IV. ALTERNATIVES STILL UNDER CONSIDERATION

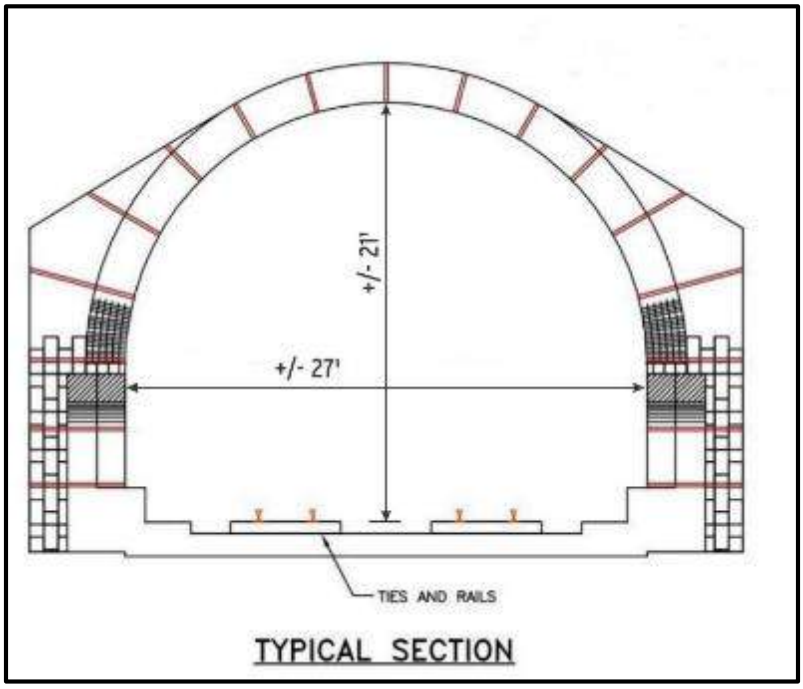
Alternatives 1, 3A, 3B, and 3C are the alternatives still being considered for the B&P Tunnels. The specific descriptions of these alternatives including the ventilation plants are provided in this section. Potential impacts associated with these four alternatives are located in **Section VI**.

A. Alternative 1: No-Build

Alternative 1: No-Build; serves as the baseline for analysis of the Build Alternatives. It entails continued use of the existing B&P Tunnel with no significant improvements aside from routine maintenance. Maintenance would include the following:

- Injection of waterproofing material behind the tunnel liner.
- Repair of brick and mortar defects in the tunnel liner.
- Repair of leaking utility lines above the tunnel.
- Rebuilding of deteriorated safety niches (also known as “manholes”).
- Repair of the Gilmor Street Tunnel portal.
- Replacement of invert slab where deteriorated.
- Removal of debris.
- Demolition of remaining portions of the Pennsylvania Avenue depot, which is no longer in use.
- Scale and removal of delaminated gunite/shotcrete.
- Cleaning of sidewall drains.
- Replacement of lighting and utility mounts.
- Replacement of catenary supports.

Figure 6: Alternative 1: No-Build Typical Section



The tunnel’s basic geometry and structure would not be improved as shown above in **Figure 6**; the existing tunnel and tracks would be left in place as shown below in **Figure 7**. This alternative would be more intensive than the maintenance currently performed, but would not modernize the tunnel and fall short of a SOGR; it

would maintain existing service and ongoing maintenance, with minimal disruption. This alternative would not meet Purpose and Need for the Project.

Repairs completed in the early 1980s included replacement and lowering of the tunnel invert, repair of the tunnel lining, drainage improvements, and installation of an improved track system. Since these repairs, evaluations concluded the B&P Tunnel should be replaced within 20 years due to the increasingly difficult and expensive maintenance exacerbated by increased train traffic and a short work window during which maintenance can be performed without adversely affecting on-time performance.

B. Alternatives 3A, 3B, and 3C

Alternatives 3A, 3B, and 3C were developed, in part, as a way to bypass the tight curves that slow train traffic through the existing B&P Tunnel while still maintaining platforms at Baltimore Penn Station. Alternatives 3A, 3B, and 3C would extend on new location along a wide arc north of the existing B&P Tunnel. The wide, continuous arc of each proposed alignment allows trains to travel at higher speeds.

Tracks in four separate tunnel bores extend between the north and south portals. The alignments would remain below ground until exiting through the tunnel portals, where the tracks would transition back to the surface. Alternatives 3A, 3B, and 3C would each involve open cut and cut-and-cover sections to bring the tracks to the surface after exiting the tunnel portals on each end. Tracks would pass through the portals, through a cut-and-cover section, followed by an open cut (trench) section prior to connecting with the existing NEC alignment.

There are several design elements that would apply to each of the Alternatives, as described below:

- All three Alternatives include a four-track alignment in four individual tunnel bores.
- Each Alternative would provide universal interlocking to the NEC mainline and would avoid the Metro Subway while servicing the West Baltimore MARC Station.
- Each includes “duck under” alignments to facilitate conflict-free operations. To properly align the tracks, the southbound MARC commuter train track would duck under the two Amtrak tracks to align as the west track on the southbound platform of the West Baltimore MARC Station.
- All three Alternatives would relocate a pier of CSX (formerly B&O) Bridge Number 3.
- NEC service would continue through the existing tunnel during construction of a new alignment.
- Each Alternative would involve surface track work between the existing Baltimore Penn Station platforms and an existing retaining wall adjacent to the MTA North Avenue LRT station. Each alignment would pierce the retaining wall to pass below the LRT tracks and station before entering into bored tunnels at the north portal.

Three ventilation plants for Alternatives 3A, 3B, and 3C would be required to ensure proper ventilation of the proposed tunnels. Two of these ventilation plants would be located near the tunnel portals, one near the north portal and one near the south. A third intermediate tunnel ventilation plant would be connected to the bored portion of the tunnels (see **Section IV.F** for more detail). Emergency egresses would also be required; locations for each alignment option have yet to be determined.

C. Alternative 3A

Alternative 3A is nearly identical to the Great Circle Passenger Tunnel concepts originally envisioned through previous studies and the PASR. As Alternative 3 underwent additional design and study, it was determined the overall travel time between Gwynns Falls Bridge and Baltimore Penn Station would be governed by the tight curve where the West Baltimore MARC Station is currently located (referred to as Curve 381). It was determined that Alternative 3A would effectively preclude measures to alleviate the tight curve for the life of the new tunnel (approximately 100-150 years).

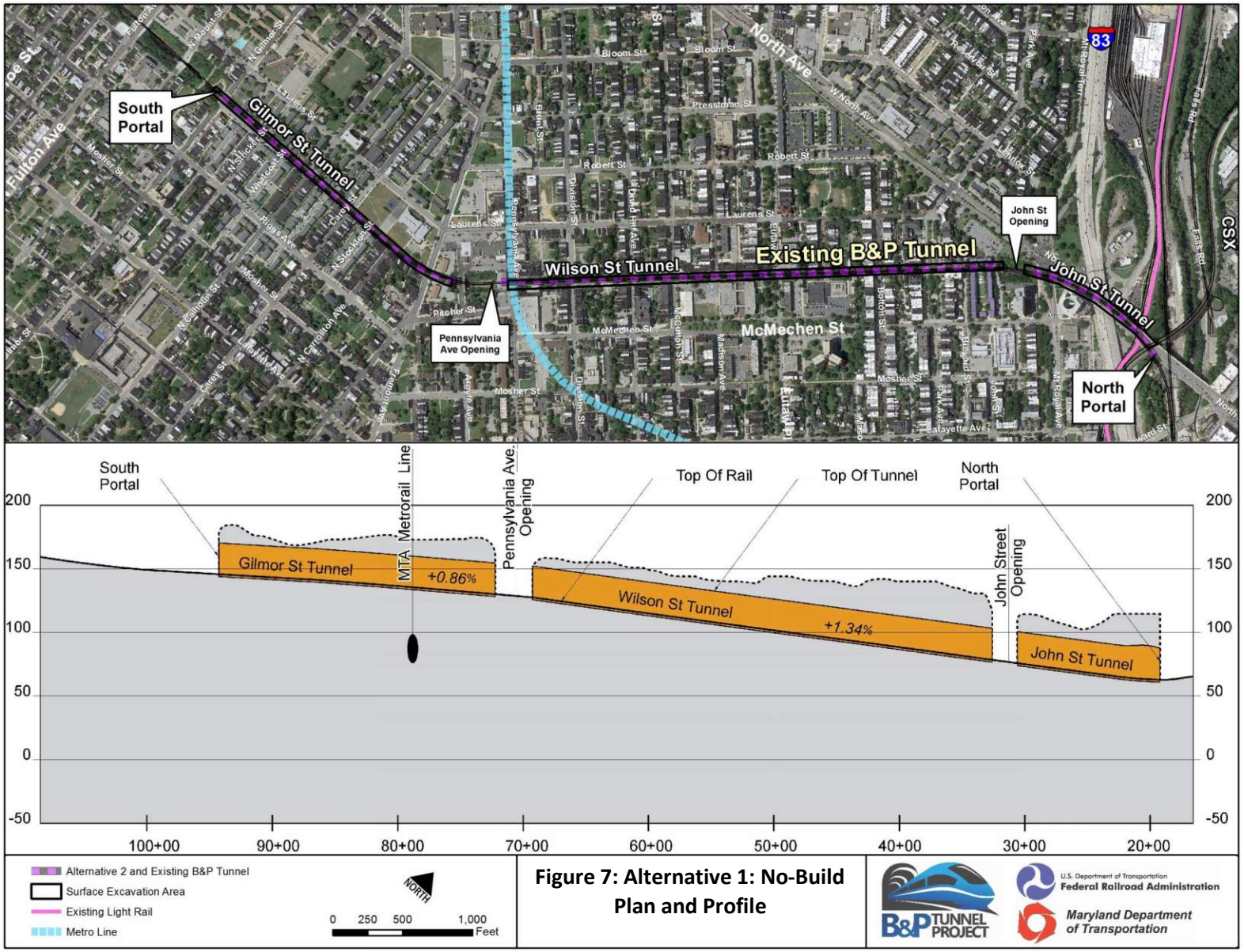


Figure 7: Alternative 1: No-Build Plan and Profile

Alternative 3A would result in a total travel distance of 3.66 miles between Baltimore Penn Station and the Amtrak Gwynns Falls Bridge. The tunnel segment of the alignment comprises 1.91 miles of the total length. Alternative 3A, including the horizontal alignment and vertical profile, is shown in **Figure 8**.

1. North Portal

Alternative 3A follows the existing mainline tracks in the Jones Falls valley under the Howard Street Bridge to just before North Avenue, where the alternative diverges from the existing track alignment. The alignment continues aboveground until the north portal located at the retaining wall next to the MTA North Avenue LRT Station. The alignment would travel through an existing retaining wall, adjacent to the LRT station, to begin its descent below ground. The north portal would require specialized tunnel construction techniques, such as ground improvement, in advance of tunneling to allow the four tracks to pass below the LRT facilities. The north portal would include a ventilation plant. A map of the north portal is shown in **Figure 9** and a rendering of the north portal is shown in **Image 3**.

2. Tunnel Segment

Alternative 3A continues below ground in a gradual arc for 1.91 miles, traversing below primarily residential city blocks in the neighborhoods of Reservoir Hill, Penn North, Sandtown-Winchester, Bridgeview/Greenlawn, Midtown-Edmondson, and Penrose/Fayette. From the north portal, the alignment crosses under I-83 (Jones Falls Expressway) north of the intersection of Reservoir Street and Mount Royal Terrace. The alignment continues in a gradual curve north of Reservoir Street and Ducatel Street, and south of the east-west portion of Whitelock Street. The alignment continues to curve southwest, crossing Whitelock Street and the intersection of North Avenue and Pennsylvania Avenue. The alignment begins to curve to the south, as the western side of the alignment runs near the east side of the Carver Vocational-Technical High School athletic field boundary. Through the tunnel segment, the depth of the alignment would reach 185 feet, with an average depth of 130 feet (from ground level to top of tunnel).

