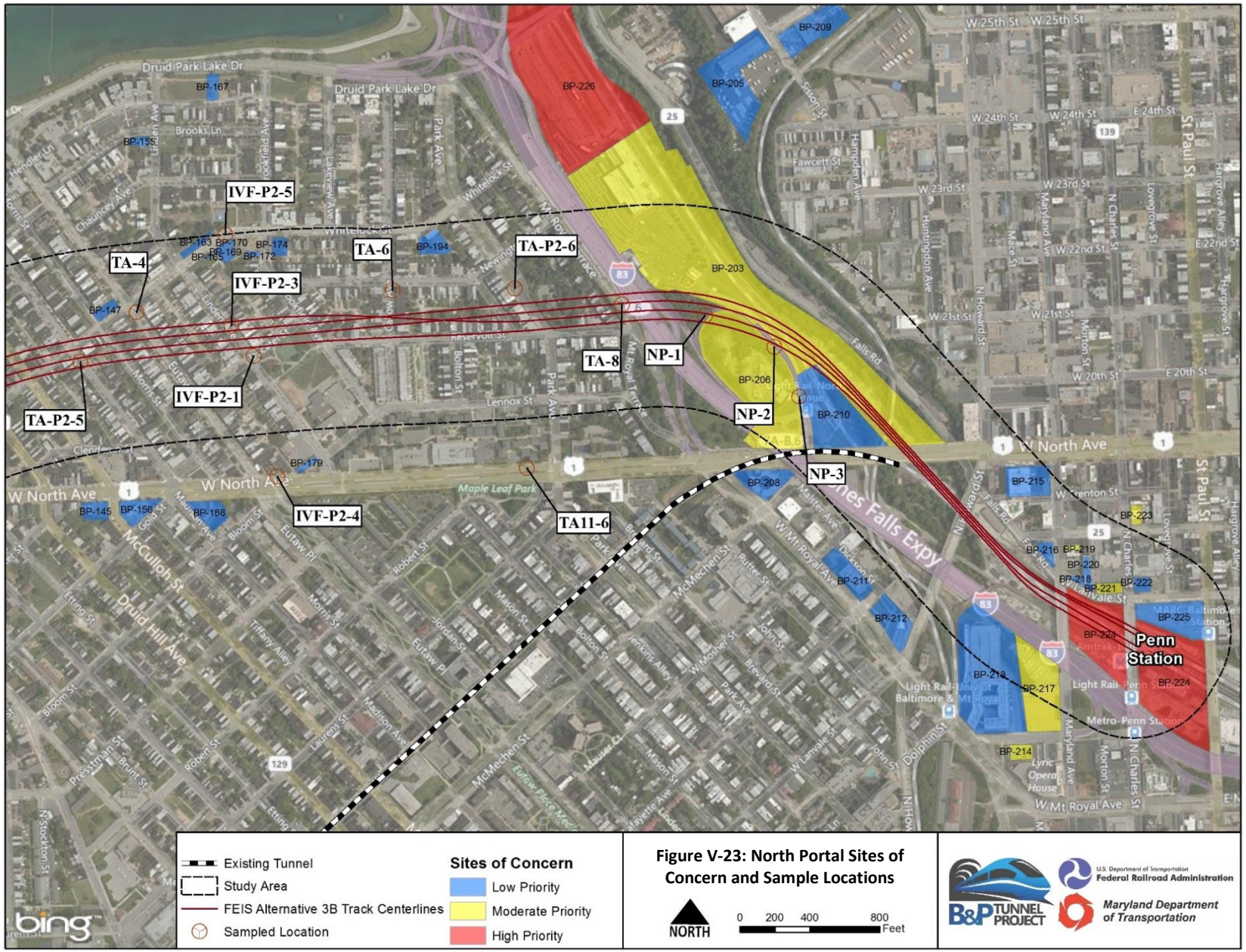


Figure V-23: North Portal Sites of Concern and Sample Locations

The North Ventilation Facility (for all build alternatives) would be located near the western portion of the Penn Station portal (see **Figure V-23**), while the South Ventilation Facility for the Preferred Alternative would be located near the northern terminus of the Gwynns Falls Bridge portal (see **Figure V-21**). Three moderate-priority sites, Norfolk Railway Yard (Hollin Yard) – BP-203, Baltimore City DPW Highway Maintenance Garage – BP-206, and the MTA Light Rail Maintenance Facility – BP-210, as well as one low priority property (Lincoln Motor, co-located at BP-210) are located within 500 feet of the Penn Station portal (North Portal) ventilation facility. Based on the historical rail and vehicle maintenance use of the underlying and surrounding properties, soils and groundwater disturbed during construction should be screened for petroleum constituents, hydraulic fluids, polychlorinated biphenyls (PCBs), chlorinated solvents, cadmium, mercury, and benzene.

Sites of concern within 500 feet of the Gwynns Falls Bridge portal ventilation facilities include three high-priority sites (ABEX Baltimore/ABC Rail Products Corp. – BP – 037, Matrix Metals – BP-050, and Baltimore Asphalt Paving Company – BP-056) and three moderate-priority parcels (Emmanuel Tire (Acme Business Park) – BP-040, Carver Vocational-Technical High School – BP-042, and E.S. Brady & Co., Inc. – BP-063). Two of the proposed portal ventilation facility footprints are located within the Baltimore Asphalt Paving Company Parcel, a site conducting significant petroleum, halogenated solvent, and corrosives storage and handling. In addition, the surrounding properties have a history of heavy industrial use, including the use of hydraulic fluids, PCBs, arsenic, mercury, metals, petroleum products, and polycyclic aromatic hydrocarbons (PAHs). Soils and groundwater disturbed during construction should be screened for petroleum constituents, hydraulic fluids, polychlorinated biphenyls (PCBs), chlorinated solvents, cadmium, mercury, and benzene.

G. Solid Waste

The regulations of the EPA under the Resource Conservation and Recovery Act (RCRA), MDE under COMAR Title 26.04.07, and the Baltimore City Department of Public Works (Bureau of Solid Waste) under Baltimore County Code Article 13 Title 04, govern activities that involve the generation, handling, and disposal of solid wastes.

