

Draft Environmental Assessment

# Repair Options for the Battery Park Trunk Sewer Line

Richmond, Virginia

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## Acronyms and Abbreviations

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ACHP	Advisory Council on Historic Preservation
APE	area of potential effect
BMP	best management practice
BPTS	Battery Park Trunk Sewer Line
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CO	carbon monoxide
CORRACTS	corrective action site
CSO	combined sewer overflow
CZMA	Coastal Zone Management Act
cyds	cubic yards
dB	decibel
DNL	day-night average sound level
DSS	Data Sharing System
EA	Environmental Assessment
EDR	Environmental Data Resources
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
FRPP	fiber-reinforced polymer pipe
HDPE	high-density polyethylene
L	liters
LEL	lower explosive limit
LTANK	leaking petroleum storage tanks
LUST	leaking underground storage tank
mg	milligrams
MGD	millions of gallons per day
MS4	municipal separate storm sewer systems
MSW	municipal solid waste
NAAQS	National Ambient Air Quality Standards



## Acronyms and Abbreviations

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NCA	Noise Control Act of 1972
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act of 1966
NHPP	National Historic Preservation Program
NMOC	non-methane organic compound
NOAA	National Oceanic and Atmospheric Administration
NO <sub>2</sub>	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
O <sub>3</sub>	ozone
OSHA	Occupational Safety and Health Administration
PA	Public Assistance Program
Pb	lead
PCB	polychlorinated biphenyls
PM <sub>2.5</sub>	particulate matter less than 2.5 microns
PM <sub>10</sub>	particulate matter less than 1.0 microns
RCRA	Resource Conservation and Recovery Act
RFP	request for proposals
RQ	reportable quantities
SO <sub>2</sub>	sulfur dioxide
SHPO	State Historic Preservation Office
SWPPP	Stormwater Pollution Prevention Plan
TBM	tunnel boring machine
UEL	upper explosive limit
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VA VRP	Virginia Voluntary Remediation Program
VOC	volatile organic compound
VDEM	Virginia Department of Emergency Management
VDEQ	Virginia Department of Environmental Quality
VDHR	Virginia Department of Historic Resources
VPDES	Virginia Pollution Discharge Elimination System
WWTP	Wastewater Treatment Plant



The Battery Park Trunk Sewer Line (BPTS) is located in the City of Richmond, Virginia, and is operated and maintained by the City Department of Public Works.

From August 29 to September 7, 2006, Tropical Depression Ernesto caused severe, persistent flooding throughout Virginia. The City of Richmond experienced widespread flooding, with significant damage to local infrastructure. The BPTS was severely damaged when a sinkhole collapsed and crushed the over 90-year old section of the line located under a landfill. The blockage in the sewer caused combined wastewater to back up into Battery Park, a linear city park, and the surrounding residential area starting on August 31, 2006. Flooding in the park reached as deep as 30 feet and covered over 80 acres. Seventy-one houses were condemned by the city because of potential health and safety risks associated with the flood damage; over 240 dwellings were evacuated. The A.V. Norrell Elementary School, located adjacent to the park, was closed; students and teachers moved to a formerly closed school building located 5 miles away. On September 22, 2006, Presidential Disaster Declaration FEMA-1661-DR-VA was issued for 19 counties and 2 independent cities, making these entities eligible for the Public Assistance Program.

The city took emergency measures to mitigate further severe flooding in the park by installing a system of aboveground bypass pumps and 18-inch, high-density polyethylene pipes from the flooded portion of Battery Park across the Fells Street landfill and into the nearby Bacon's Quarter Sewer Interceptor. However, this emergency bypass operation brought the sewer capacity to only 94 millions of gallons a day (MGD), over 435 MGD less than normal capacity. Because of the reduced capacity, the city took further emergency measures and installed a 72-inch belowground emergency overflow relief pipe between November 2006 and January 2007. Installation of this emergency relief pipe brought the capacity of the system to 212 MGD. However, even small rain events or snow melts continue to cause repeated flooding of the park, requiring sanitary cleanup operations and significant impacts on local residents from the odor of sewage throughout their neighborhood.

The City of Richmond is examining options for permanent repairs to the damaged sewer line under the Federal Emergency Management Agency (FEMA) Public Assistance Program.

## 1.1 PROJECT LOCATION

The BPTS is adjacent to the historic neighborhoods of Battery Court, Barton Heights, and Brookfield Gardens, and is centered at approximately 37.560 N, 77.438 W, north of the CSX railroad tracks and southeast of the intersection of Wickham and Hawthorne Avenues, on the north side of the City of Richmond, Virginia (**Figure 1**). The area surrounding Battery Park that flooded as a result of the blocked sewer line is an approximately 80-acre area and extends from the tennis courts located near Wickham Street north to Moss Side Avenue (**Figure 2**). In the early 1900s, an open-water sewer system was installed at the bottom of a natural ravine through what is now Battery Park. Around 1915, the open-water system was converted to an enclosed concrete dome, creating an 8-foot wide by 9.5-foot tall horseshoe-shaped tunnel. In 1946, the City of Richmond began using the ravine as a city dump for municipal solid waste. The dump became known as the Fells Street Landfill; filling operations continued until 1979, when a shallow cap was placed over the fill material and the landfill was officially closed. **Figure 3** was developed by the city's contractors using current and historic topographic information and the results of soil borings to depict the estimated extent of the landfill.



The sinkhole is approximately 150 feet in diameter and 300 feet deep; it is within the Fells Street Landfill. The sinkhole is approximately 300 feet north of Bacon's Quarter Sewer Interceptor, a 10-foot high by 20-foot wide concrete box sewer, which serves as both storage for sewage and stormwater and as a conveyance to the city's wastewater treatment plant. The Bacon's Quarter Sewer Interceptor runs parallel to the CSX railroad tracks south of the project area (**Figure 4**).

## 1.2 PURPOSE AND NEED

The objective of the FEMA Public Assistance Program is to assist communities in recovering from damage caused by natural disasters. The purpose of the action alternatives is to alleviate the continued flooding and associated health hazards of the Battery Park neighborhood originating from the damage of Tropical Depression Ernesto. During even small rain events, northern areas of the park are flooded with sewage and stormwater. The BPTS serves over 5,000 residential and commercial properties.

This project is needed to restore the capacity of the BPTS. The capacity of the sewer prior to the 2006 collapse is estimated to be between 535 and 650 MGD. Temporary emergency bypass pumping measures were taken immediately to dewater the park and residential neighborhoods. The pumps must be constantly monitored and maintained. These repairs are not expected to withstand regular sustained use and are not a long-term solution. The capacity of the BPTS must be restored to prevent potential continued flooding of Battery Park and continued costs of maintaining the emergency bypass measures.

The President's Council on Environmental Quality has developed regulations for implementing the National Environmental Policy Act (NEPA). These Federal regulations, set forth in Title 40, Code of Federal Regulations (CFR) Parts 1500-1508, require an evaluation of alternatives and a discussion of the potential environmental impacts of a proposed Federal action, as part of the Environmental Assessment (EA) process. The FEMA regulations, which establish FEMA's process for implementing NEPA, are set forth in 44 CFR Subpart 10. This EA was prepared in accordance with FEMA's regulations as required under NEPA. As part of this NEPA review, the requirements of other environmental laws and executive orders are addressed.



## 2.1 ALTERNATIVES CONSIDERED AND DISMISSED

### *Point Repair Existing Tunnel and Slip Line*

The Applicant considered fully excavating soil material and municipal solid waste (MSW) in and around the sinkhole to gain access to the damaged portions of the sewer. The damaged portion of the sewer would be repaired, and then a new slip line would be inserted via an upstream access shaft and carried through the existing sewer to a downstream access shaft. This was the first alternative evaluated immediately after the disaster, as it was considered the most obvious solution. However, further scrutiny of this alternative revealed that it posed too great a health and safety risk to the excavation crews. The city's contractors concluded that there was no safe way of shoring the fragile south slope of the sinkhole. Another disadvantage of this alternative was that hydraulic capacity would be reduced from 600 MGD to 350 MGD. This alternative was dismissed because if the south slope failed, the lives of the work crews would be at risk and because it would not meet the required capacity.

### *Point Repair Existing Tunnel and Slip Line Plus Deep Relief Pipeline*

After considering the Point Repair Existing Tunnel and Slip Line alternative and determining that the reduction in hydraulic capacity would not meet the needs of the sewershed, the city and their contractors evaluated an alternative that introduced a new "Deep Relief Pipeline." This alternative posed the same safety risks as the above alternative: possible south slope failure and a large hydrostatic head on the sewer line during excavation. The Deep Relief Pipeline proposed as part of this alternative would provide an immediate relief to the recurring flooding in Battery Park by creating a new bypass sewer, but this alternative still holds incredible health and safety risks for the crews conducting the construction and excavation. A rough cost of \$37 to \$59 million was estimated for this option and the time to completion was 512 days. This alternative was dismissed both because the timeframe was not considered practical for re-establishing full drainage capacity of the sewershed and because of the risk to life of the excavation/construction crews.