3. South Portal

Alternative 3A would include a south portal located within the existing P. Flanigan and Sons Asphalt plant, roughly a third of a mile west of the existing B&P Tunnel south portal. The cut-and-cover and open cut sections would be located between the P. Flanigan and Sons property and Lafayette Avenue, with some additional at-grade track work located between Lafayette Avenue and Edmondson Avenue. Further at-grade track work within Amtrak ROW would be located between Mulberry Street and the Amtrak Gwynns Falls Bridge. A new "Fulton" Interlocking would be constructed south of the south portal. No modifications to the West Baltimore MARC Station would be required; consequently, no high-level platform for level boarding at the Station would be provided. A map of the south portal is shown in **Figure 10** and a rendering of the south portal is shown in **Image 4**.

D. Alternative 3B

Alternative 3B was developed to retain the basic conceptual alignment of Alternative 3, while eliminating speed restrictions imposed by Curve 381. This is achieved by shifting the alignment east to modify/improve the curve. Alternative 3B would result in a total travel distance of 3.66 miles between Baltimore Penn Station and the Amtrak Gwynns Falls Bridge. The tunnel segment of the alignment comprises 2.03 miles of the total length. An overview of Alternative 3B, including the horizontal alignment and vertical profile, is shown in **Figure 11**.

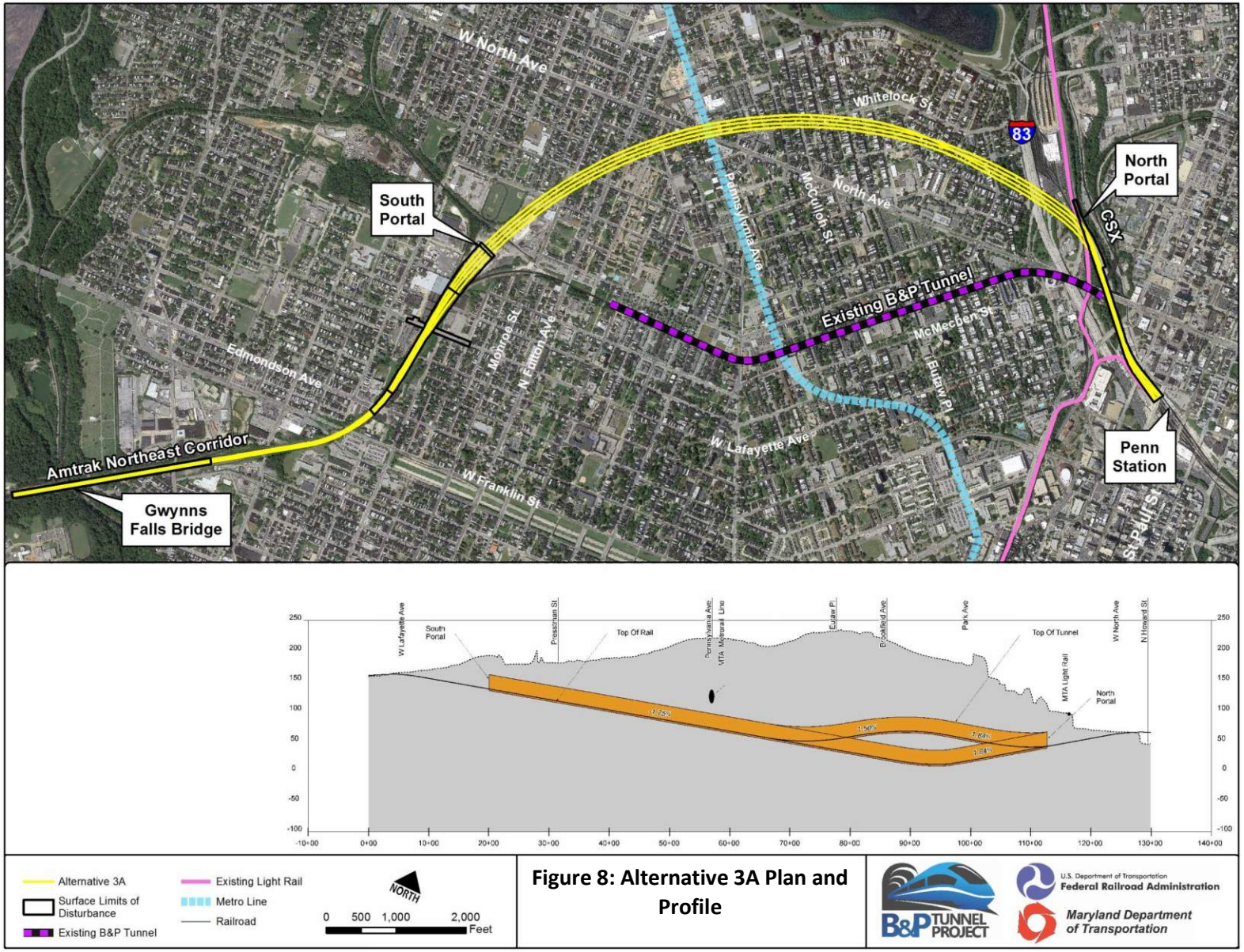


Figure 8: Alternative 3A Plan and Profile

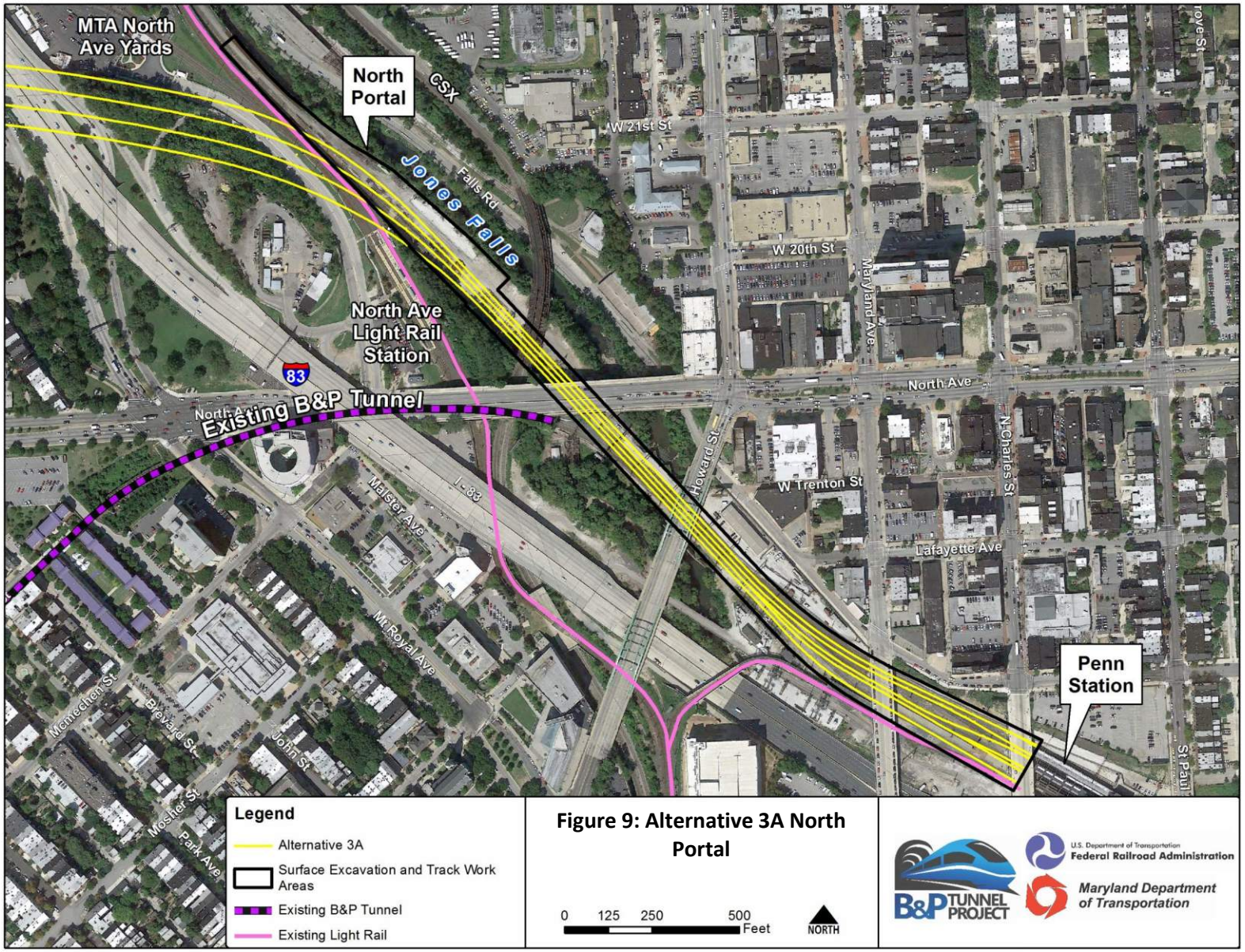
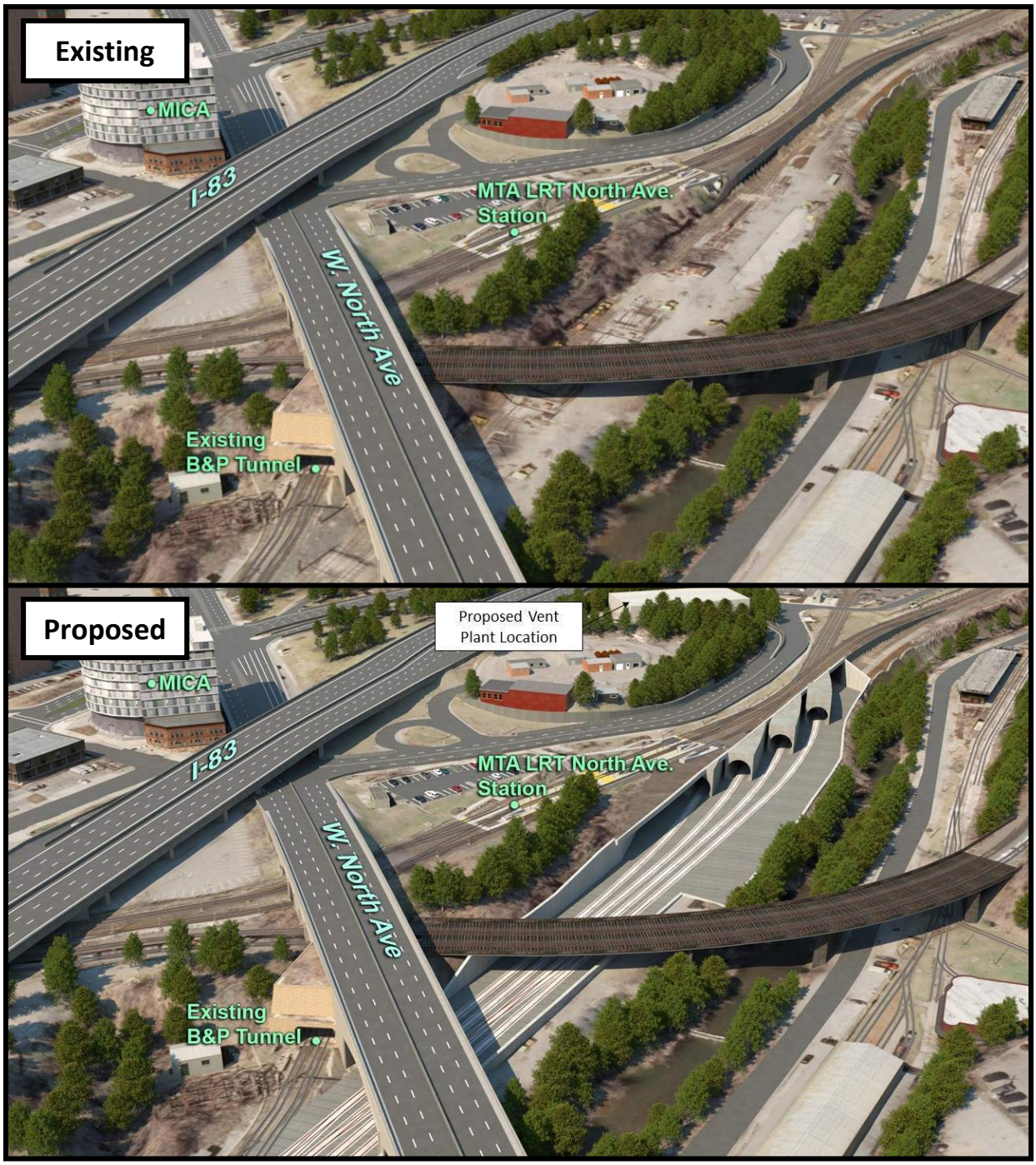