Currently, solid waste generation from the existing B&P Tunnel comes from activity surrounding maintenance of the structure (worker trash, worker equipment, general debris from the existing structure) and fugitive trash from the City streets above.

Wastes containing contaminated materials require special handling, storage, transportation, and disposal methods to prevent releases that could impact human health or the environment. Depending on the nature of the material, federal, state and municipal regulations require the use of special containers or stockpiling practices for on-site storage to prevent the release of contaminated materials. The Federal and State Departments of Transportation have requirements for transportation of wastes containing contaminated materials. Facilities that receive contaminated materials require federal, state, and municipal permits to accept the waste, and generally require specific representative waste sampling and laboratory analysis prior to accepting material for disposal.

Two types of landfills that accommodate solid waste from projects like the B&P Tunnel are Rubble (Construction & Debris [C&D]) Landfills and Land Clearing Debris Landfills. A rubble (C&D) landfill is a solid waste acceptance facility that is restricted to accepting waste derived from building construction, demolition, or remodeling. As of 2013, there were five permitted rubble landfills in the state and one more under construction. At the 2013 disposal rate, there would be approximately 25 years of available C&D landfill capacity in the state. Land clearing debris (LCD) landfills are solid waste acceptance facilities that are restricted to acceptance of earthen materials such as clays, sands, topsoil, rock, and vegetation. As of 2013, there were five permitted LCDs accepting solid waste and one more under construction. At the 2013 disposal rate, there would be approximately 58 years of available land clearing debris landfill capacity in Maryland (Waste Diversion and Utilization Program, 2015).

H. Air Quality

Air quality describes the level of pollutants in the air. Individual air pollutants degrade the atmosphere and can harm human or animal health, reduce visibility, damage property, and reduce productivity of crops or natural vegetation.