### *East Alignment*

The city evaluated a new sewer alignment that would have lain in an alignment to the east of the damaged sewer. However, this alternative was dismissed early on when it became apparent that it would involve lengthy delays because the access point on this alignment into the Bacon's Quarter Sewer Interceptor would be sited off of city property. The delay associated with property acquisition, as well as other factors, including the risks involved in maneuvering equipment around high-tension power lines along the alignment and the compromised structural integrity of the east-aligned sewer from siting it in a shallower Miocene clay layer (compared with alignments to the west) led the city and their contractors to focus on alignments to the west of the existing sewer.



The following alternatives are being considered for the permanent repair of the BPTS.

## 2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the City of Richmond would complete construction and maintenance of the emergency bypass sewer lines, but no permanent measures would be taken to relocate or repair the damaged sewer using FEMA funds. Pumps and temporary aboveground bypass lines installed immediately following Tropical Depression Ernesto to alleviate flooding and evacuate the combined wastewater in Battery Park would remain in place. The bypass and emergency pumps brought the capacity of the system to 80 MGD. Because wet weather events require a capacity of 212 MGD, the city also constructed an additional belowground emergency overflow relief pipe and installed additional pumps to meet this capacity requirement. The No Action Alternative would include maintenance of these emergency relief measures; however, permanent repairs would not be made to the existing infrastructure. Battery Park would be subject to future flooding of combined wastewater if the pumps failed, the bypass lines were blocked, or an extreme wet weather event occurred. Residents would risk service interruptions which could pose potential human health concerns from combined sewer backing up into public spaces and residences. Nuisance odors from sewage would continue. Battery Park and the surrounding neighborhoods would continue to be at risk from future flooding and repetitive losses related to future flood disasters.

## 2.3 ALTERNATIVE 1

Under Alternative 1, a new bypass sewer tunnel replacing the damaged section of the BPTS would be constructed to restore the capacity of the existing tunnel. The new tunnel would extend from the parking lot of the First Tee Golf Course, approximately 250 feet north of the intersection of School and Hickory Streets, south to the Bacon's Quarter Interceptor Sewer. The new section of BPTS would connect to the existing sewer at or near an existing junction box in the golf course parking lot. From this point, the sewer would extend south for approximately 1,300 feet, and then turn southeast for approximately 500 feet before connecting with the Bacon's Quarter Sewer Interceptor. Tunneling equipment would be used to dig an approximately 12-foot diameter tunnel in which 108-inch diameter fiber-reinforced polymer pipe (FRPP) would be placed. The annular space between the FRPP and the tunnel would be backfilled with grout.

Though the majority of the proposed new tunnel lies within natural soils, approximately 200 to 250 feet of the northernmost portion of the tunnel lies within the existing landfill. This section would require hand-excavation to avoid damaging the tunneling equipment. A lesser extent of MSW is expected for a short distance at the tunnel crown upstream of the connection to the Bacon's Quarter Sewer Interceptor. Despite the expected encounter with MSW, this alternative maximizes the new sewer's alignment in a structurally advantageous layer of Miocene clay (Lachel Felice, 2007a).

The new section of the BPTS would be gravity forced; the hydraulic alignment is preferable compared to many of the dismissed alternatives, and all construction would be within the City of Richmond's property. Alternative 1 is expected to take approximately 280 days to complete (Lachel Felice, 2007a). The drawings included as **Appendix A** depict two separate designs (2-



Shaft and 3-Shaft) for the alignment proposed under Alternative 1. The two designs differ in the number and location of proposed work shafts.

### *Two-Shaft Design*

Two work shafts would be excavated as part of this design: one 46-foot diameter “North Shaft” located at the First Tee parking lot and one 36-foot diameter “South Shaft” located near the intersection of Fendall Avenue and Bacon Street. The shafts would be constructed first to allow tunneling equipment to be lowered to the appropriate depth. Two straight tunnel drives would be excavated from the South Shaft, one in a northerly direction to the North Shaft, and one in a southeasterly direction, to the Bacon’s Quarter connection. The North Shaft has dual functions of providing a recovery point for the Tunnel Boring Machine (TBM) and digger shield, and providing an additional wet well for augmented emergency bypass pumping capacity. A temporary, shored structure would be built at the Bacon’s Quarter connection to support the recovery of TBM equipment at the southern end (Lachel Felice, 2007a).

Two new laterals (smaller sewers connecting individual neighborhood lines to the main trunk sewer) would be constructed to tie the upstream flow and western neighborhoods into the new tunnel. The North Shaft would be constructed around an existing junction chamber, the existing junction would be dismantled, and new connection junctions would be established in its place for a new 60-inch School Street lateral from the south and a new 48-inch lateral from the east. The laterals would be constructed at a depth between 19.5 and 24 feet deep by performing surface excavation to the referenced depth. To connect the joint between the two main tunnel drives, a new junction chamber would be constructed at the South Shaft as well (Lachel Felice, 2007a).

### *Three-Shaft Design*

The Three-Shaft Design involves the excavation of three work shafts. Two 30-foot diameter shafts would be excavated near the First Tee parking lot, and the third shaft would be identical in form and location to the 36-foot diameter South Shaft proposed under the Two-Shaft Design. The northernmost 30-foot shaft would be excavated immediately downstream of the existing junction box. The shaft would serve as future access for performing relining operations for upstream sewer segments as required, and would provide a wet well for augmentation of bypass pumping capacity. This shaft would be the connection point for a new 48-inch lateral from the east. The second 30-foot shaft would be constructed approximately 260 feet south of the existing junction box. This “School Street Shaft” would be the connection point for an existing 48-inch lateral from the west along School Street. The shaft would also provide a recovery point for the TBM or digger shield and would accommodate the sewer connection, riser, and associated construction (Lachel Felice, 2007a).

## **2.4 ALTERNATIVE 2**

Alternative 2 avoids encountering MSW to the fullest extent possible by aligning the new sewer to the west of the estimated limits of MSW. This configuration is also designed to bypass the entire section of the circa 1915 sewer below the landfill, thereby reducing any risk of future collapse of active sewers and minimizing risks associated with disturbing the landfill material. Under Alternative 2, it is anticipated that MSW could be encountered in just two locations: the



proposed North Shaft (see description below), and to a lesser extent, over a short distance at the tunnel crown near the Bacon's Quarter Sewer Interceptor. This alternative also maximizes the new sewer's alignment in a structurally advantageous layer of Miocene clay (Lachel Felice, 2007a). As depicted in the design drawings for Alternative 2 in **Appendix B**, this alternative would involve constructing a new, gently curved bypass sewer tunnel from the Bacon's Quarter Sewer, extending northwest around the landfill, and connecting to the existing sewer near the intersection of Battery Park and Wickham Street.

At the Bacon's Quarter Sewer connection, a temporary, shored structure would be built to facilitate construction of the tunnel to the Bacon's Quarter Sewer and to allow recovery of the tunneling equipment. An optional work shaft may be constructed along this alignment in the existing parking lot near the intersection of Fendall Ave. and Bacon Street. No permanent structure would be required at this location, but the parking lot would offer a useful staging area and access point for tunnel construction should access here be required by the contractor's choice of equipment or construction methods. The tunnel drive would continue north to a point adjacent to School Street, just northwest of the First Tee Parking Lot, where another shaft, known as the "School Street Shaft" would be excavated. A new 60-inch lateral from the southwest would be connected to the new tunnel at the School Street Shaft. The tunnel drive would continue to the northwest with a curved radius extending for approximately 1,000 feet, and then veer back to the east in the direction of Battery Park. A third shaft, known as the "North Shaft," would be excavated just south of the intersection of Wickham Street and Hawthorne Avenue. This location would provide an additional staging area and an access point for the tunneling equipment. The North Shaft would also provide a connection point for an existing 72-inch lateral that would be extended from the southwest. The North Shaft would be completed with a structure to accommodate a drop connection and an access manhole riser to the ground surface. From the North Shaft, the tunnel drive would continue northeast to the "North Diversion Structure," to be located at the valley bottom in Battery Park. The existing and fully functioning portion of the BPTS would be connected to the new tunnel at North Diversion Structure (Lachel Felice, 2007b). A new lateral would be constructed along the northern portion of Fendall Avenue, and would drain the eastern neighborhoods from Yancey Street north to Wickham Street. This new 60-inch lateral would be connected at the North Diversion Structure.

The proposed tunnel would have a mined diameter of 12 feet. The final lining for the new tunnel would be 108-inch diameter FRPP or an acceptable alternative, grouted in place. The estimated time to complete Alternative 2 is approximately 301 days (Lachel Felice, 2007b).

### 3.1 GEOLOGY, TOPOGRAPHY, AND SOILS

#### *Existing Environment*

The proposed project site is in the Atlantic coastal plain. The coastal plain is underlain by layers of Cretaceous and younger clay, sand, and gravel. The youngest deposits of the coastal plain are sand, silt, and mud (MME, 2006).