Figure 9: Alternative 3A North Portal

Image 3: Rendering of Alternative 3A North Portal



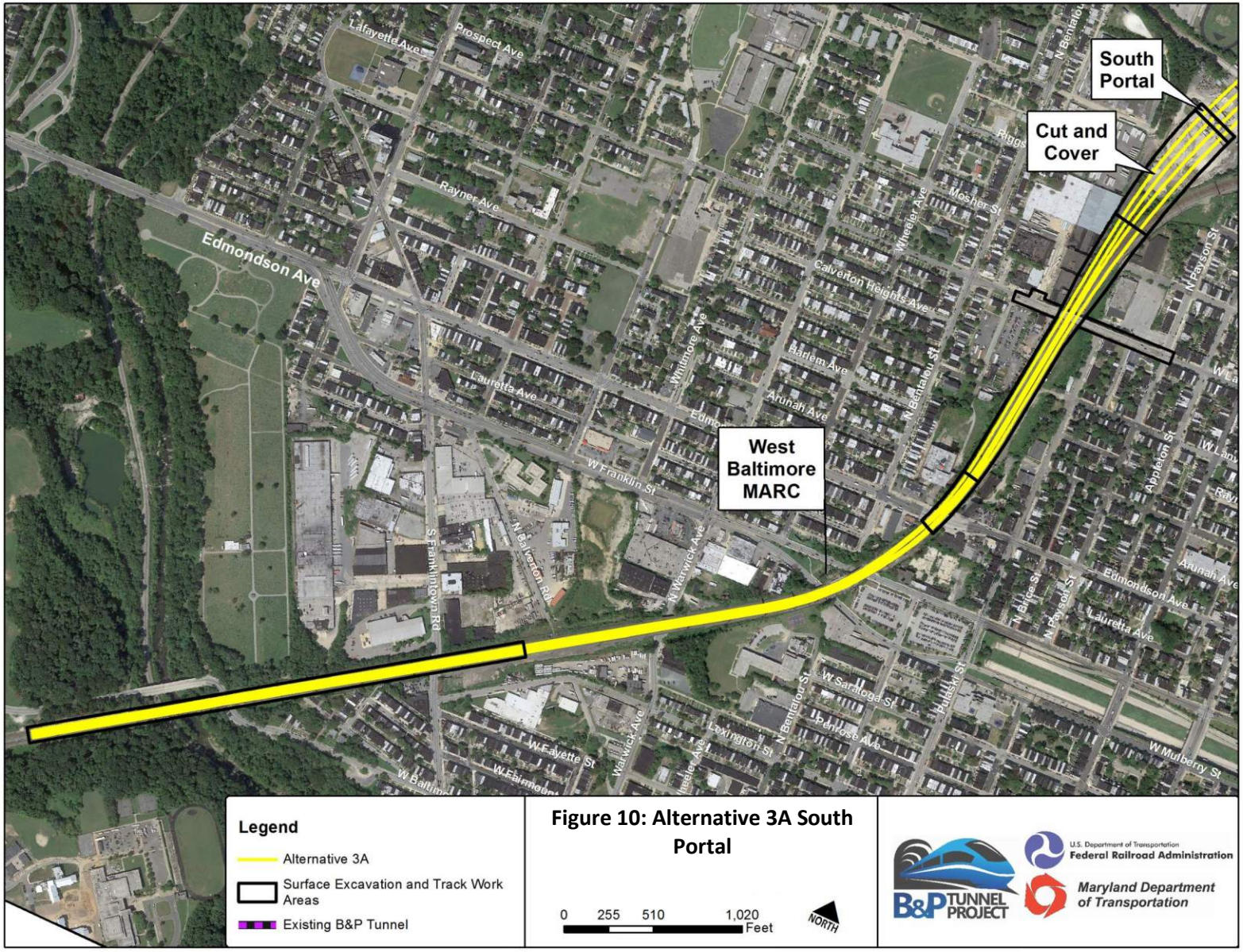
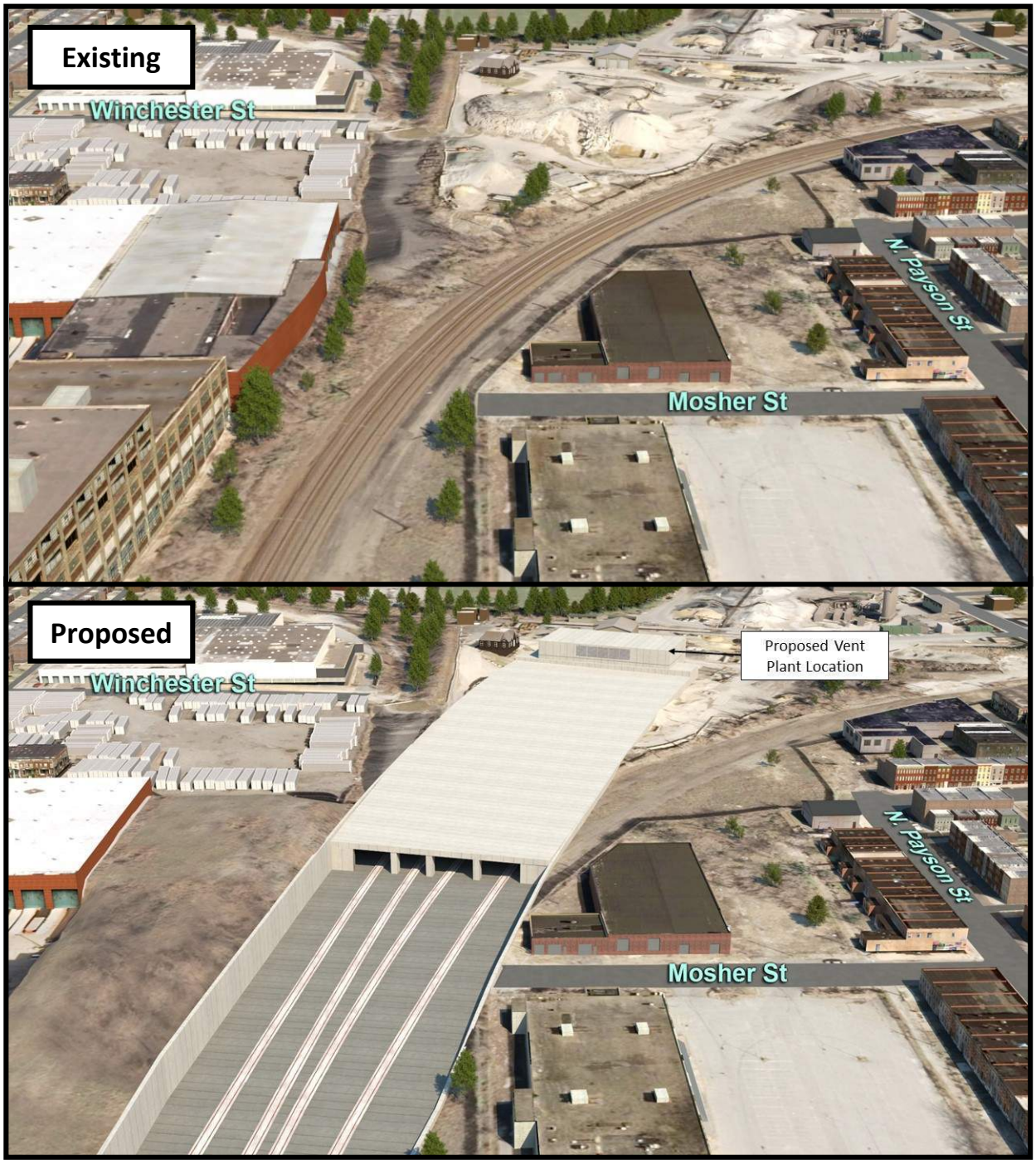


Figure 10: Alternative 3A South Portal

Image 4: Rendering of Alternative 3A South Portal



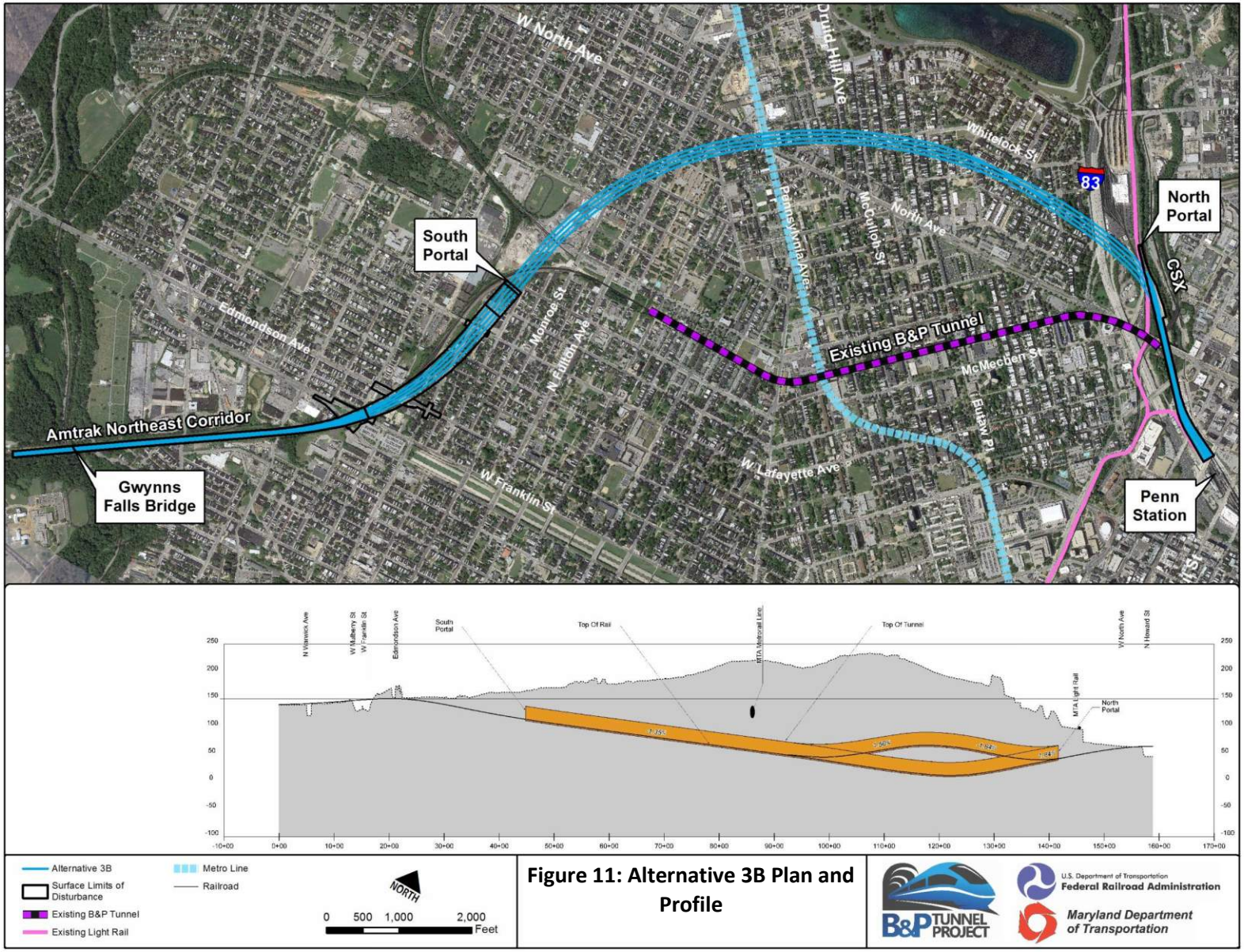


Figure 11: Alternative 3B Plan and Profile

Alternative 3B differs from 3A primarily in the location of the southern portal and the southern tie-in with existing tracks. The existing speed-limiting curve (referred to as Curve 381), located at the West Baltimore MARC Station, is improved to eliminate the speed restriction. The alignment shifts the existing NEC corridor east between Edmondson and Riggs Avenues near Pulaski and Payson Streets and slightly west near Franklin and Mulberry Streets.