Pursuant to the requirements of the Clean Air Act (CAA), the EPA establishes, enforces, and periodically reviews the National Ambient Air Quality Standards (NAAQS) for six common air pollutants, referred to as criteria pollutants--carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone, sulfur dioxide (SO_2), and particulate matter (PM) which includes particulate matter with a diameter of ten microns or less (PM_{10}) and particulate matter less than or equal to 2.5 micrometers ($PM_{2.5}$).The MDE has adopted the same standards as the NAAQS.

The EPA designates areas as either meeting (attainment) or not meeting (nonattainment) the NAAQS. An area with measured pollutant concentrations lower than the NAAQS is designated as an attainment area and an area with pollutant concentrations that exceed the NAAQS is designated as a nonattainment area. Once a nonattainment area meets the NAAQS and the additional redesignation requirements in the CAA, the EPA will designate the area as a maintenance area. Ozone nonattainment areas are further classified as extreme, severe, moderate, or marginal.

The CAA requires states to develop a general plan to attain and/or maintain the primary and secondary NAAQS in all areas of the country and to develop a specific plan to attain the standards for each area designated nonattainment for a NAAQS. These plans, known as State Implementation Plans (SIPs), are developed by state and local air quality management agencies and submitted to the EPA for approval.

The General Conformity Rule of the federal CAA prohibits federal agencies (such as FRA) from permitting or funding projects that do not conform to an applicable SIP. The General Conformity Rule applies only to areas that are in nonattainment or within a maintenance status. Under the Rule, project-related emissions of the applicable nonattainment/maintenance pollutants are compared to *de minimis* level thresholds. If the emissions exceed the thresholds, a formal Conformity Determination is required to demonstrate that the action conforms to the applicable SIP. Conversely, if project-related emissions are below the *de minimis* levels the project is assumed to conform to the SIP. The proposed Project would require input and/or approval by the FRA; therefore, the General Conformity requirements of the CAA are applicable. The General Conformity *de minimis* levels for the B&P Tunnel Replacement Project are presented in **Table V-22**.

Table V-22: General Conformity *de minimis* Thresholds (tons per year)

Pollutant	Primary/ Secondary (tons per year)	Area Designation
Ozone (NO_x)	100	Marginal and moderate nonattainment inside an ozone transport region
Ozone (VOC)	50	Marginal and moderate nonattainment inside an ozone transport region
$PM_{2.5}$	100	All nonattainment & maintenance areas

Note: Ozone thresholds are for locations inside an Ozone Transport Region (OTR).
Source: US EPA, De-Minimis Levels, http://www.epa.gov/oar/genconform/deminimis.htm

The B&P Tunnel Project is located in Baltimore City, Maryland, which is presently designated by the EPA as a moderate nonattainment area for the eight-hour ozone, and a maintenance area for $PM_{2.5}$. Although a portion of Baltimore City is designated as a maintenance area for CO, the B&P Tunnel project is located outside of the maintenance area. The existing B&P Tunnel operations data for 2014 is summarized in **Table V-23**. Additional information regarding air quality of the Study Area can be found in the *Air Quality Technical Report* and the *Noise and Air Quality Technical Memorandum for Ventilation Plants*.

Table V-23: Tunnel Operating Characteristics in the Existing Year (2014)

Train Service	Locomotive Type	Total Bi-directional Frequencies		Consist Data		Speed N/S* (mph)
		Daily	Peak Hour	Number of Locos	Number of Cars	
MARC (Regional)	Diesel (~60%) & Electric (~40%)	57	4	1	8	30/30
Acela (Intercity Express)	Electric	39	2	1	8	30/30
NE Regional (Intercity Corridor)	Electric	49	3	1	8	30/30
Freight	Diesel	2	0	1	30	30/30
Total	**All**	**145**	**9**			

** Average train speed entering and exiting the North Portal (N) and South Portal (S).*
Source: General Orders Timetable (Amtrak, December 2012 and 2014).

Background concentrations accounting for existing nearby emissions sources were included in ventilation system air dispersion modeling. The background concentration was obtained from the nearby EPA monitoring station located in the Oldtown Fire Station at 100 Hillen Street in Baltimore, which is approximately 1.5 miles from the project. Following US EPA guidance, the 1-hour NO_2 background concentration was based on the most recent (i.e., 2013 through 2015) three-year average of the 98th percentile of the daily 1-hour maximum value, which equals 51 ppb.