The nearest fault line to the proposed project area is the New Madrid fault line, located in the Mississippi River Valley. It is the most active fault zone east of the Rocky Mountains, and seismic activity of a magnitude 5 or greater on the Richter scale has been known to occur throughout Virginia. Seismic activity within Virginia is limited to two areas of Quaternary deformation and liquefaction: the Pembroke Faults, located near Blacksburg, and the Central Virginia Seismic Zone, located about 60 miles northwest of Richmond (USGS, 2006).

The proposed project site is underlain by a Cenozoic Tertiary Miocene rock unit. The site contains soils consisting primarily of Udorthents-Dumps complex pits, but also contains Edgehill Very Gravelly Fine Sandy Loam, 2 to 6 percent slopes in the residential portions of the proposed project area. Udorthents soils consist of soil material that has been reworked by machinery. As is the case with this site, this map unit often includes fills consisting of municipal solid waste, construction debris, old building materials, stumps, and other rubble and soil material. Because Udorthents soils are so varied, on-site investigation is required to determine specific properties of permeability and runoff. The Edgehill series are deep, well drained, gently sloping to steep soils on high terraces, with dominantly clayey subsoil. Permeability is moderate, runoff is medium, and erosion hazard is severe (USDA, 1982). The topography at the proposed project site is gently undulating as a result of the contours of fill material, and the project site is located at approximately 80 feet above mean sea level.

The City of Richmond retained Schnabel Engineering South, LLC, to perform subsurface exploration of the soils along the alignment of the proposed projects. Based on the geotechnical investigations conducted on site by the city's contractors, the stratigraphy of the site was assessed and described as follows, from the ground surface down: fill, MSW, Pleistocene Age terrace deposits, Miocene Age clays and silts of the Calvert Formation, Eocene Age sands, Cretaceous Age sands, and residual soils and Petersburg granite rock (Schnabel, 2006). The extent of MSW was estimated by the city's contractors by overlaying a current topographic map atop historic topographic maps and delineating the difference in elevations. This estimate was further revised based on data collected from subsurface soil exploration, borings, and soil laboratory testing.

The Farmland Protection Policy Act states that federal agencies must "minimize the extent to which federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses..." The proposed project is not within a soil type identified as a prime or unique farmland.

#### *Affected Environment*

**No Action Alternative** – Under the No Action Alternative, no construction would occur and there would be no impacts to geology or topography. There would continue to be impacts to soils



from runoff and erosion associated with repeated flooding of Battery Park. The continual scouring of soils would also contribute sediment into the city's combined sewer system, requiring treatment and removal at the wastewater treatment plant. Combined sewer water flooding the park during extreme wet-weather events could also deposit contaminants onto the Battery Park soils.

**Alternative 1** – Under Alternative 1, no impacts to geology would occur. Construction of the new sewer section would not require excavation to bedrock. The alignment locates the new sewer section within a structurally advantageous layer of Miocene clay. Relatively minor impacts to soils and topography would occur during the excavation and construction, but most work would take place in already disturbed areas. Soils excavated from the shafts and tunnels determined to be free of hazardous materials may be used to fill the sinkhole or regraded on site as necessary. There is a high potential of encountering MSW and hazardous waste with this alternative. Effects from the excavation and construction can be mitigated by disposing of all excavated MSW according to the requirements of the Virginia Department of Environmental Quality (VDEQ). The mitigative treatment of any hazardous waste encountered is described later in this document. Implementation of appropriate Best Management Practices (BMPs), including but not limited to the installation of silt fences and revegetating bare soils to minimize erosion, can mitigate the effects on soil and topography.

**Alternative 2** – Under Alternative 2, no impacts to geology would occur, as construction of the new sewer would not require excavation to bedrock. The alignment of Alternative 2 locates the new sewer line within a structurally advantageous layer of Miocene clay. Relatively minor impacts to soils and topography would occur during the excavation and construction of the possible three work shafts and the new sewer. Soils excavated from the shafts and tunnel would be used to fill the sinkhole and regraded on site as necessary. There is some potential of encountering MSW and hazardous waste with this alternative. Effects from the excavation and construction can be mitigated by disposing of all excavated MSW according to the requirements of the VDEQ. The mitigative treatment of any hazardous waste encountered is described later in this document. BMPs, including but not limited to the installation of silt fences and revegetating bare soils to minimize erosion, can mitigate the effects on soil and topography.

## 3.2 WATER QUALITY

### 3.2.1 Surface Waters

#### *Existing Environment*

The proposed project site is approximately 2 miles north of the James River. There are no water bodies on or adjacent to the project area. Cannon Branch and Shockoe Creek, tributaries of the James River, lie to the east of the proposed project area, and both flow through underground culverts before their confluence with the James River. The waters of neither Cannon Branch nor Shockoe Creek would be affected by any of the proposed alternatives.

An approximately 1,200-acre watershed drains into the BPTS. The BPTS drains into the Bacon's Quarter Sewer Interceptor, which serves as both storage for sewage and stormwater and a conveyance to the city's wastewater treatment plant. Under normal conditions, combined



wastewater is treated and released into the James River. In extreme wet-weather events, the city is permitted by the VDEQ to release untreated combined wastewater directly into the James River up to four times a year. The city's Virginia Pollutant Discharge Elimination System (VPDES), Combined Sewer Overflow (CSO) and Municipal Separate Storm Sewer Systems (MS4) permits, issued by VDEQ, are included in **Appendix C**.

### *Affected Environment*

**No Action Alternative** – Under the No Action Alternative, there would be no impacts to surface water resources. Any floodwaters are pumped or drained into the Bacon's Quarter Sewer Interceptor and to the city's wastewater treatment plant before being released into the James River.

**Alternative 1/Alternative 2** – Under both Alternatives 1 and 2, there could be short-term impacts to surface waters from increased runoff and erosion during mobilization, excavation, and construction. During construction, the surface water that contacts exposed waste is considered leachate. Leachate typically contains a wide range of contaminants as a result of passing over or through various potentially hazardous waste materials. Discharge of the leachate directly into the Bacon's Quarter Sewage Interceptor without testing could result in the wastewater treatment plant not properly treating the discharge, and could be considered a discharge of pollutants into state waters.

In a meeting with FEMA, the Virginia Department of Emergency Management (VDEM), and VDEQ on November 8, 2006, VDEQ did not express specific concern regarding discharge of leachate into the combined sewer overflow at the Bacon's Quarter Interceptor. If conditions significantly change, coordination with VDEQ would be required. A Stormwater Pollution Prevention Plan (SWPPP) and a VPDES permit would be required prior to the start of construction and would specify BMPs to reduce the effects on water quality.

Construction of Alternative 1 or 2 could have long-term beneficial impacts on water quality. The capacity of the new sewer would be greater than the previous capacity of the BPTS. This extra sewage storage capacity may reduce the amount of untreated waste being released in the James River annually.

### 3.2.2 Groundwater

#### *Existing Environment*

The proposed project lies within a coastal plain physiographic province. The coastal plain region is composed mostly of unconsolidated deposits, primarily alternating layers of sand, gravel, shell, rock, silt, and clay, with high groundwater storage capacity.

Because the Fells Street Landfill is not lined and capped according to current regulations, rainwater and contaminated leachate permeates through the soil and MSW materials in the proposed project area. Assumed leachate was observed repeatedly in the fall of 2006 excreting from the toe of the southern slope of the Fells Street Landfill near Bacon's Quarter. The city's contractors installed piezometers across the proposed project area as part of a soil and subsurface site conditions report prepared for the project. Groundwater was recorded in the piezometers to



be at depths between 8 and 46 feet (Schnabel, 2007). The residential community surrounding the proposed project area is connected to the city's potable water supply system; there are no houses in the vicinity that rely on groundwater wells as a source of drinking water (EDR, 2006). The groundwater beneath the project area likely drains in a southerly direction and ultimately enters the James River.

### *Affected Environment*

**No Action Alternative** – Under the No Action Alternative, impacts to groundwater could occur because Battery Park would continue to flood during extreme wet weather events. As the water is being pumped, untreated floodwaters may leach into the soil and groundwater in the park.

**Alternative 1/Alternative 2** – Under both Alternatives 1 and 2, increased sediment in surface water could infiltrate the groundwater system, but the effect of this is anticipated to be negligible, and would be mitigated with appropriate BMPs specified in the applicant's MS4, VPDES, CSO, and SWPPP permits. Groundwater that contacts exposed waste is subsequently considered leachate. Leachate can drain through the soil and permeate into the groundwater, thereby contaminating the entire downstream system. The typical quality of leachate from solid waste includes heavy metals such as arsenic, barium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver, and zinc. This information on leachate quality was published after studying leachate collected both from landfills in operation prior to and after promulgation of regulations for solid waste landfills (FEMA, 2006a). It is assumed that such contaminants would be found in the Fells Street Landfill as well. The soils in and around the Fells Street Landfill have presumably been leaching contaminants into the groundwater since the landfill was established. The additional incremental amount of leachate contributed to the groundwater system as a result of construction and excavation is anticipated to be minimal. Any excavation conducted below the water table would not affect groundwater quality.