1. North Portal

Alternative 3B follows the existing railroad mainline track in the Jones Falls valley under the Howard Street Bridge to just before North Avenue, where the alternative leaves the existing track alignment to begin its gradual arc. The alignment continues aboveground until it reaches its north portal located at the retaining wall next to the MTA North Avenue LRT Station. The alignment would travel through an existing retaining wall adjacent to the LRT rail station to begin its descent below ground. The north portal would require specialized tunnel construction techniques, such as ground improvement, in advance of tunneling to allow the four tracks to pass below the LRT facilities. A map of the north portal is shown in **Figure 12** and a rendering of the north portal is shown in **Image 5**.

2. Tunnel Segment

Alternative 3B continues below ground in a gradual arc for 2.03 miles, traversing below primarily residential city blocks in the neighborhoods of Reservoir Hill, Penn North, Sandtown-Winchester, Bridgeview/Greenlawn, Midtown-Edmondson, and Penrose/Fayette. From the north portal, the alignment crosses under I-83 (Jones Falls Expressway) north of the intersection of Reservoir Street and Mount Royal Terrace. The alignment continues in a gradual curve north of Reservoir Street and Ducatel Street, and south of the east-west portion of Whitelock Street. The alignment continues to curve southwest, crossing the northeast-southwest portion of Whitelock Street and the intersection of North Avenue and Pennsylvania Avenue. The alignment continues to curve southwest, under the center of an industrial property at 1320 North Monroe Street. In comparison to Option A, the Option B alignment is shifted further east, away from the depth south, crossing under the Amtrak NEC railroad curve at North Payson Street. Through the bored tunnel segment, depth of the alignment reaches 185 feet, with an average depth of 130 feet (from ground level to top of tunnel).

3. South Portal

Alternative 3B would include a south portal located southeast of the P. Flanigan and Sons Asphalt plant, and southeast of the existing NEC tracks, approximately 200 feet east of the 3A south portal. The cut-and-cover and open cut sections would be located adjacent to the existing NEC between the proposed south portal and Lafayette Avenue. The alignment would continue on a new aerial structure over Franklin and Mulberry Streets, then return to the existing NEC ROW near Warwick Avenue. At-grade track work within Amtrak ROW would occur from near Edmondson Avenue to just south of the Gwynns Falls Bridge. A new “Fulton” Interlocking would be constructed south of the permanent south portal. The West Baltimore MARC Station would be relocated slightly east of its current location to align with the new tracks. Some neighborhood streets near the new portal would be closed at the new rail ROW and others re-established after construction. A map of the south portal is shown in **Figure 13** and a rendering of the south portal is shown in **Image 6**.

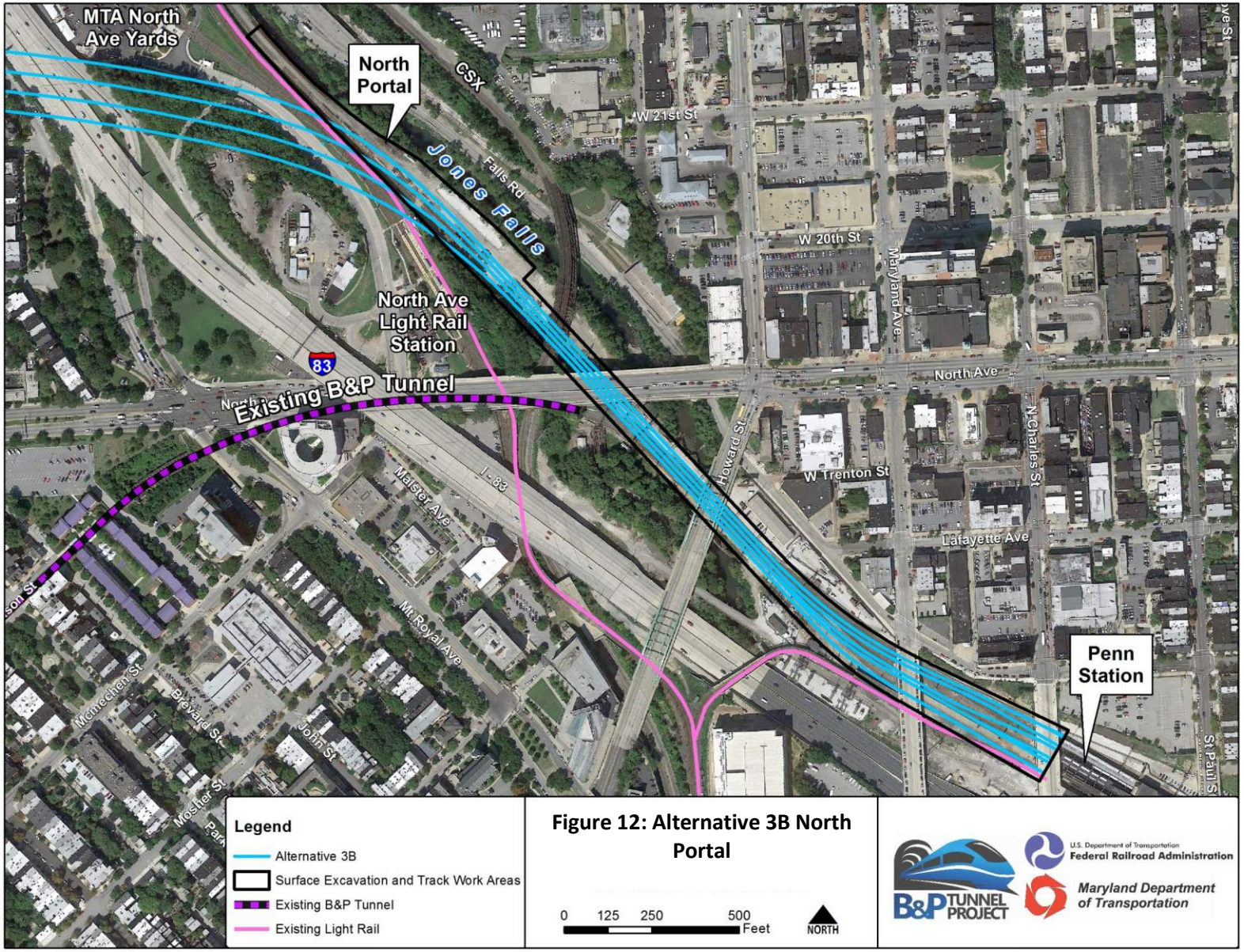
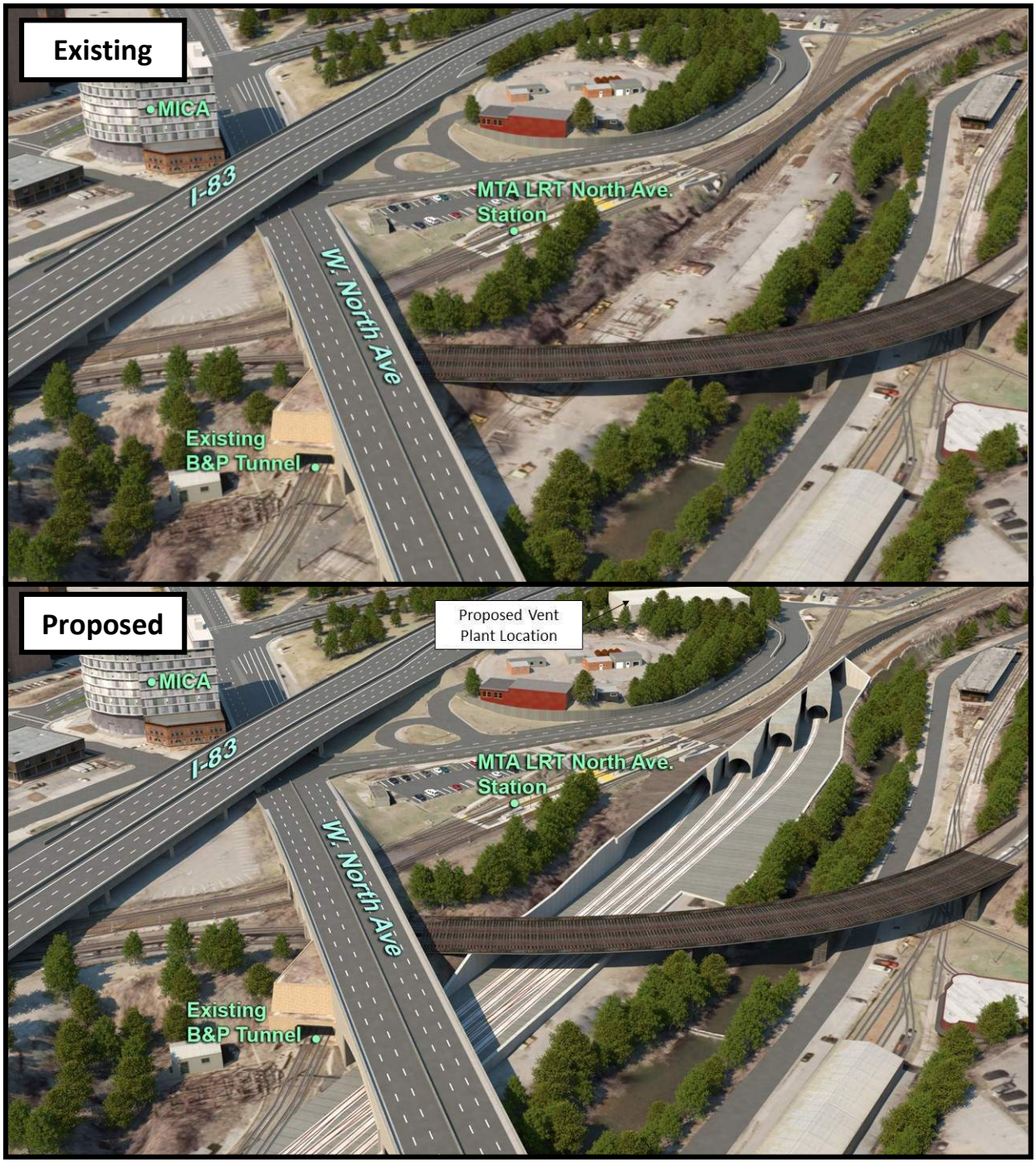