Historically, Greenhouse Gas (GHG) emissions have not been regulated under the CAA as air pollutants. However, after the US Supreme Court clarified in 2007 that CO_2 is an "air pollutant" subject to regulation under the CAA, the EPA embarked on developing requirements and standards for GHG emissions from mobile and stationary sources. However, there are no current NAAQS or *de minimis* thresholds in place for GHG.

In February 2010, the CEQ released a draft guidance memorandum addressing the ways federal agencies can improve their consideration of the effects of GHG emissions and climate change in their evaluation of proposals for federal actions under NEPA (CEQ, 2010). On December 2014, CEQ released revised draft guidance which supersedes the guidance released in February 2010. The revised guidance explained that agencies should consider both the potential effects of a proposed action on climate change, as indicated by its estimated GHG emissions, and the implications of climate change for the environmental effects of a proposed action. The guidance also emphasized that agency analyses should employ quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigations. CEQ recommends that agencies consider 25,000 metric tons of carbon dioxide equivalent (CO_{2e}) emissions on an annual basis as a reference point below which a quantitative analysis of GHG is not recommended unless it is easily accomplished based on available tools and data (CEQ, 2015). The CEQ released final GHG guidance in August 2016.

I. Noise

FRA has adopted FTA's Noise and Vibration Impact Assessment guidelines. According to the FTA, noise is generally considered unwanted sound.[1] Transit noise impacts are assessed based on land use categories and sensitivity to noise from transit sources (see **Table V-25**) under FTA's guidance manual, *Transit Noise and Vibration Impact Assessment.* The FTA noise criteria are delineated into two categories: *moderate* and *severe* impact. The moderate threshold defines areas where the change in noise is noticeable but may not be sufficient to cause a strong, adverse community reaction. The *severe* impact threshold defines the noise limits above which a significant percentage of the population would be highly annoyed by new noise. The level of impact at any specific site is established by comparing the predicted future Project noise level at the site to the existing noise level at the site.

Various sound metrics are used to quantify noise from transit sources. The A-weighted decibel (abbreviated "dBA") is used to describe the overall noise level and closely matches the human ear's response to audible frequencies. The following A-weighted noise metrics are used to describe impacts from transit related sources:

- L_{max}: The maximum noise level that occurs during an event (such as a train passby);
- L_{eq}: The equivalent sound level, which is the level of constant noise with the same acoustical energy as the fluctuating noise levels observed during a given time interval (such as one hour); and
- L_{dn}: The 24-hour day-night average sound level, an average sound level which includes a 10-decibel penalty added between 10:00 pm and 7:00 am to account for greater nighttime sensitivity to noise.
- SEL: The sound exposure level that converts the cumulative noise energy of an event into one second.

The L_{dn} is used to characterize noise exposure for residential areas (FTA Category 2). The L_{dn} metric describes a receiver's cumulative noise exposure from all events over 24 hours. For other noise-sensitive land uses such as schools and libraries (FTA Category 3) and outdoor amphitheaters (FTA Category 1), the average hourly equivalent sound level L_{eq}(h) is used to represent the peak operating hour. See **Table V-24** for FTA land use categories and noise metrics.

Potential noise impacts from the B&P Tunnel Project were also evaluated using the noise level standards included in the Noise Regulation of the Health Code of Baltimore City.[2] This regulation provides the noise limits for manufacturing, commercial, and residential zones in Baltimore City—depending on the source of noise and the types of adjacent land uses. For noise generated within residential zones, there is a limit of 55 dBA at any point on the property line of the use (the noise limit is described as a measured maximum sound level; although not specifically stated, it is assumed to be in terms of L_{max}). Between 9:00pm and 7:00am, the limit is five dBA lower for any uses within a residential zone (that is, 50 dBA). Although the Health Code allows for different noise limits for "short, durational deviations," for the purposes of this report, it is assumed that the noise limit for the ventilation facilities is L_{max} 50 dBA at the property boundary of each ventilation plant facility. Additionally, regulations from COMAR 26.02.03—Control of Noise Pollution, were applied, as appropriate, to the impact evaluation.