Construction of Alternative 1 or 2 could have long-term beneficial impacts on water quality. Flooding and subsequent leaching of untreated sewage and stormwater would be eliminated, resulting in a small beneficial effect on groundwater.

## **3.3 FLOODPLAINS/WETLANDS**

### *Existing Environment*

Executive Order (EO) 11988 (Floodplain Management) requires federal agencies to take action to minimize occupancy and modifications of the floodplain. Specifically, EO 11988 prohibits federal agencies from funding construction in the 100-year floodplain unless there are no practical alternatives. FEMA's regulations for complying with EO 11988 are promulgated in 44 CFR Part 9. This project is not within the 100-year floodplain. As indicated by the Flood Insurance Rate Map community panel # 510129 0010C, the entire project site is located in Zone X, an area determined to be outside of the 500-year floodplain.

According to the National Wetlands Inventory Map, no wetlands are located on or immediately adjacent to the proposed project site. Wetland soils, hydrology, and/or hydrophytic vegetation were not observed during a field investigation conducted on November 15, 2006. Because the



City of Richmond is situated along the James River, a tidal waterbody associated with the Atlantic coast watershed, the city is considered to be located within a Coastal Zone Management Area.

### *Affected Environment*

**No Action /Alternative 1/Alternative 2** – Because the proposed project is not located within the 100-year floodplain or any wetland areas, no impacts to these resources would occur. FEMA is coordinating the Coastal Zone Management Area consistency determination with VDEQ; it is anticipated that Alternative 1 and Alternative 2 would have no permanent impact on the coastal zone and would be consistent with the Virginia Coastal Resources Management Program.

## 3.4 BIOLOGICAL RESOURCES

### *Existing Environment*

The proposed project site consists of an approximately 40-acre grassy, sparsely wooded, and occasionally paved/gravel parcel. Portions of the project area are within the old Fells Street Landfill, a city dump that was used for municipal solid waste from about 1930 to 1979. A FEMA environmental specialist conducted a field review of biological resources on the proposed project area on November 15, 2006. Species typical of disturbed sites were observed, including tree-of-heaven (*Ailanthus altissima*), raspberry (*Rubus hispidus*), white mulberry (*Morus alba*), Siberian elm (*Ulmus pumila*), English ivy (*Hedera helix*), various grasses (*Poa spp.*) and various mint species (*Mentha spp.*). The proposed project site supports wildlife common to suburban areas in Virginia, including songbirds, reptiles, amphibians, small mammals, and occasional white-tailed deer (*Odocoileus virginianus*).

According to the U.S. Fish and Wildlife Service (USFWS, 2006b), the bald eagle (*Haliaeetus leucocephalus*) is the only federally listed threatened or endangered species that occurs in the City of Richmond. As there are no open waterbodies on or near the project area, the potential for bald eagle habitat on site is limited. On November 14, 2006, FEMA requested a project review by USFWS. USFWS responded via electronic mail indicating they have no comments on the proposed project (**Appendix D**).

### *Affected Environment*

**No Action Alternative** – Since no action will occur other than maintenance to existing structures, no impact to biological resources is anticipated.

**Alternative 1/Alternative 2** – Under both alternatives, the proposed project area would be cleared of vegetation and graded as necessary for staging, construction, and excavation. This vegetated land primarily sitting atop and adjacent to the old Fells Street Landfill would be temporarily disturbed by construction and excavation activities. The majority of the affected area would be seeded and allowed to revegetate after completion of the construction activities. Some small areas totaling less than 1 acre in size in and around the work shafts would be permanently converted to BPTS use. Any impacts to biological resources would be mitigated by BMPs.



### 3.5 AIR QUALITY

#### *Existing Environment*

Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) establishes primary and secondary air quality standards. Primary air quality standards protect the public health, including the health of “sensitive populations, such as people with asthma, children, and older adults.” Secondary air quality standards protect public welfare by promoting ecosystems health and preventing decreased visibility and damage to crops and buildings. EPA has set national ambient air quality standards (NAAQS) for six of the following criteria pollutants; ozone (O<sub>3</sub>), particulate matter (PM<sub>2.5</sub> and 10), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), and lead (Pb). According to the VDEQ, the City of Richmond is classified as a non-attainment area for ozone, meaning one or more criteria air pollutants (ozone) exceed the NAAQS (VDEQ, 2007b).

There is a high level of nuisance odors in the area during and after rain events, when untreated sewage floods areas of Battery Park. There are no known health effects from these odors, but they have a considerable impact on the quality of life in the surrounding community. Nuisance odors are not regulated by the EPA.

Portions of the project site are within the Fells Street Landfill, which has a long history of landfill gas migration issues. The landfill is an unpermitted site that was closed prior to the promulgation of solid waste regulations. In 1975, an explosion in a 4-unit apartment building, caused by heavy concentrations of methane from the landfill, initiated a series of improvements to the landfill. As a result of the explosion, the City of Richmond purchased and demolished the building. A City Ordinance adopted on October 27, 1975, included funding for gas migration control systems at various landfills in their Capital Improvement Projects. Between 1975 and 1977, the city hired a consultant to design and install a gas extraction and gas migration control system. The city also installed a gas monitoring system in A.V. Norrell Elementary School. These systems went online in 1977, and consisted of extraction wells, laterals (to each well) and headers, condensate traps, flares, and monitoring probes (FEMA, 2006a).

Based on the results of the borings performed in the area of the proposed work, it appears the presence of landfill gas is at levels approaching the lower explosive limit (LEL), which is 5 percent methane by volume, and was as high as 24 percent methane by volume—nearing the upper explosive limit (UEL). Although there has been a gas extraction and collection system in place since 1977, it is unclear if that system is still operational today (FEMA, 2006a). FEMA requested any historic information related to the gas collection and control system; the City of Richmond provided a sketch of monitoring station locations where they have been taking gas readings since the start of the construction efforts at the BPTS project site. Monitoring results were also included with this package, and are included in this EA as **Appendix E**. The city has committed to continue to take readings throughout the period of construction, and will prepare monthly reports and submit them, as requested, to FEMA. According to an internal VDEQ memorandum, in 1993, after a series of complaints of headaches and coughs from teachers at A.V. Norrell School that eventually led to a congressional inquiry of the Fells Street Landfill, the City of Richmond issued a request for proposals (RFP) to upgrade and maintain the gas migration system. After investigations by the city’s consultant, VDEQ, the Occupational Safety and Health Administration (OSHA), and Virginia Commonwealth University Medical



Department, the landfill and school were deemed safe, and the congressional inquiry was dismissed, though repairs to the system were suggested (VDEQ, 2001). The results of the investigation revealed that the landfill did not pose health, safety, and environmental threats or exhibit signs or conditions that would define it as an open dump. Repairs to the system have been made as recently as 2002; however, details of those repairs have not yet been made available.

The existing flare (the control device which burns off the gas) is located south of the A.V. Norrell Elementary School in an area that flooded during and after the incident period. The Applicant has stated that the landfill does not produce enough decomposition gas to ignite the flare.

Landfill gas consists of a mixture of various gases, some of which are listed below, and traces of sulfides, CO, and non-methane organic compounds (NMOCs):

- Methane (45-60 percent)
- Carbon Dioxide (40-60 percent by volume)
- Nitrogen (2-5 percent by volume)
- Oxygen (0.1-1.0 percent by volume)
- Ammonia (0.1-1.0 percent by volume)
- Hydrogen (0-0.2 percent by volume)

Landfill gas reaches a stable production rate at around 20 years once decomposition begins, then continues to produce but at a declining rate for 50 years or more (FEMA, 2006a). It is, therefore, expected that landfill gas is still an issue of concern for the Fells Street Landfill, and specifically for the proposed activities.

The proposed project location is aligned to the west of the landfill to minimize the amount of landfill disturbance to the greatest extent possible. Though gas levels are currently being monitored at the surface level on the project site, potential gaseous conditions may develop during sub-surface excavation and construction.

### *Affected Environment*

**No Action Alternative** – Since there will be no action under this alternative, it is anticipated that there will no long-term impacts to air quality. Repeated flooding of Battery Park would continue to contribute nuisance odor to the surrounding neighborhoods, a temporary effect.

**Alternative 1/ Alternative 2** – Under both Alternatives 1 and 2, temporary impacts to air quality may occur during excavation and construction of the new BPTS. Based on the results of the soil samples and boring logs taken along the proposed project alignment, the city’s contractors anticipate “potentially gassy conditions” inside of the work shafts and tunnel. A Health and Safety Plan has been established accordingly, and is discussed further in this document. To mitigate temporary impacts to air quality, the construction contractors would be required employ BMPs, including monitoring for methane and other landfill gasses, and watering down construction areas when necessary. Emissions from fuel-burning internal combustion engines (e.g., heavy equipment and earthmoving machinery) could temporarily increase the levels of some of the criteria pollutants, including CO, NO<sub>2</sub>, O<sub>3</sub>, PM<sub>10</sub>, and non-criteria pollutants such as



Volatile Organic Compounds (VOCs). To reduce the emission of criteria pollutants, fuel-burning equipment running times would be kept to a minimum and engines would be properly maintained. In written correspondence with FEMA, VDEQ has required that transitions between soil and waste material be properly sealed to prevent migration of landfill gasses (**Appendix D**).