Figure 12: Alternative 3B North Portal

Image 5: Rendering of Alternative 3B North Portal



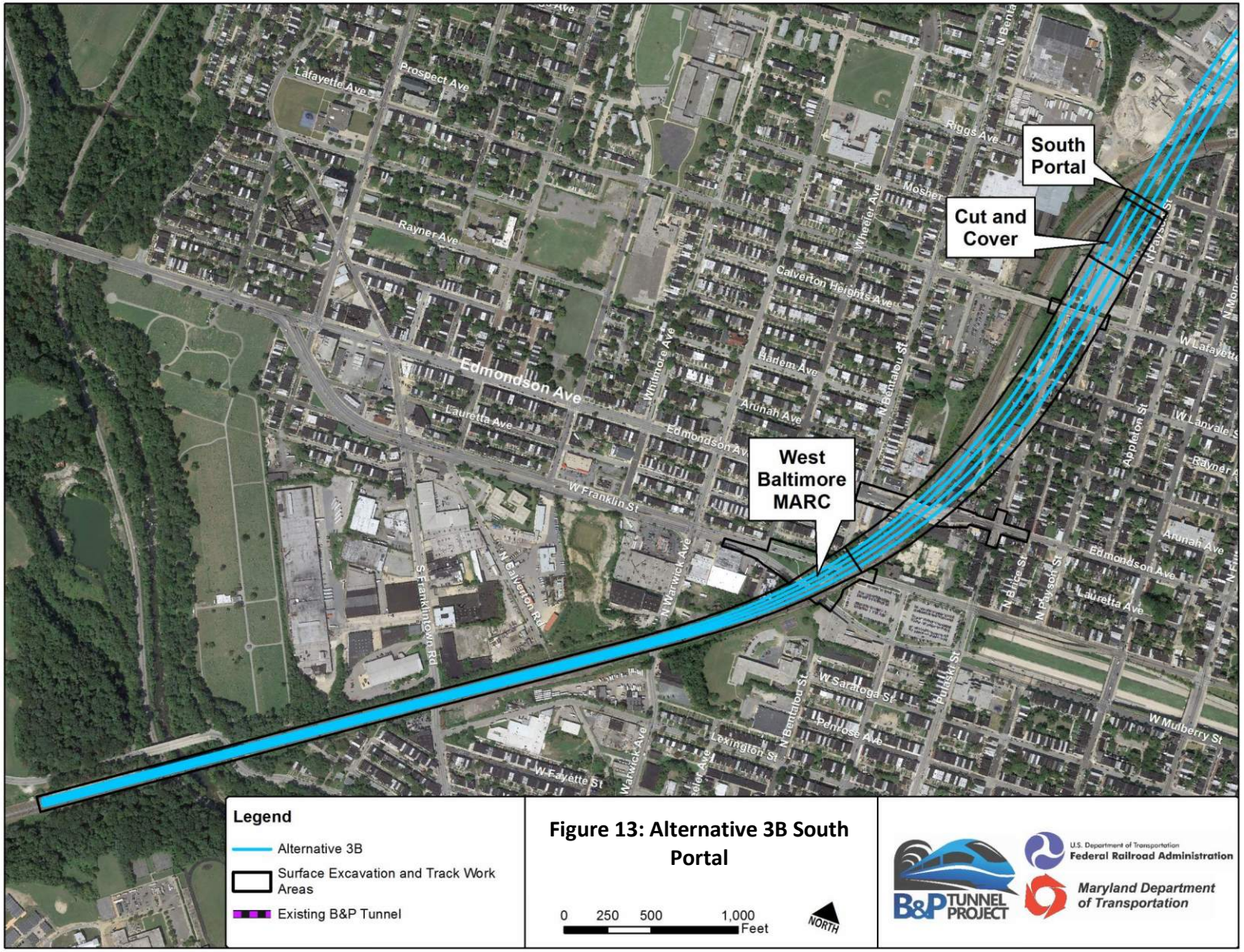
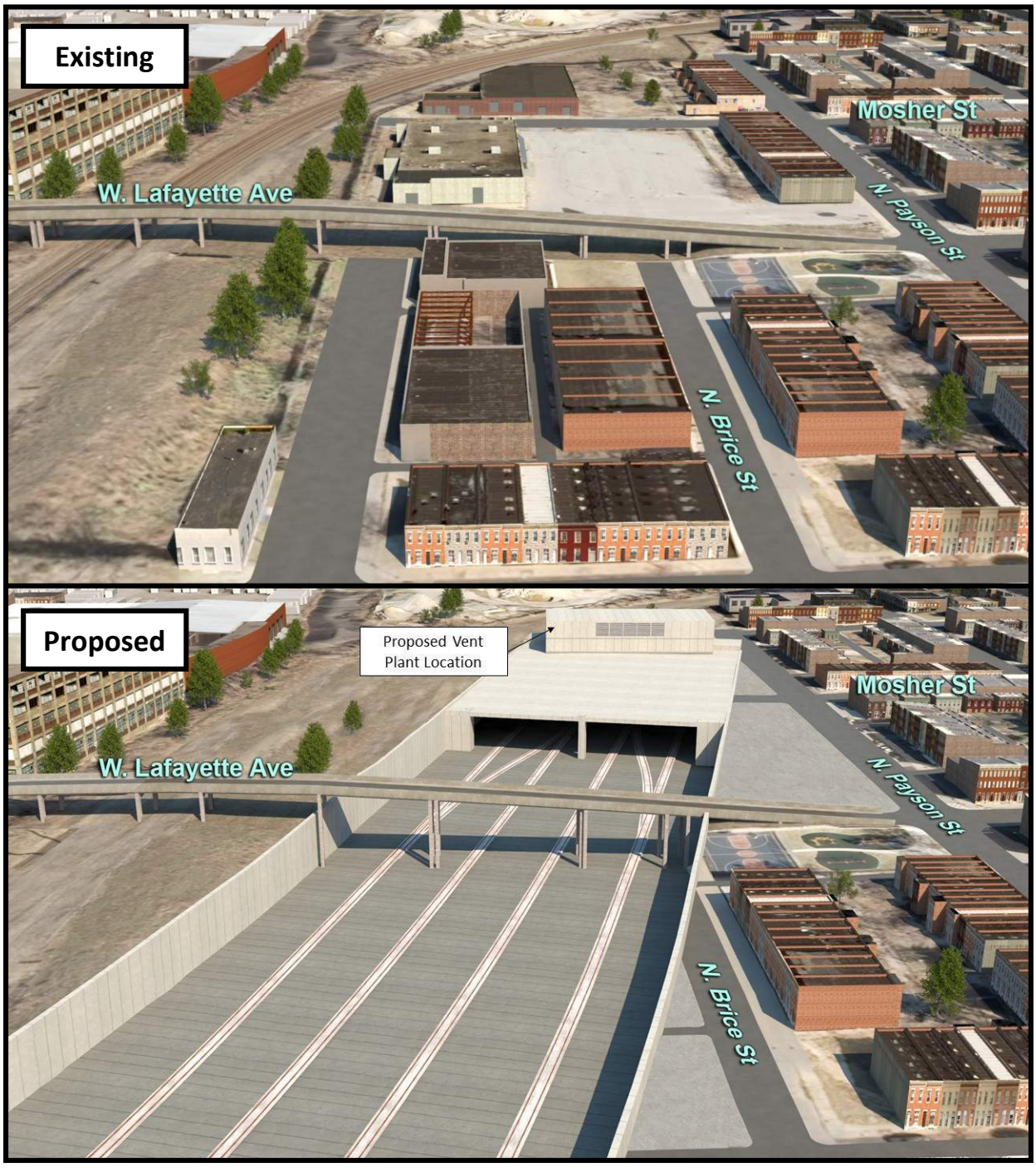


Figure 13: Alternative 3B South Portal

Image 6: Rendering of Alternative 3B South Portal



E. Alternative 3C

Alternative 3C was also developed to retain the basic conceptual alignment of Alternative 3, while eliminating speed restrictions imposed by Curve 381. This is achieved by shifting the alignment west to modify/improve the curve. Alternative 3C would result in a total travel distance of 3.83 miles between Baltimore Penn Station and the Amtrak Gwynns Falls Bridge (average of the four tracks). The tunnel segment of the alignment comprises

2.23 miles of the total length. An overview of Alternative 3C, including the horizontal alignment and vertical profile, is shown in **Figure 14**.

Alternative 3C differs from 3A and 3B in the location of the southern portal and tie-in and alignment of the underground tunnels. Alternative 3C would modify the existing speed-limiting curve (referred to as Curve 381) located at the West Baltimore MARC Station. This would be achieved by shifting the alignment up to approximately 100 feet west of the existing NEC corridor between Lafayette Avenue and Warwick Avenue; the alignment is further west of Alternative 3A and 3B.

1. North Portal

Alternative 3C follows the existing railroad mainline tracks in the Jones Falls valley under the Howard Street Bridge to just before North Avenue, where the alternative diverges from the existing alignment. The alignment continues aboveground until it reaches its north portal located at the retaining wall next to the MTA North Avenue LRT Station. The alignment would travel through an existing retaining wall adjacent to the LRT station and begin its descent below ground. The north portal would include tunnel construction techniques that allow the four tracks to pass below the LRT facilities. The segment of the alignment below the MTA North Avenue LRT Station would require specialized construction, such as ground improvement, in advance of tunneling. A map of the north portal is shown in **Figure 15** and a rendering of the north portal is shown in **Image 7**.

2. Tunnel Segment

Alternative 3C continues below ground in a gradual arc for 2.23 miles. The alignment traverses below primarily residential city blocks in the neighborhoods of Reservoir Hill, Penn North, Easterwood, Bridgeview/Greenlawn, Midtown-Edmondson, and Penrose/Fayette. From the north portal, the alignment crosses under I-83 (Jones Falls Expressway) north of the intersection of Reservoir Street and Mount Royal Terrace. The alignment crosses under I-83 farther north than either 3A or 3B. The alignment continues in a gradual curve south of Chauncey Avenue and north of Newington Avenue and Whitelock Street. At the intersection of Madison Avenue and Brooks Lane, the alignment begins to arc to the southwest, running roughly in between Clifton Avenue and Retreat Street. The alignment curves to the south, traveling below the intersection of Payson Street and Baker Street. Before entering the south portal, Alternative 3C runs fully under the center of the Carver Vocational-Technical High School athletic field. Through the tunnel segment, the depth of the alignment reaches 170 feet, with an average depth of 140 feet.

3. South Portal

Alternative 3C would include a south portal located within the P. Flanigan and Sons Asphalt plant, just south of the athletic fields at Carver Vocational-Technical High School and, roughly a third of a mile west of the existing B&P Tunnel south portal. The cut-and-cover and open cut sections would be located along the western edge of the P. Flanigan and Sons property, and travel south in a cut-and-cover section, parallel to the existing Amtrak ROW near Lafayette Avenue. The alignment would continue in an open-cut section shifted west of the NEC, south of Lafayette Avenue. The alignment would continue on a new aerial structure over Franklin and Mulberry Streets, then return to the existing NEC ROW near Warwick Avenue. At-grade track work within Amtrak ROW would occur from near Edmondson Avenue to just south of the Gwynns Falls Bridge. A new “Fulton” Interlocking would be constructed south of the permanent south portal. The West Baltimore MARC Station platforms would be relocated west to align with the new tracks. Some neighborhood streets near the new portal would be closed at the new rail ROW and others re-established after construction. A map of the south portal is shown in **Figure 16** and a rendering of the south portal is shown in **Image 8**.