[1] Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, Washington, DC, May 2006.

[2] Health Code of Baltimore City, § 9-206 Noise Regulation, 2015.

Table V-24: FTA Land Use Categories and Noise Metrics

Land-Use Category	Noise Metric	Description
1	$L_{eq}(h)$	Tracts of land set aside for serenity and quiet, such as outdoor amphitheaters, concert pavilions, and historic landmarks.
2	L_{dn}	Buildings used for sleeping such as residences, hospitals, hotels, and other areas where nighttime sensitivity to noise is of utmost importance.
3	$L_{eq}(h)$	Institutional land uses with primarily daytime and evening uses including schools, libraries, churches, museums, cemeteries, historic sites, and parks, and certain recreational facilities used for study or meditation.

Source: Transit Noise and Vibration Impact Assessment (FTA, 2006).

A noise monitoring program was conducted at three representative locations near the south portal on May 14th and May 28th, 2015. Measurements near the north portal were not available due to the lower density of noise sensitive receptors and the farther distances between the railroad lines and noise sensitive receptors (compared to the south portal where actual measurements were taken). As a result, existing noise levels were estimated using tabulated values from the FTA's General Noise Assessment guidelines. Based on FTA's guidelines, these tabulated values were significant underestimates intended to compensate for the reduced precision of the estimated values compared to measured values. This conservative approach to estimating background levels "casts a larger net (i.e., larger contour)" when estimating the number of impacted receptors, which means that the estimate may overestimate the impacts of the Project. At this location, existing noise levels were estimated based on proximity to major roads, such as I-83, and existing railroad lines. The noise measurements documented existing noise sources within the Study Area, such as rail traffic (including passenger and freight traffic along the NEC) and motor vehicle traffic along surface streets. As shown in **Table V-25**, measured peak-hour noise levels near the south portal ranged from 64.3 dBA to 70.3 dBA, and the measured day-night noise levels range from 63.2 dBA to 64.7 dBA. The estimated noise levels near the north portal are 60.0 dBA for both the peak-hour and day-night noise levels. More detailed information regarding noise within the Study Area can be found in the *Noise Technical Report* and the *Noise and Air Quality Technical Memorandum for Ventilation Plants*.

Table V-25: Existing Noise Levels

Receptor Location	FTA Land Use Category	FTA Description	Peak Hour $L_{eq}(h)$ (dB)	24-Hour L_{dn} (dB)
Near South Portals *(Measured)*				
N Mount Street	2	Residential	N/A	64.7
W Lanvale Street	2	Residential	N/A	63.4
Mary Ann Winterling Elementary School	3	Institutional	64.3	N/A
Near North Portals *(Estimated)*				
Residential and Institutional receptors in vicinity of the Project	2 and 3	Residential and Institutional	60.0	60.0

Source: Study Team conducted noise measurements near the South Portals on May 14th and May 28th, 2015. North Portal data are estimates based on FTA's Transit Noise and Vibration Impact Assessment (FTA, 2006).