Long-term impacts to air quality are not anticipated as a result of the actions proposed under either Alternative 1 or Alternative 2. Design drawings depicting the proposed alignment, as well as the existing gas collection system, would be developed to avoid inadvertently encountering the gas system during construction.

### 3.6 TRANSPORTATION

#### *Existing Environment*

The proposed project area is located north of the CSX railroad tracks, east of Hickory Street and the southern portion of Fendall Avenue, and south of Wickham Street. School Street and West Bacon Street provide the primary access routes to and from the Fells Street Landfill and the First Tee Golf Course areas. Immediately following the incident period and the subsequent Battery Park flooding, portions of several streets, including Fendall Avenue, W. Fells Street, Hickory Street, and School Street were closed for the purpose of routing the 18-inch emergency discharge pipes along the roadways. In October 2006, these pipes were relocated to public right-of-ways to allow vehicular access to these residential streets.

#### *Affected Environment*

**No Action Alternative** – Under the No Action Alternative, no additional construction will occur, and the ongoing pumping operation does not have a significant effect on traffic in the area.

**Alternative 1** – Under Alternative 1, temporary impacts to transportation or site access are anticipated. There would be temporary road closures and an increase of construction traffic on roads in the immediate vicinity of the proposed project site for the duration of the construction phases. To mitigate potential delays and nuisances, construction vehicles and equipment would be stored on site in the equipment staging areas during project construction, and appropriate signage would be posted on affected roadways. Equipment staging areas would be located in the existing parking lot to the west of the intersection of Bacon Street and Fendall Avenue and the parking lot of the First Tee Golf Course. Road closures are anticipated primarily along the southern portion of Fendall Avenue and School Street; however, portions of Yancey would be closed for the construction of the 60-inch lateral. Alternative street parking is available throughout the neighborhoods. Possible road closures are depicted on **Figure 5**.

The southern portion of the proposed project area is bounded by the CSX railroad tracks, an active rail line. The City of Richmond would be responsible for negotiating any potential interference issues or necessary access rights directly with CSX. Impacts to railway traffic are not anticipated.

**Alternative 2** – Under Alternative 2, temporary short-term impacts to transportation or site access are anticipated. There would be temporary road closures and an increase of construction



traffic on roads in the immediate vicinity of the proposed project site for the duration of the construction phases. To mitigate potential delays and nuisances, construction vehicles and equipment would be stored on site in the equipment staging areas during project construction, and appropriate signage would be posted on affected roadways. Equipment staging areas would be located in the existing parking lot to the west of the intersection of Bacon Street and Fendall Avenue, in the parking lot of the First Tee Golf Course, and near the location of the northernmost shaft, south of the intersection of Wickham Street and Hawthorn Street. Road closures are anticipated in both the eastern and western neighborhoods; however, alternative street parking is available on adjacent residential streets. Possible road closures are depicted on **Figure 6**.

The southern portion of the proposed project area is bounded by the CSX railroad tracks, an active rail line. The City of Richmond would be responsible for negotiating any potential interference issues or necessary access rights directly with CSX. Impacts to railway traffic are not anticipated.

### 3.7 NOISE

#### *Existing Environment*

Sound is most commonly measured in decibels (dB) on the A-weighted scale, which is the scale most similar to the range of sounds that the human ear can hear. The Day-Night Average Sound Level (DNL) is an average measure of sound. The DNL descriptor is accepted by federal agencies as a standard for estimating sound impacts and establishing guidelines for compatible land uses.

Noise, defined herein as undesirable sound, is federally regulated by the Noise Control Act of 1972 (NCA). Although the NCA gives the EPA authority to prepare guidelines for acceptable ambient noise levels, it only charges those federal agencies that operate noise-producing facilities or equipment to implement noise standards. EPA guidelines, and those of many other federal agencies, state that outdoor sound levels in excess of 55 dB DNL are “normally unacceptable” for noise-sensitive land uses such as residences, schools, or hospitals.

Noise levels associated with the proposed project area are already at elevated levels as a result of the ongoing emergency pumping operation. There are noise-sensitive areas immediately adjacent to the proposed project site, including residential neighborhoods and A.V. Norrell Elementary School. However, the school was closed in September in response to the Battery Park flooding. The City of Richmond has a noise ordinance which enumerates loud or disturbing acts; the proposed construction associated with the BPTS alternatives do not fall into these categories.

#### *Affected Environment*

**No Action Alternative** – Intermittent noise associated with the emergency pumping operations would continue indefinitely.

**Alternative 1/Alternative 2** – Under both alternatives, no long-term noise impacts would occur. During the construction period, temporary short-term increases in noise levels are anticipated. The proposed project would involve construction noise typical of underground tunneling



operations, including noise from equipment that ranges from approximately 74 dB to 90 dB (FHWA, 2006). To mitigate nuisance noise to the surrounding neighborhoods during the construction period, construction activities would take place primarily during normal business hours. Equipment and machinery would meet all local, state, and federal noise regulations. Long-term noise impacts associated with the emergency pumping operation would be eliminated.

### 3.8 CULTURAL RESOURCES

Cultural resources include archaeological or cultural sites, standing structures, and other historic properties considered to be eligible for or listed on the National Register of Historic Places (NRHP). Section 106 of the National Historic Preservation Act of 1966 (NHPA) mandates that federal agencies consider the impact of their undertakings on historic properties within the project's area of potential effect (APE). If adverse effects on historic, archaeological, or cultural properties are identified, then agencies must attempt to avoid, minimize, or mitigate these impacts to resources considered significant for local, state, or national history.

The NHPA, as amended, was passed by Congress to create a National Historic Preservation Program (NHPP). The NHPA established the Advisory Council on Historic Preservation (ACHP), State Historic Preservation Offices (SHPOs), and the NRHP. Consideration of impacts to historic properties is mandated under Section 106 of the NHPA, as amended, and implemented by 36 CFR Part 800 and the Programmatic Agreement in effect between the Virginia Department of Historic Resources (VDHR) and FEMA.

Requirements include the identification of significant historic properties and a determination whether these properties may be affected by the proposed federally funded or assisted project. For the purposes of Section 106, the criteria for evaluating archaeological sites, buildings, structures, districts, and objects to determine their eligibility for listing in the NRHP is defined in 36 CFR 60.4. Coordination under Section 106 must be completed prior to initiating any undertaking.

As defined in 36 CFR Part 800.16(d), the APE "is the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist." In addition to identifying historic properties that may exist in the proposed project's APE, the federal agency must also determine, in consultation with the appropriate SHPO, what effect, if any, the action would have on historic properties. Moreover, if the project phases would have an adverse effect to these properties, the federal agency must consult with the SHPO on ways to avoid, minimize, or mitigate the adverse effects.

The project's APE for archaeological resources is defined as the proposed construction limits of disturbance. The APE for architectural resources (buildings, structures, and districts) is defined as the archaeological APE, plus the project's view-shed.

#### *Existing Environment*

Research through the VDHR Data Sharing System (DSS) database indicates that the project area is near two historic districts (**Figure 7**).

Battery Court Historic District (VDHR # 127-5897), settled in the late 19<sup>th</sup>–early 20<sup>th</sup> centuries, begins at the north end of the project area. On October 9, 2003, the district was listed on the



NRHP. The oldest structures in the district include 19<sup>th</sup> century Victorian homes on spacious urban lots. Streetcar lines provided residents with quick transportation to downtown Richmond. The neighborhood is bisected by a natural ravine known as Battery Park. The names “Battery Court” and “Battery Park” are derived from their proximity to a Civil War-era defensive structure. Maps available through the Library of Congress indicated that a ring of 16 defensive artillery battery positions encircled the city. Battery #8, or Dove’s Battery, was located near the southeastern corner of the district. Civil War-era maps also indicate that a smaller line of fortification trenches was built near the southwest edge of the district to guard the roads between Battery #8 and Battery #9 (Bow’s Battery) to the west.

The City of Richmond’s Battery Park is a historically significant recreational facility in the ravine running through Battery Court Historic District. The 11.8-acre city park was developed starting in the 1920s. The Arthur Ashe Tennis Courts within the park are named after Richmond native Arthur Robert Ashe, Jr. (7/10/1943- 2/6/1993). Ashe was among the first African Americans to gain prominence in the sport of tennis. In addition to his three Grand Slam titles and other tennis achievements, Ashe was a social activist. Ashe is honored locally with a statue on Monument Avenue, which is otherwise reserved for key figures of the Confederacy. The Arthur Ashe Athletic Center, another facility named after Ashe in northern Richmond, served as an emergency shelter for the 250 homes evacuated near Battery Park in September 2006 after Tropical Depression Ernesto.