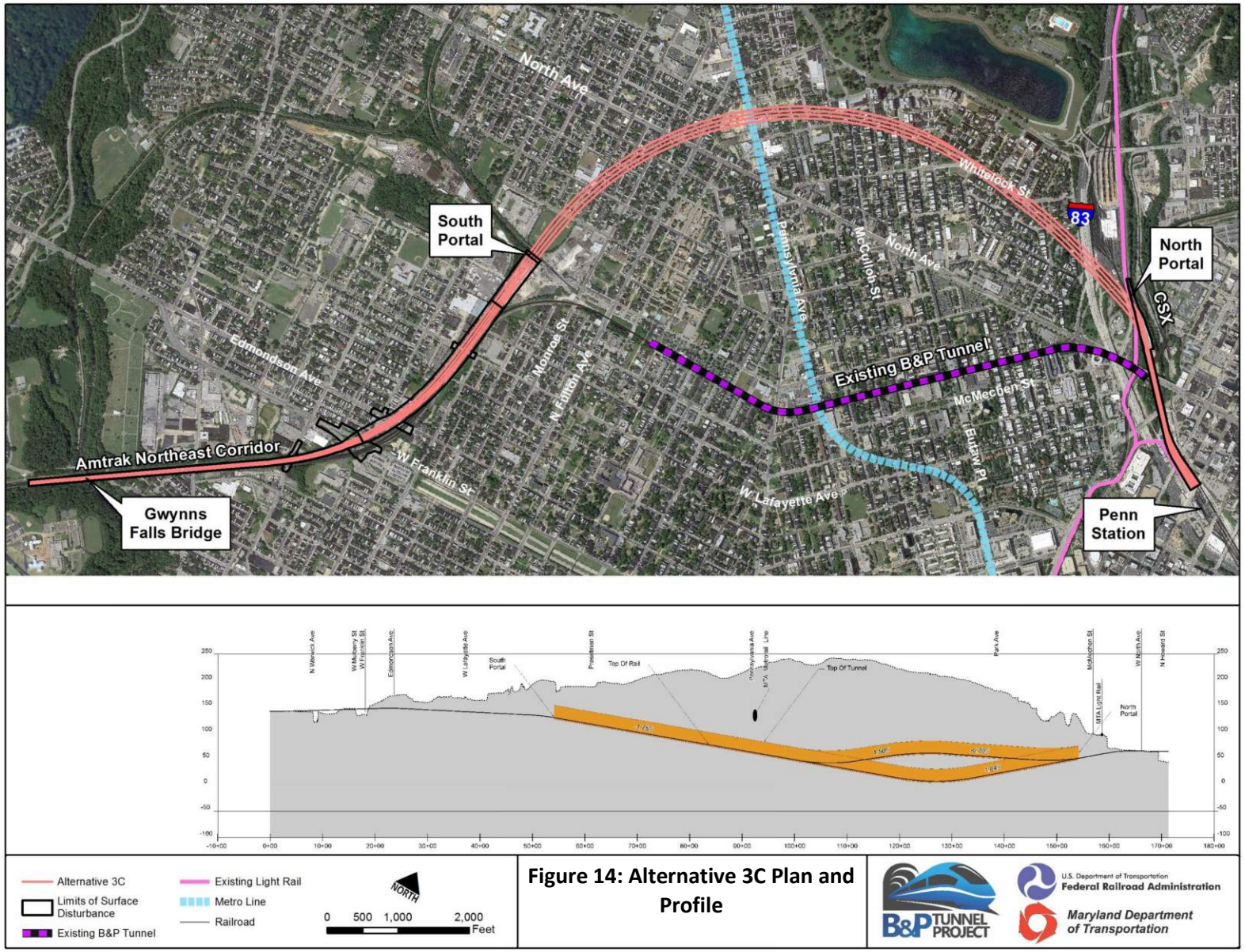
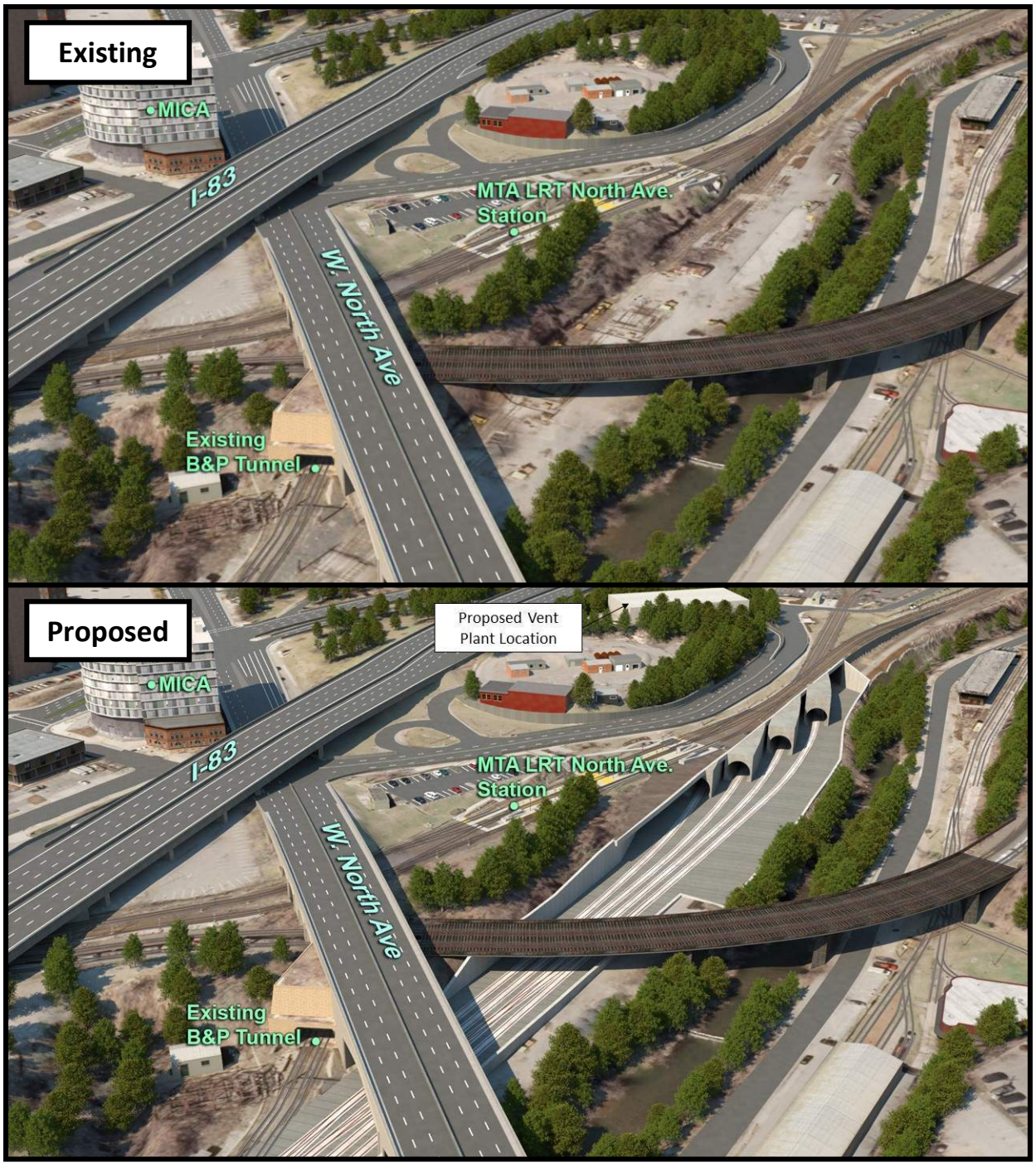


Figure 14: Alternative 3C Plan and Profile

Figure 15: Alternative 3C North Portal

Image 7: Rendering of Alternative 3C North Portal



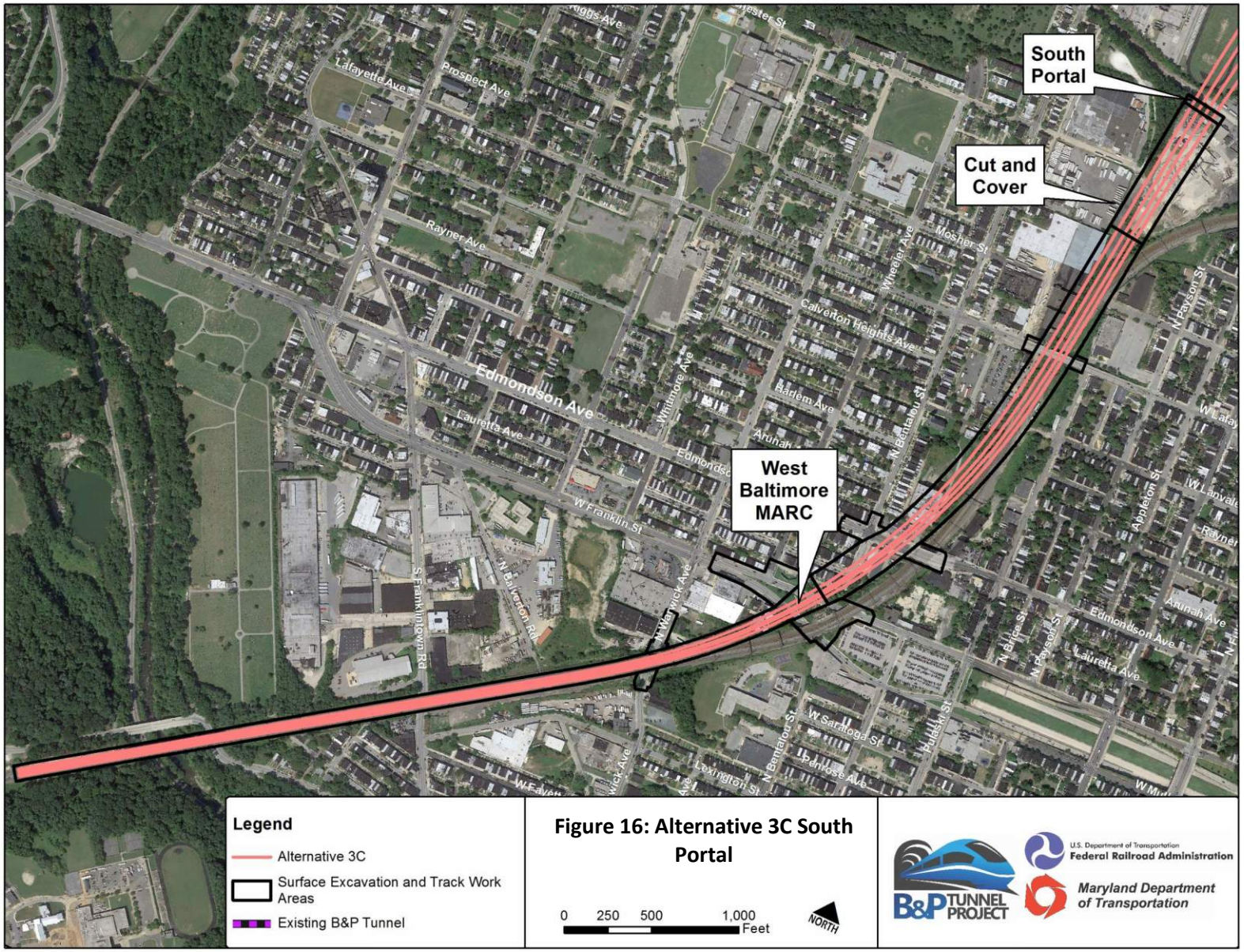


Figure 16: Alternative 3C South Portal

Image 8: Rendering of Alternative 3C South Portal

F. Intermediate Ventilation Plant

As described previously in **Section III.B.6**, each of the Build Alternatives would require three ventilation plants to ensure proper ventilation of the proposed tunnels. Two of the ventilation plants would each be located at the north and south portals. A third intermediate ventilation plant would be located at street level, connected to the bored portion of the tunnels by a vertical shaft and connecting tunnel (plenum), splitting the proposed tunnel into two unequal lengths. The ventilation plant would consist of a building, approximately 100 feet by 200 feet in plan with a maximum height of 55 feet.