J. Vibration

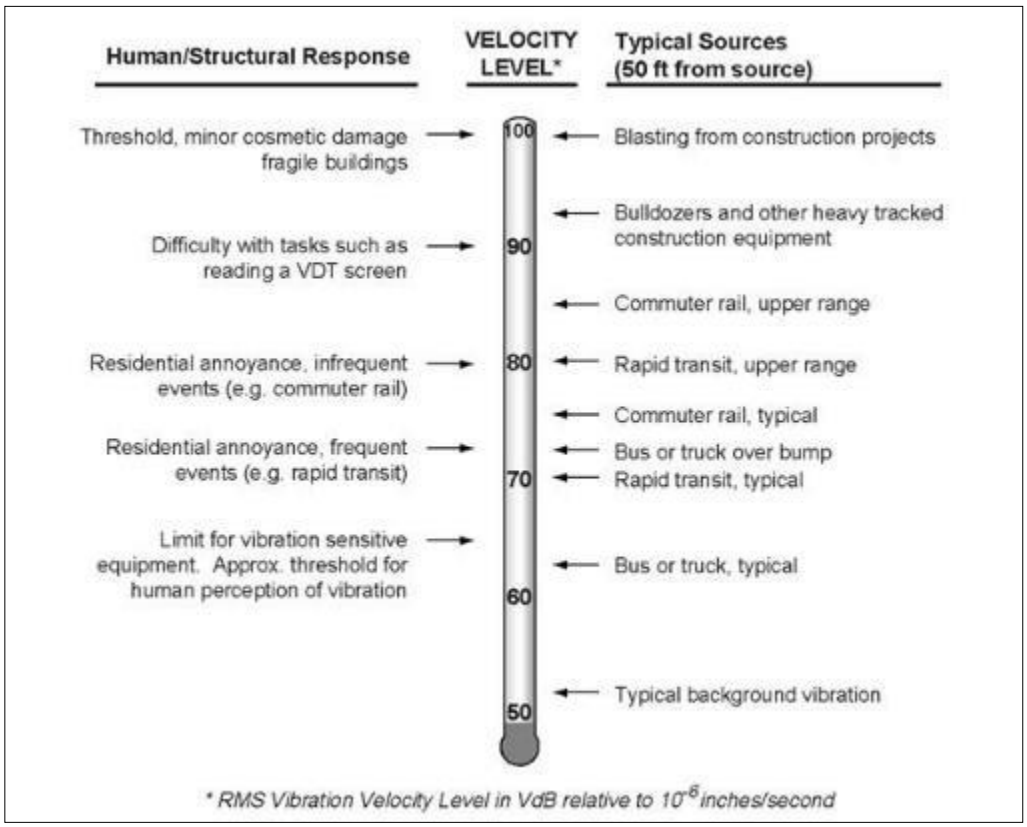
Because FRA has not published noise and vibration regulations, the agency defers to guidance published by the FTA. The vibration assessment was prepared in accordance with NEPA and the guidelines set forth by FTA's *Transit Noise and Vibration Impact Assessment* (FTA, 2006). The future predicted vibration levels from the B&P Tunnel Project were evaluated using the FTA guidelines. The FTA criteria are used to evaluate instantaneous levels from single events (such as a single train passby).

1. Technical Overview

Typical ground-borne vibration levels, in addition to typical sources and human/structural responses, are shown in **Figure V-24**.

Ground-borne vibration associated with vehicle movements is usually the result of uneven interactions between wheels and the road or rail surfaces. Examples of such interactions (and subsequent vibrations) include train wheels over a jointed rail and an untrue rail car wheel with flats spots. Typical ground-borne vibration levels at a receptor 50 feet from a diesel locomotive traveling at 50 miles per hour is 85 VdB and 73 VdB for LRT vehicles. Similarly, a typical background vibration velocity level in residential areas is usually 50 VdB or lower, well below the threshold of human perception, which is around 65 VdB. Typical background levels refer to ambient ground vibrations not related to any specific transportation source (e.g., naturally occurring ground vibration). This background vibration level is assumed to be fairly constant from site to site, except near active fault lines.

Figure V-24: Typical Ground-Borne Vibration Levels (FTA, 2006)



Unlike noise, which travels in air, transit vibration typically travels along the surface of the ground. Depending on the geological properties of the surrounding terrain and the type of building structure exposed to transit vibration, vibration propagation can be more or less efficient. Buildings with a solid foundation set in bedrock are "coupled" more efficiently to the surrounding ground and experience relatively higher vibration levels than buildings located in sandier soil. Heavier buildings (such as masonry structures) are less susceptible to vibration than wood-frame buildings because they absorb more vibration energy.

Vibration induced by passing rail vehicles can generally be discussed in terms of displacement, velocity, or acceleration. However, human responses and responses by monitoring instruments and other objects are most accurately described with velocity; therefore, vibration velocity level is used to assess vibration impacts from transit projects.