Bounding the project area on the east is the Town of Barton Heights Historic District (VDHR # 127-0816), another streetcar suburb of northern Richmond settled in the late 19<sup>th</sup> –early 20<sup>th</sup> centuries. On August 6, 2003, the district was listed on the NRHP. Barton Heights is named after James Barton, an Arkansas real estate developer who made 200 lots available there starting in 1889. Ornate Queen Anne-style dwellings were built on the spacious lots throughout the 1890s. Varieties introduced to the neighborhood in the early 20<sup>th</sup> century include American four square and bungalow style houses.

The Barton Heights Cemeteries (VDHR # 44HE0779/127-5679) are located within the southern part of the Town of Barton Heights historic district. The site contains six adjacent cemeteries established between about 1815 and 1865 by African American churches, fraternal orders, and benevolent societies. On April 10, 2002, the site was listed on the NRHP. A roadside marker installed near the cemeteries by the VDHR describes its history to visitors.

A Programmatic Agreement between FEMA, VDHR, and VDEM existed prior to the disaster declaration for Tropical Storm Ernesto. The Programmatic Agreement took effect in April 2003 and it is on file with each of the above-named agencies.

Following Tropical Storm Ernesto, initial coordination between FEMA and the VDHR began on October 4, 2006. At that time, VDHR was informed that a disaster had been declared and that additional consultations related to recovery activities were anticipated. The correspondence indicated that FEMA would incorporate procedures and allowances as outlined in the Programmatic Agreement to fulfill NHPA Section 106 responsibilities.

### *Affected Environment*

**No Action Alternative** – Under the No Action Alternative, the BPTS would not be relocated, and the current temporary repair measures would continue indefinitely. This alternative would



have a detrimental effect on local historic resources. The historic Battery Park recreational facility would remain closed and fenced off due to the potential for contamination. The two Historic Districts would continue to be inundated with flood water during heavy rains. Repeated floods could irreparably damage historic structures and make the neighborhoods unsafe for occupation.

**Alternative 1** – Consultations related to the Battery Park Trunk Sewer Project were initiated in a meeting between VDHR and FEMA staff on December 4, 2006. Construction plans for Alternative 1 (two-shaft design) were presented at the meeting. The parties agreed that archaeological testing and monitoring for a portion of the project area would be required.

On December 12, 2006, FEMA archaeological staff conducted a Phase I survey in the area specified during the meeting. FEMA concluded that the test area was highly disturbed and did not contain any significant archaeological deposits. On December 14, 2006, VDHR concurred with the FEMA finding that Alternative 1 (two-shaft design) would have no effect on historic properties, and should significant cultural deposits be identified during the construction monitoring, FEMA would notify VDHR pursuant to 36 CFR Part 800.13 Post-review discoveries.

Alternative 1 (three-shaft design) was presented to VDHR in a meeting with FEMA staff on February 28, 2007. Construction designs indicated that the three shafts would be located in the former landfill and did not pose any threats to historical resources. VDHR concurred with FEMA that Alternative 1 (three-shaft design) would have no effect on historic resources.

FEMA and VDHR concur that Alternative 1 will have no effect on historic properties. Any visual impacts to the two Historic Districts will be temporary in nature, since no permanent aboveground structures are planned. The excavation of the shafts in both the two-shaft and three-shaft designs is not expected to disturb historic resources due to their location in the former landfill. Limited Phase I archaeological testing was conducted on the Alternative 1 eastern lateral pipeline, but the area was found to be extensively disturbed. Due to the possibility of encountering deeply buried intact archaeological deposits, monitoring was recommended during the excavation of the lateral pipelines. If significant cultural deposits are identified during the construction monitoring, FEMA will notify the VDHR pursuant to 36 CFR Part 800.13 Post-Review Discoveries. A representative from the City of Richmond and/or FEMA will be present during the lateral pipeline excavation in order to identify and evaluate any possible extant archaeological resources. A layered removal approach may be pursued during the monitoring process, if requested by FEMA staff. If a possible cultural feature is identified, work will be halted immediately until the resource is examined and formally documented in written and/or photographic format. If the monitoring archaeologist determines that cultural features (such as walls, deposits, or foundations) are present, then all work in that location shall stop. Work will resume once all parties agree on the best course of action for recovering information from the identified feature. This process may involve consultation between FEMA and VDHR regarding the NRHP eligibility status of any identified materials.

**Alternative 2** – On February 7, 2007, FEMA contacted VDHR regarding Alternative 2, the longer tunnel design. FEMA did not recommend any additional archaeological testing, but construction monitoring in certain areas was prescribed. VDHR concurred with these recommendations on February 13, 2007, on the condition that contractors would return any areas within the Historic Districts to their original contour.

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FEMA and VDHR concur that Alternative 2 will have no effect on historic properties, provided that contractors return any areas within the Historic Districts to their original contour. This stipulation, and the fact that no new permanent above ground structures are planned, will insure that any visual impacts to the Historic Districts are temporary in nature. Due to the possibility of contamination and surface disturbance, no archeological testing was recommended in the recreational park. Archeological monitoring of all ground disturbing activity in the park was recommended, however. Additional monitoring was also recommended during the construction of the lateral sewer lines. Monitoring will be conducted in the manner prescribed for Alternative 1.

### 3.9 SOCIOECONOMIC RESOURCES

#### *Existing Environment*

The neighborhoods surrounding the project site contain a variety of housing and business properties that were affected by the disaster. Those property types include single-family and multi-family houses, commercial, community, and institutional facilities, and green/open space. According to the U.S. Census Bureau, the proposed project site is located within census tract 111. The total population of census tract 111 in 2000 was 3,329 people, with an unemployment rate of 17.6 percent and 62.7 percent of the population participating in the labor force. The median household income within census tract 111 in 2000 was \$27,091, and 21.4 percent of individuals were living in poverty. The leading employment sectors are management, professional, and related occupations (30 percent); service occupations (24 percent); and sales and office occupations (22 percent) (USCB, 2000).

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, directs federal agencies to “make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low income populations in the United States...”

According to the 2000 population census, within the Commonwealth of Virginia, the overall population is more than 72 percent white, as compared with less than 4 percent within the project area. **Table 1** compares demographic data in the vicinity of the proposed project area to data for the City of Richmond, the Commonwealth of Virginia, and the United States. Disaster recovery for minority and low-income groups can be exacerbated by a lack of financial resources to repair damaged residences and replace personal property.





unsanitary conditions. These could cause water damage to single and multi-family homes and businesses, and would drive down property values. Some residents may eventually choose to relocate, and residents lacking the means or resources to relocate may find themselves living in unsanitary conditions, should future sewage back-ups occur.

**Alternative 1/Alternative 2** – Under Alternative 1 and 2, there would be no disproportionate adverse impacts anticipated on minority or low-income populations. All populations would benefit from the repairs to the BPTS. No permanent employment positions would be created or lost. Temporary jobs would be created during the construction and excavation of the new BPTS. Gas stations, fast-food restaurants, and other businesses along Chamberlayne Avenue, the nearest commercial area to the site, may experience a small temporary increase in business as a result of contractors associated with the proposed project frequenting their establishments. The economic impacts of Alternative 1 are not significant as related to jobs or increased business revenue, but are very significant as related to the private property values in the Battery Park neighborhoods.

### 3.10 SAFETY

#### *Existing Environment*

Safety and security issues considered in this EA include the health and safety of the area residents and the public at large, and the protection of personnel involved in activities related to the proposed relocation of the BPTS. Established safety and security plans include, but are not limited to, fire protection systems, security procedures, and emergency planning and procedures. Issues related to safety and security are of particular concern with the proposed project, as there are potentially hazardous materials within the project area and a residential community immediately adjacent to the proposed work area.

In the days following the initial flood event, 8-foot chain link security fencing was placed around primary access points of the project area, because of the risk of exposure to contaminants contained in the floodwaters. Several houses on the perimeter of the project area have been condemned by the City of Richmond. On January 24, 2007, the Richmond City Council approved the purchase of \$5 million worth of floodprone property. The properties will be demolished and the land will be converted to recreational use (Richmond, 2007).

The city has implemented a health and safety plan that establishes protocols such as employee safety awareness training, periodic inspections and audits, accident report procedures and processing, and record keeping functions, for the duration of the proposed project.

EO 13045, Protection of Children, requires federal agencies to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. The A.V. Norrell Elementary School is located within a 1-mile radius of the project area. A.V. Norrell Elementary has been closed since the flooding began, and the students have been relocated to Patrick Henry Elementary School, located about 5 miles from the project area.

#### *Affected Environment*

**No Action Alternative** – Under the No Action Alternative, safety risks associated with contaminated water repeatedly flooding Battery Park would continue. Despite the security



fencing that was installed to limit entry to hazardous areas, there is a potential of trespassers, including children, gaining access. These hazardous areas include contaminated areas of Battery Park or the unstable soils and large sinkhole on the Fells Street Landfill, which may seem benign to the general public. Fencing should be upgraded to ensure the safety of neighborhood residents. The No Action Alternative also has the potential of the temporary pumping operation failing. Any interruptions in sanitary sewer service pose human health concerns.