1. Area of Consideration

An Area of Consideration for the intermediate tunnel ventilation plant of each Build Alternative has been identified as part of the preliminary engineering, based on considerations described above. The three overlapping Areas of Consideration (corresponding with Alternatives 3A, 3B, and 3C) are located in the Reservoir Hill neighborhood and shown in **Figure 17** and **Image 9**. The area is roughly bounded by Whitelock Street to the north, Ducatel Street to the south, Brookfield Avenue to the east, and Morris Street to the west. This area was developed to assist with identifying the ideal ventilation plant location, from an engineering standpoint, while allowing for flexibility in the specific site proposed to minimize community impacts.

Open properties with no buildings within the Area of Consideration were initially considered for the intermediate ventilation plant site. A proposed suitable site, located at the corner of Whitelock Street and Brookfield Avenue was identified within the Area of Consideration.

2. Identification of Alternate Sites

Public comments regarding the proposed ventilation plant location on Whitelock Street have prompted further consideration of other potential intermediate ventilation plant locations. These sites are located inside and outside of the original Area of Consideration. The following sites are being considered (see **Figure 18** for site locations):

- Druid Park Lake Drive between Brookfield Avenue and Linden Avenue
- Druid Park Lake Drive between Brookfield Ave and Lakeview Ave
- Whitelock Street at Linden Avenue
- North Avenue between Linden Avenue and Park Avenue
- North Avenue between Linden Avenue and Eutaw Place
- North Avenue between Morris Street and Madison Avenue
- North Avenue between Madison Avenue and McCulloh Street
- Druid Hill Avenue between Whitelock Street and Clendenin Street
- Druid Hill Avenue between Cloverdale Road and Retreat Street.

In general, these sites are much further from the ventilation zone interface. A longer connection could result in changes to the ventilation system such as increased ventilation duct cross-section size, increased ventilation fan horsepower and associated electrical power, and reduced effectiveness of piston action ventilation requiring the fans to run in normal operations more frequently. Furthermore, a greater amount of drill-and-blast construction leading to more severe construction-related impacts would result from a site with a longer connecting shaft. It is estimated that, as the connection between the ventilation zone interface (described above) and the intermediate ventilation plant become longer, the cost increases by approximately $50,000 per foot of extension due to additional drilling of the lateral shaft.

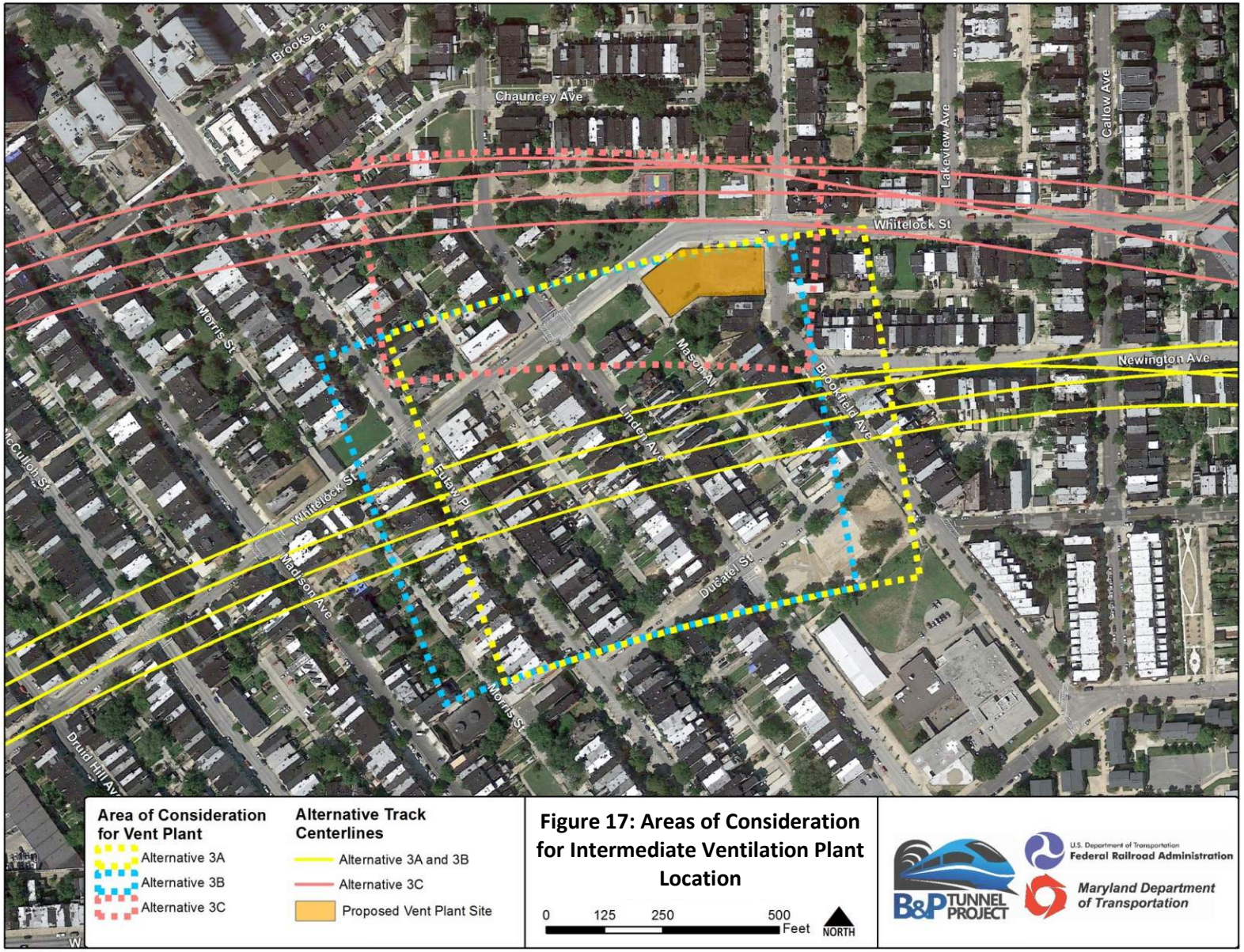


Figure 17: Areas of Consideration for Intermediate Ventilation Plant Location

Image 9: Rendering of Alternatives 3A, 3B, and 3C Intermediate Ventilation Plant Location

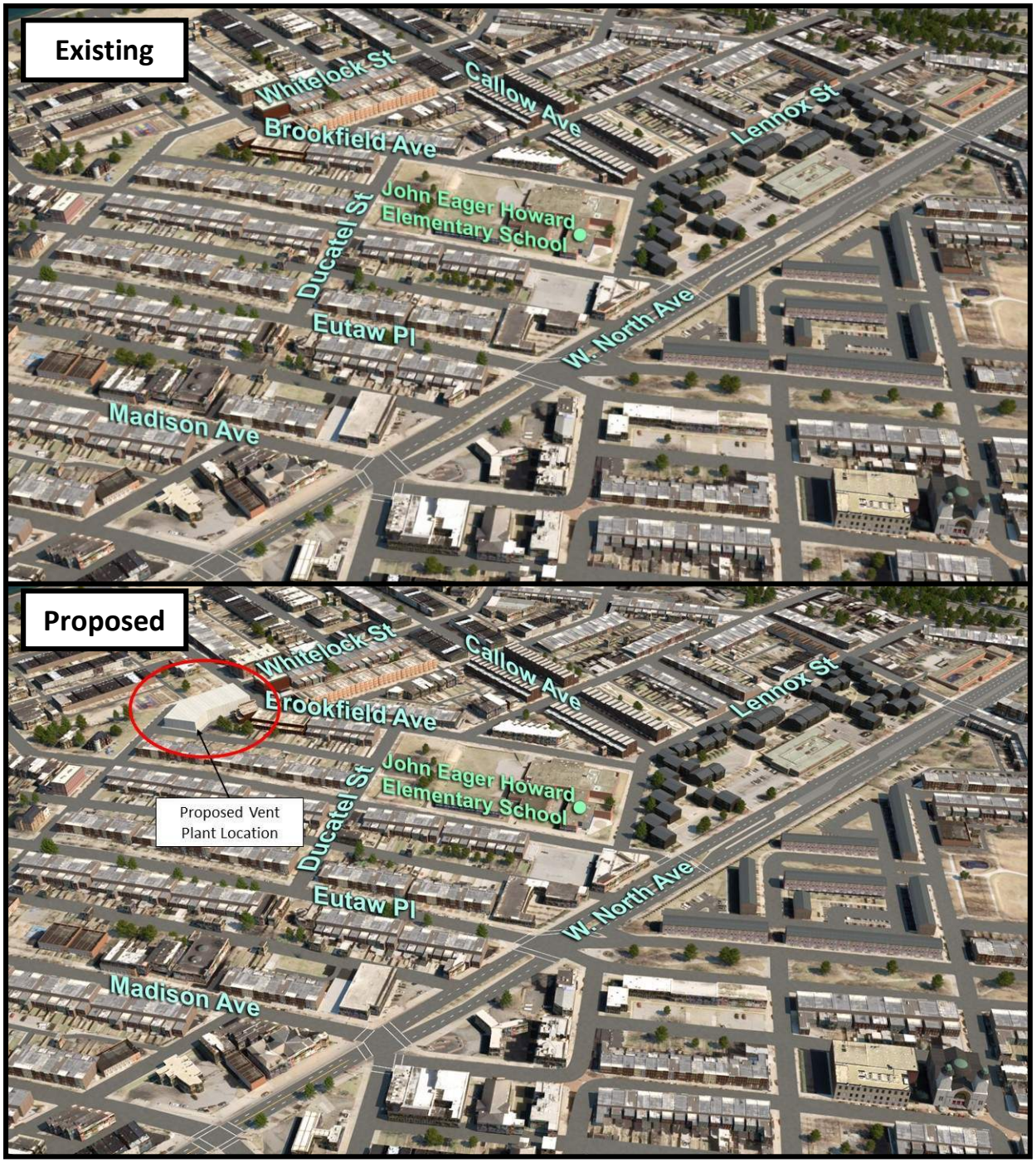


Figure 18: Alternate Intermediate Ventilation Plant Locations

Additional ventilation zones would allow reducing the headway below the two-minute mark, which is not warranted for the project. This would not reduce the size of the ventilation facilities, which are governed by the design fire and size of trains in the tunnel. More ventilation zones would require more ventilation plants of the same minimum size and capacity, one at each zone interface. Each ventilation plant would cost an estimated $150 million.

G. Future of the Existing B&P Tunnel

The existing B&P Tunnel is a functioning railroad structure connecting Baltimore Penn Station with the NEC. If Alternative 1: No-Build is selected, the tunnel would continue use in its current configuration and condition, with maintenance limited to that necessary to maintain safe operation. If any of the Build Alternatives are selected as the Preferred Alternative, the tunnel would be replaced by new tunnels in a different location and disposition of the existing tunnel determined. Under each Build Alternative, the disposition of the existing B&P Tunnel will need to be evaluated.

Three options for disposition of the existing B&P Tunnel include:

(1) Close with no additional use ("abandonment");
(2) Modify train use (single track); or
(3) Convert for alternative use.

The following briefly describes characteristics of the existing B&P Tunnel and proposed options for disposition.

The existing B&P Tunnel was built in 1873. It is comprised of three tunnel sections separated by two daylight sections with a total length of approximately 7,500 linear feet (1.4 miles). **Section II.E.1** includes a detailed description of the existing tunnel. The three tunnel sections are approximately 21 feet in height at the centerline and 27 feet wide, where the walls of the tunnel meet the top arch (i.e., the springline). The tunnels are primarily supported by a multiple course brick-lined arch and brick walls, with some stone masonry. Later improvements included the installation of a concrete slab invert (floor) and spraying the walls with gunite as a liner. Repairs to the tunnel in the early 1980s included repair of the lining, drainage improvements, replacement of the invert, and installation of an improved track system.