2. Existing Vibration Levels

Baseline (or background) vibration measurements (vibration levels under Alternative 1) were not conducted as part of the B&P Tunnel Project because the focus of this preliminary phase is intended to compare the potential impacts between different alternatives and options. Typical background levels refer to ambient ground vibrations not related to any specific transportation source (e.g., naturally occurring ground vibration). This background vibration level is assumed to be fairly constant from site to site, except near active fault lines. Background vibration levels near the proposed B&P Tunnel Project alternatives are dominated by local traffic, while background vibration levels near the existing B&P Tunnel are dominated by current rail operations due to Amtrak, MARC, and freight train passbys along the NEC.

Ground-borne vibration from train passbys under Alternative 1 is predicted to exceed the FTA frequent impact criterion of 72 VdB at 23 residences and other FTA Category 2 land uses (see **Table V-25** for Land Use Categories). Exceedances of the FTA impact criterion of 75 VdB are predicted at one FTA Category 3 receptor (Eutaw-Marshburn Elementary School). No exceedances of the FTA ground-borne vibration impact criteria are predicted at any Category 1 land uses (highly sensitive equipment) under Alternative 1.

Vibration from train passbys in tunnels could contribute to ground-borne noise inside residences due to vibrating surfaces. Ground-borne noise from train passbys under Alternative 1 is predicted to exceed the FTA frequent impact criterion of 35 dBA at 126 residences and other FTA Category 2 land uses. Exceedances of the FTA impact criterion of 40 dBA are predicted at one FTA Category 3 receptor (Eutaw-Marshburn Elementary School). FTA Category 1 land uses (highly-sensitive equipment) are generally not sensitive to ground-borne noise. Additional information regarding vibration within the Study Area can be found in the *Vibration Technical Report.*

K. Energy

Consideration of energy consumption and conservation potential of alternatives and mitigation measures in EIS documents is required by CEQ guidance at 40 CFR Part 1502.16(e)—Environmental Consequences and FRA regulations. Amtrak and MARC trains traveling through the Study Area in the existing B&P Tunnel are electric or diesel powered, while NS freight trains are fueled primarily by diesel. Catenary lines provide overhead electric power to Amtrak and MARC trains along the trackway and through the existing B&P Tunnel in the Study Area.

Nationally, Amtrak trains use 2,214 Btu per passenger mile and traveling by Amtrak is 11 percent more efficient than domestic airline travel (2,484 Btu) and 31 percent more efficient than auto travel (3,193 Btu) on a per-passenger-mile basis (USDOE, 2014). In contrast, freight rail uses on average 13,800 Btu per freight-car-mile. Amtrak's goal is to reduce its consumption of diesel fuel by improving operating practices and conservation measures. Diesel fuel use in revenue-generating trains was reduced by 1.11 percent from Fiscal Year 2012 to 2013 (Amtrak, 2013).

Table V-26 presents the estimated daily energy consumption of Amtrak and MARC services through the Study Area based on NEC FUTURE 2014 data and statistics available from the National Bureau of Transportation Statistics. As discussed in the **Chapter II**, freight traffic through the existing B&P Tunnel is currently limited by the market forces, national government policy and the cost of track connections between the CSX and the NEC, resulting in most freight on the NEC being re-routed around the existing B&P Tunnel. As only two NS freight trains travel through the Study Area per day, their energy use is nominal.

Table V-26: Estimated Energy Consumption of Existing Amtrak and MARC Service in the Study Area

Type of Service	Daily Passenger Trips	Length of Travel (Miles)	Daily Passenger Miles	Average Btu Per Passenger-Mile	Daily Estimated Energy Consumption (Btu)
Amtrak	17,000[1]	3.5	59,500	2,214[1]	131,733,000
MARC	4,600[1]	3.5	16,100	2,838[2]	45,691,800

Source: NEC FUTURE (USDOT, Accessed September 8, 2014).
[1]2014 data.
[2]2012 data.

Energy is also consumed by the operation of facilities such as tunnels, where power is needed for lighting, trackway signage, and operating ventilation and safety equipment. Petroleum and electrical energy are also typically consumed during construction to operate various equipment.