Because the students of A.V. Norrell Elementary School have been moved to an alternate location, no disproportionate risks to the health and safety of children are anticipated.

**Alternative 1/Alternative 2** – In the short-term, the construction of work shafts and the underground tunnels would present potentially serious health and safety risks to the contractors performing the work. To minimize risks to safety and human health, all construction activities would be performed using qualified personnel trained in the proper use of the appropriate equipment, including all appropriate safety precautions. Additionally, all activities would be conducted in a safe manner in accordance with the standards specified in OSHA regulations. The appropriate signage and barriers should be in place prior to construction activities, to alert pedestrians and motorists of project activities. Access to unsafe areas and heavy equipment would be restricted during the construction activities (e.g., site grading), and signage would be posted to warn of unsafe conditions. During site grading and tunneling operations, access to the site will be restricted. Measures will be taken to ensure adequate access to the site for the safe ingress and egress of fire and emergency vehicles.

Borings performed along the proposed alignment indicate the presence of landfill gas (i.e., methane). At some sampling points, the levels were at levels of concern (high percentage of the LEL of methane) or at levels approaching the LEL. Concentrations of methane at the LEL mean the gases have the potential for ignition (FEMA, 2006a). The presence of methane in excavation, and especially tunneling, is a specific concern for the health and safety of the workers. Special precautions must be taken during excavations to ensure that landfill gases do not build up to explosive limits in the excavations/tunnels.

Due to the complex nature of the construction and excavation activities proposed, it is anticipated that Alternatives 1 and 2 would pose a moderate risk to the safety of neighborhood residents and onsite construction crews. These risks can be mitigated by employing the guidelines established in the city's Health, Safety, and Environment Management Plan (**Appendix F**).

### 3.11 HAZARDOUS MATERIALS

#### *Existing Environment*

Hazardous substances are defined as any solid, liquid, contained gaseous or semisolid waste, or any combination of wastes that pose a substantial present or potential hazard to human health and the environment. Hazardous substances are primarily generated by industry, hospitals, research facilities, and the government. Improper management and disposal of hazardous substances can lead to pollution of groundwater or other drinking water supplies, and the contamination of surface water and soil. The primary federal regulations for the management and disposal of hazardous substances are the Comprehensive Environmental Response,



## SECTION THREE

## Affected Environment and Impacts

Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA).

An Environmental Data Resources (EDR) Hazardous Materials search was conducted in October 2006. Table 2 summarizes the results of the database search. No recognizable hazardous materials or wastes were identified at the proposed project site during the September 28, 2006, site visit.

**Table 2: Summary of Hazardous Materials Database Search**

Facility	Address	Hazardous Materials	Status
A.V. Norrell Elementary School	2120 Fendall Ave	CERCLIS	Discovery
Rehig International Inc	901 N Lombardy	CORRACTS	Violations exist; No further remedial action planned
Research Glass Company	704 Dawn St	LUST, LTANKS	Removed; Facility closed
Julian Graham Chevrolet	1801 Chamberlayne Ave	LUST, LTANKS	Removed; Facility closed
Hertz Penske Truck Leasing	1903 Chamberlayne Ave	LUST, LTANKS	Removed; Facilities closed
Arcet Equipment Company	1700 Chamberlayne Ave	LUST, LTANKS	Facilities closed
Phoenix Roofing	611 Wickham St	LUST, LTANKS	Facilities closed
Aboulhosn Mobil	2032 Chamberlayne Ave	LUST, LTANKS	Facilities closed
National Linen Service	1414 Chamberlayne Ave	LUST, LTANKS	Facilities closed
USRY Properties Building	1415 Chamberlayne Ave	LUST, LTANKS	Facilities closed
USPS Vehicle Maintenance Facility	1001 School St	LUST, LTANKS	Facilities closed
Virginia Parts and Equipment	2207 Tazewell St	LUST, LTANKS	Facilities closed
Robertson Automatic Transmission	2219 Tazewell St	LUST, LTANKS	Facilities closed
North Avenue Food Market	2301 North Ave	LUST, LTANKS	Facilities closed
Automotive Rebuilders	1505 High St	LUST, LTANKS	Violations exist
P E Eubank and Company	1518 High St	LUST, LTANKS	Facilities closed
Seiberts Chamberlayne Texaco	2021 Chamberlayne Ave	LUST, LTANKS	Facilities closed; No violations found
Hertz Equipment Rental Corp.	2219 Chamberlayne Ave	LUST, LTANKS	Facilities closed
Gay Jeff Residence	316 Overbrook Rd	LUST, LTANKS	Facilities closed
Shipping Supplies Inc	1514 Brook Rd	LUST, LTANKS	Facilities closed; No violations found
General Builders Inc.	1501 Sledd St	LUST, LTANKS	Facilities closed
Price Auto Service	1617 Brook St	LUST, LTANKS	Facilities closed
Martin Brothers Roofing	1531 Saint James St	LUST, LTANKS	Facilities closed
Champs Auto Parts	2303 Chamberlayne Ave	VA VRP	Contaminants confirmed at levels of concern
Richmond City Gas Works	Axtell Street	Gas Plant	unknown

Source: Environmental Data Resources, Inc. 2006. <http://www.edrnet.com>



No further information was available from EDR on the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) site at A.V. Norrell Elementary School; however, VDEQ and EPA are aware of CERCLIS standing at the school. The remaining sites, while located within a 1-mile radius from the proposed project site, do not present hazardous waste issues related to the proposed BPTS repair. The EDR report is included as **Appendix G**

MSW is defined by the Virginia Administrative Code as “waste which is normally composed of residential, commercial, and institutional solid waste and residues derived from combustion of these wastes.” The formation of the sink hole in the southern section of the project area afforded an unusual opportunity to observe a significant cross section of the waste placed in that portion of the landfill. Observations confirm that the material contained in the landfill, at least in the area of the sinkhole, consists of typical household wastes. Other materials observed included car parts, metal pieces, bricks, burnt wood, asphalt, and other construction and demolition debris.

The extent of MSW at the Fells Street Landfill was estimated by the city’s contractors by overlaying a current U.S. Geological Survey (USGS) topographic quadrangle map atop historic topographic maps and delineating the difference in elevations. This estimate was further revised based on data collected from subsurface soil exploration, borings, and soil laboratory testing. The city’s contractors estimate that approximately 3 million cubic yards (cyds) of fill material (waste and cover material fill) is contained within the boundary. Based on the location of the landfill gas extraction system in the parking lot in the southwest corner of the proposed project area, and a review of the boring logs in that area, FEMA suggested the estimated limits of waste in the southwest corner be further modified to include the area indicated by the solid green line in **Figure 8**. This adjustment is corroborated by the results of the boring logs in that area, which indicate the presence of MSW. Further review of the boring logs indicates that the putrescible waste is intermixed with the construction and demolition waste in the areas of the borings (FEMA, 2006a). The borings were performed along the proposed alignments and portions of the emergency overflow relief pipe; the summary of the subsurface exploration is included in **Appendix H**

It is not possible to accurately estimate how much of the 3 million cubic yards of material contain hazardous constituents without field sampling the entire landfill. Based on the results of the boring logs, however, it can be assumed the site does contain some quantities of hazardous waste. According to the sampling results, there were 10 composite samples collected and tested out of 3,100 cyds of excavation. One of the 10 composite samples contained hazardous waste, which represents a rate of 10 percent; however, this rate cannot be assumed to apply to the entire site (FEMA, 2006a).

Due to the unknown nature and origin of the waste contained in the landfill, the VDEQ required that the Applicant prepare a sampling plan that outlines the procedures and protocol for evaluating the waste to determine if any of it is hazardous. It is understood that the sampling plan has been reviewed and approved by VDEQ, and VDEQ is satisfied that the guidelines are sufficient for protecting the public from the exposure to possible hazardous waste during construction (FEMA, 2006a). The Sampling and Analysis Plan is included as **Appendix I**.





hazardous materials are encountered during construction, all hazardous materials shall be remediated, abated, or disposed of as appropriate, and otherwise handled in accordance with applicable local, state, and federal regulations. If a sufficient amount of hazardous waste is encountered requiring notification of the EPA, it will be necessary to coordinate the removal with the EPA and VDEQ to ensure both agencies accept the proposed removal action.

Under Alternative 2, there is a potential of encountering hazardous waste, effects can be mitigated by proper handling and treatment as described above.



FEMA is the lead federal agency for conducting the NEPA compliance process for the BPTS relocation project in the City of Richmond, Virginia. It is the goal of the lead agency to expedite the preparation and review of NEPA documents, and to be responsive to the needs of the community and the purpose and need of the proposed action, while meeting the intent of NEPA and complying with all NEPA provisions.

The City of Richmond notified the public of the proposed project via notices for the construction of the emergency overflow relief pipe in the *Richmond Times* and *The Richmond Free Press* newspapers on December 17th and December 24th, 2006 (See **Appendix K**). The project description was available for review between these dates at the Norrell Annex, located at 201 W. Graham St., and at the North Side Public Library, located at 2901 North Avenue in Richmond, Virginia. The city has published regular “Battery Park Update” newsletters as well, to inform the neighborhood residents of new developments concerning the BPTS. These publications were produced by the Communications Division of the City of Richmond Department of Public Utilities in conjunction with other city agencies. The newsletters were distributed bi-weekly beginning September 9, 2006, and are posted on the Department of Public Utilities’ website. The newsletters contain information on the construction process, disinfection and management plans, community civic association meeting dates, and general flood information. Furthermore, since the incident period, representatives from the city have regularly attended the meetings of the Battery Park Civic Association and the Brookfield Gardens Civic Association to field questions and offer information.

The objective of the public participation process is to provide parties interested in or affected by the proposed project the opportunity to comment on the draft EA. FEMA used its discretion in determining the public comment period duration necessary to meet its NEPA obligations and other applicable environmental laws, and in consideration of the situation’s urgency and the action’s anticipated level of controversy. A 15-day public comment period, for which a precedent has previously been established, has been determined to be sufficient for this proposed action. A public notice was published in the *Richmond Times-Dispatch* newspaper on March 11, 2007, and in *The Richmond Free Press* newspaper on March 15, 2007. The draft EA was made available to the public at the North Side Public Library, and was posted on FEMA’s website at <http://www.fema.gov/plan/ehp/envdocuments/ea-region3.shtm>. A copy of this notice is included as **Appendix L**.



The following agencies and organizations were contacted by a letter requesting project review during the preparation of this EA. If required for NEPA documentation, agencies (marked with an asterisk [\*]) were asked to submit a formal response. Letters received to date are included in **Appendix D**.

### *Federal*

- U.S. Department of Agriculture, Natural Resources Conservation Service
- EPA, Region 3, Water Protection Division
- EPA, Region 3, Waste and Chemicals Management Division
- EPA, Region 3, Mid-Atlantic Air Protection Program
- USFWS, Virginia Field Office

### *State*

- VDHR\*
- VDEQ, Piedmont Region\*
- Virginia Department of Agriculture and Consumer Services
- Virginia Department of Health
- Natural Resources Conservation Service, Virginia State Office

In accordance with applicable local, state, and federal regulations, the applicant would be responsible for acquiring any necessary federal, state, or local permits prior to commencing construction at the proposed project site.



The following table summarizes the potential impacts of the No Action Alternative, Alternative 1, and Alternative 2, and mitigation measures to offset those impacts:

**Table 3. Potential Impacts of No Action Alternative and Alternatives 1 and 2**

<b>Affected Environment</b>	<b>No Action</b>	<b>Alternative 1 Impacts</b>	<b>Alternative 2 Impacts</b>	<b>Mitigation Measures/Conditions</b>
<b>Geology, Topography, and Soils</b>	No impact to geology or topography. Continued flooding has potential to contaminate and erode soils.	No impacts to geology; minor impacts to topography and soils would occur during the construction period.	No impacts to geology; minor impacts to topography and soils would occur during the construction period.	Appropriate BMPs, such as installing silt fences and revegetating bare soils immediately upon completion of construction, to stabilize soils.
<b>Surface Water</b>	No impact.	No impacts to surface waters are anticipated	No impacts to surface waters are anticipated.	Appropriate BMPs, such as installing silt fences and revegetating bare soils, would minimize runoff. Acquire appropriate VA permits.
<b>Floodplains/Wetlands</b>	No impact.	No impact.	No impact.	FEMA will coordinate CZMA consistency determination with VDEQ.
<b>Groundwater</b>	Continued flooding has potential to leach combined sewage into groundwater.	No impact.	No impact.	Appropriate BMPs, such as installing silt fences and revegetating bare soils, would minimize runoff. Acquire appropriate VA permits.
<b>Biological Resources</b>	No impact.	Short-term impacts to biological resources would occur during the construction period.	Short-term impacts to biological resources would occur during the construction period.	None. Disturbed areas would be left to revegetate naturally.



# SECTION SIX

## Conditions and Mitigation Measures

Affected Environment	No Action	Alternative 1 Impacts	Alternative 2 Impacts	Mitigation Measures/Conditions
<b>Air Quality</b>	Nuisance odors from untreated sewage flooding areas of Battery Park would continue intermittently during rain events. No other impact.	Short-term impacts to air quality would occur during the construction period. Nuisance odors would be eliminated.	Short-term impacts to air quality would occur during the construction period. Nuisance odors would be eliminated	Contractors would be required to monitor air quality while excavating in potentially gassy conditions. Construction crews would water down construction areas when necessary, and fuel-burning equipment running times would be kept to a minimum and engines would be properly maintained.
<b>Transportation</b>	No impact.	Minor temporary increases in construction traffic on roads in the immediate vicinity of the proposed project site are anticipated. Interference with rail traffic is not anticipated	Minor temporary increases in construction traffic on roads in the immediate vicinity of the proposed project site are anticipated. Interference with rail traffic is not anticipated	Construction vehicles and equipment would be stored on site during project construction, and appropriate signage would be posted on affected roadways. The Applicant must negotiate any necessary access privileges with CSX railway prior to the start of construction.
<b>Noise</b>	Community would continue to be affected by intermittent increased noise levels from emergency pumping operations.	Noise levels would increase temporarily during construction. Effects can be mitigated.	Noise levels would increase temporarily during construction. Effects can be mitigated.	Construction would take place during normal business hours, and equipment and machinery installed at the proposed site would meet all local, state, and federal noise regulations.



# SECTION SIX

## Conditions and Mitigation Measures

Affected Environment	No Action	Alternative 1 Impacts	Alternative 2 Impacts	Mitigation Measures/Conditions
<b>Cultural Resources</b>	Repeated floods could irreparably damage historic structures and make the neighborhoods unsafe for occupation.	No impacts to archeological or historic resources are anticipated.	No impacts to archeological or historic resources are anticipated.	Archeological monitoring is recommended during the excavation of the lateral pipelines. Should archeological features be discovered, all work in that location shall stop and will resume only when FEMA, VDEM, and VDHR have agreed on the best course of action for recovering information from the identified feature.
<b>Socioeconomic Resources and Environmental Justice</b>	Minority and low-income populations would continue to be affected by the decline in property values, relocation of the neighborhood school, lack of available recreation and open space, and the quality of life due to continuing nuisance odors when even small rain events occur.	Potential short-term increases in patronage to local businesses. No disproportionately high or adverse effect on minority or low-income populations is anticipated	Potential short-term increases in patronage to local businesses. No disproportionately high or adverse effect on minority or low-income populations is anticipated	None.
<b>Safety</b>	No impacts.	No impacts to safety are anticipated.	No impacts to safety are anticipated.	All construction activities would be performed using qualified personnel and in accordance with the standards specified in OSHA regulations. Appropriate signage and barriers should be in place prior to construction activities, to alert pedestrians and motorists of project activities. Protocols outlined in the Health, Safety, and Environmental Management Plan will be strictly adhered to.



# SECTION SIX

## Conditions and Mitigation Measures

Affected Environment	No Action	Alternative 1 Impacts	Alternative 2 Impacts	Mitigation Measures/Conditions
<b>Hazardous Materials</b>	No impacts.	Based on soil testing and volume of material to be excavated, hazardous wastes are likely to be encountered during construction. Effects can be mitigated.	Soil testing has not been conducted, but a limited amount of material will be excavated in the landfill. There is some chance of encountering hazardous waste during construction.	Any hazardous materials discovered, generated, or used during construction would be disposed of and handled in accordance with applicable local, state, and federal regulations. Protocols outlined in the Health, Safety, and Environmental Management Plan will be strictly adhered to.



The City of Richmond is examining options for the permanent repair of the Battery Park Trunk Sewer line. One alternative involves excavating either two or three work shafts and using a TBM to excavate a new, approximately 1500-foot-long tunnel, some of which would be within old landfill material. A second alternative avoids the potential for contact with municipal solid waste in the old Fells Street landfill nearly entirely, by extending the new sewer alignment north to Wickham Street. This approximately 2800-foot-long extended alignment would eliminate many of the contingencies associated with excavating significant amounts of MSW under the first alternative.

In compliance with NEPA, this EA describes the anticipated effects two alternatives, plus a No Action Alternative, would have on geology, surface water, floodplains, groundwater, surface water, biological resources, air quality, transportation, noise, cultural resources, socioeconomic resources, environmental justice, safety, and hazardous materials.

Beneficial impacts to water resources and socioeconomics are anticipated due to the anticipated improved drainage of the Battery Park Trunk sewershed. No negative long-term impacts to any of the resource areas are anticipated with either of the proposed build alternatives. During the construction period, short-term impacts to soils, topography, surface water, biological resources, air quality, noise, transportation, socioeconomics, and hazardous materials are possible. All short-term impacts require conditions to minimize and mitigate impacts to the proposed project site and surrounding areas.



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## Figures

## **Appendices**