The present-day condition of the B&P Tunnel is documented by a visual inspection conducted in July of 2014 and reported in the *Existing B&P Tunnel Inspection Report*. The visual inspection and prior studies of the B&P Tunnel identified water leaks caused by groundwater seepage and leaking water pipes. The drainage system below the tracks is not fully functioning as it is clogged with efflorescence (water soluble salts). Saturated soil beneath the tunnel segments is causing the aging floor slabs to settle under train loading and require periodic repair. The tunnel lining is deteriorating with cracked and spalled gunite, loss of bricks, and degraded mortar in some areas of the brick-lined arch, especially in the Gilmor Street and Wilson Street Tunnel sections. Utilities throughout the tunnels would require repairs and maintenance.

1. Abandon the Existing B&P Tunnel

Abandonment can be temporary or permanent; either must provide for long-term stability of tunnel openings. The two methods of abandonment considered include:

- Permanent abandonment by backfilling the tunnel
- Temporary abandonment by securing the portals and conducting limited repairs

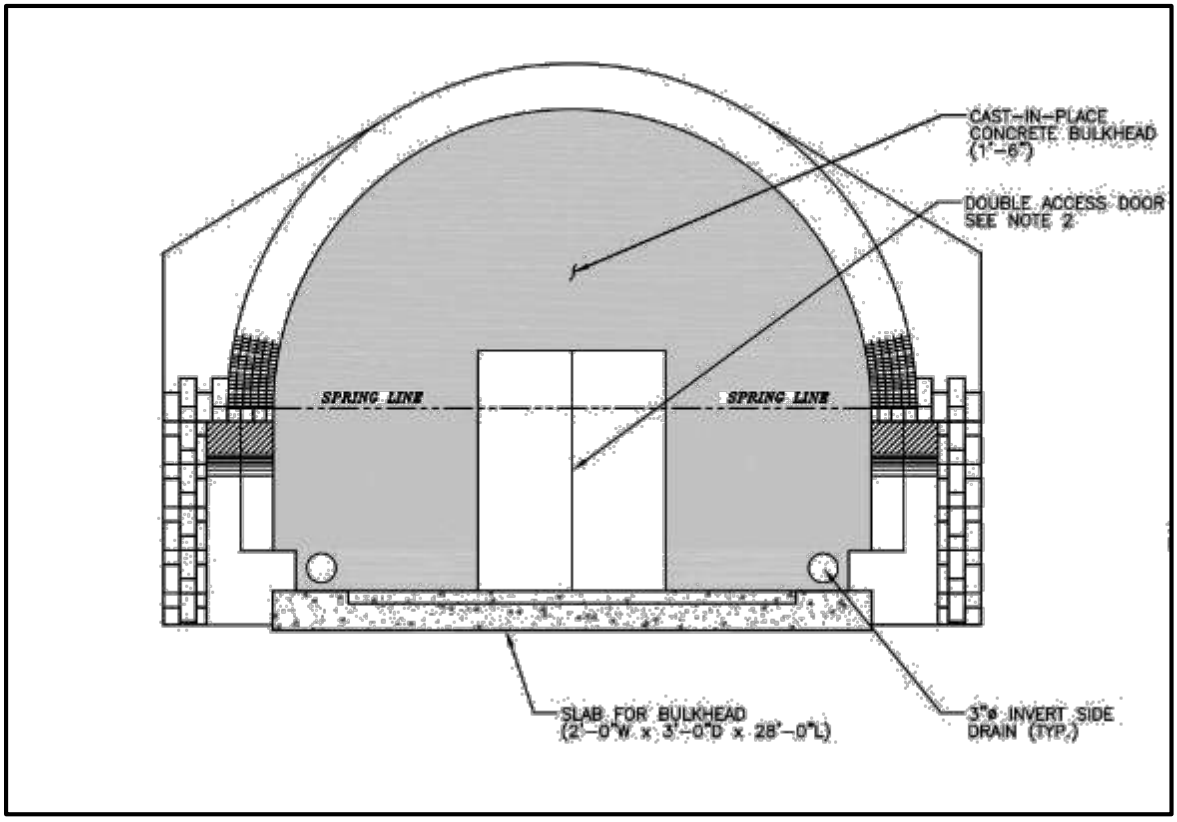
Backfilling would provide a walk-away solution with no future maintenance. Backfill materials could include concrete, crushed stone or aggregate filled with grout, or excavation materials from construction of the replacement tunnel (temporarily stockpiled until the existing tunnel was ready to be abandoned).

Methods of backfilling:

- Drilling holes from grade at specific intervals and inserting backfill through the holes; temporary storage of backfill would have short-term surface impacts to surrounding communities.
- Horizontal placement of fill, in stages, using temporary bulkheads.
- Backfill, grade, and cover with top soil the two daylight sections of the tunnel at Pennsylvania Avenue and John Street; these areas could be reclaimed for other surface uses. Backfilling would eliminate the risk of collapse and subsidence, but would preclude subsequent re-use of the tunnel.

Temporary abandonment would require securing the portals, conducting regular inspections of the tunnel, and long-term maintenance. This option would preserve the tunnel for either transportation or other uses in the future. A concrete bulkhead would fill the portal, with a locked door for authorized access (**Figure 19**). At the two daylight sections, an enclosed stairwell would provide access at the tunnel level to access doors, with the adjacent open trench filled, graded, and covered with topsoil, making it suitable for other surface uses. The tunnel liner could require some strengthening and/or mitigation for water leakage to maintain tunnel stability. Fire and Life/Safety facilities, much less substantial than the ventilation plants required for new tunnels, would be required to protect maintenance crews, but not the public as the tunnel would be closed. Ongoing ventilation of the tunnels must occur to prevent accumulation of unsafe gases and allow maintenance personnel to work. Disadvantages of temporary closure include long-term maintenance and risk of tunnel collapse, or subsidence, if maintenance does not occur.

Figure 19: Temporary Abandonment Concept

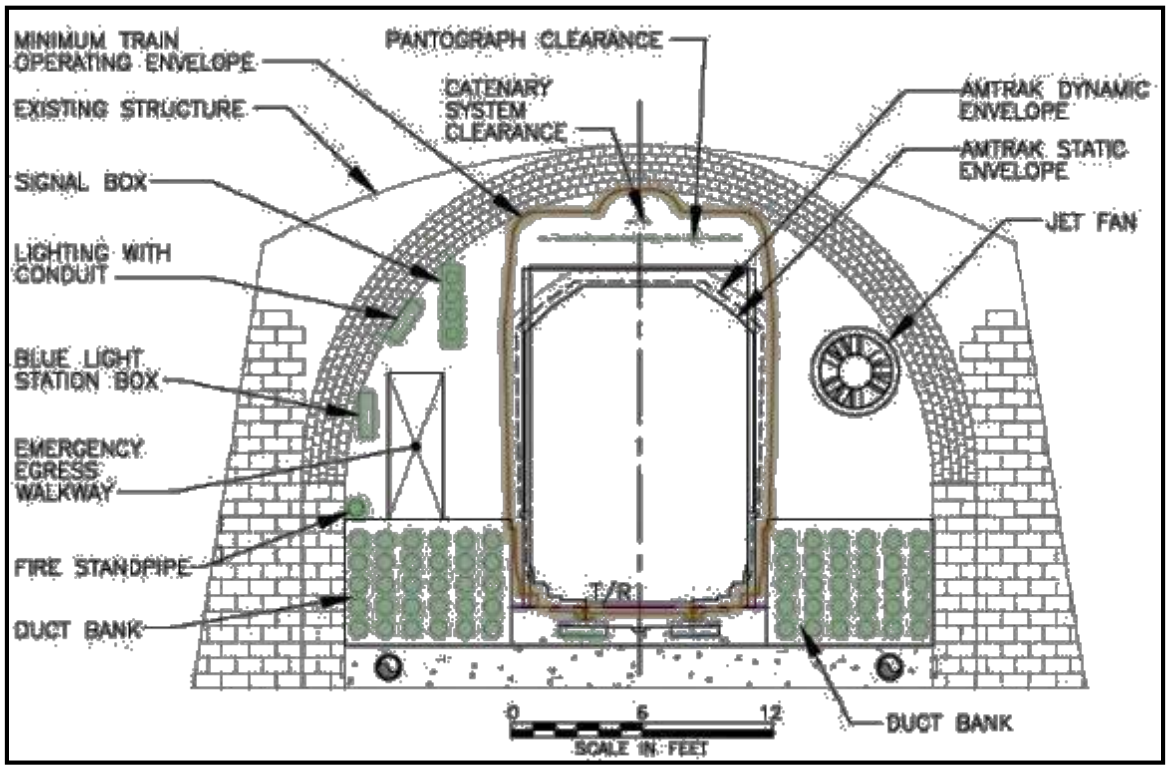


2. Modified Train Use (Single Track)

The existing B&P Tunnel may be a valuable transportation resource in the future. For example, the tunnel could be used with one track to move Amtrak, MARC, or freight trains (**Figure 20**). Future use would require modifications such as increased vertical clearance to accommodate double-stack rail cars as an independent

freight route (profile issues prevent a connection back into the NEC). Vertical clearance could be attained by either lowering the tracks or raising the tunnel roof (raising the roof would require open-cut construction). Modifications for a single track may not involve increasing the width of the existing tunnel and would not require extensive cut-and-cover construction along the majority of the existing alignment. Restoration and modernization of the tunnel could potentially involve repair of the liner, replacement of the invert, and upgrading fire suppression, ventilation and emergency egress to meet current safety standards. Drainage problems would also need to be addressed. The track could be used by MARC to store out-of-service trains on nights and weekends, and during non-rush hour periods (which would not require improved clearance). The storage would free up platform space at Baltimore Penn Station and limit non-revenue movements to and from MARC's facility near Martins Airport. Since these should be non-revenue trains, the full rehabilitation to current safety standards would not be required.

Figure 20: Single Track Concept



3. Adaptive Re-Use of the Existing B&P Tunnel

A range of alternative uses have been considered, some of which are being evaluated for other tunnels in the country. Adaptive re-use could involve other parties besides, or in addition to, Amtrak. Re-use concepts evaluated include:

- Recreation space
- Underground businesses (e.g. mushroom farm, storage)
- Community facility
- Public exhibit
- Utility corridor/stormwater control
- Linear park/rail "trail"

While there are potential economic and community building opportunities from adaptive re-use, there would be challenges that must be taken into consideration. Challenges relate to feasibility of implementation due to

the need for infrastructure upgrades, depth, and proximity to ground surface. A combination of uses would be feasible, for example a utility corridor (**Figure 21**) and public space, such as a recreational park (**Figure 22**). Public use, as a park or community facility, would initially require repairs to stabilize the tunnel lining and floor and modifications to accommodate new utilities, including stormwater lines. Once the new utilities were in place, the tunnels could be modified for adaptive re-use. It would be about a 30-35 minute walk from the north portal to the south portal.

Some improvements would be necessary to ensure functionality and occupant safety. For example, the tunnel liner would need to be repaired and grouted, throughout or in specific locations, depending on the desired use. New stairways and elevators may need to be installed at the existing portals, including the Pennsylvania Avenue and John Street open cuts, to allow for improved ingress and egress as required by code. Additional Fire Life/Safety elements, such as low-velocity fan ventilation and construction of emergency vehicle access roadways, may be required as under local, state, and federal codes and ordinances. Adaptive re-use would also need to meet Americans with Disabilities Act accessibility regulations.

Figure 21: Utility Corridor Concept

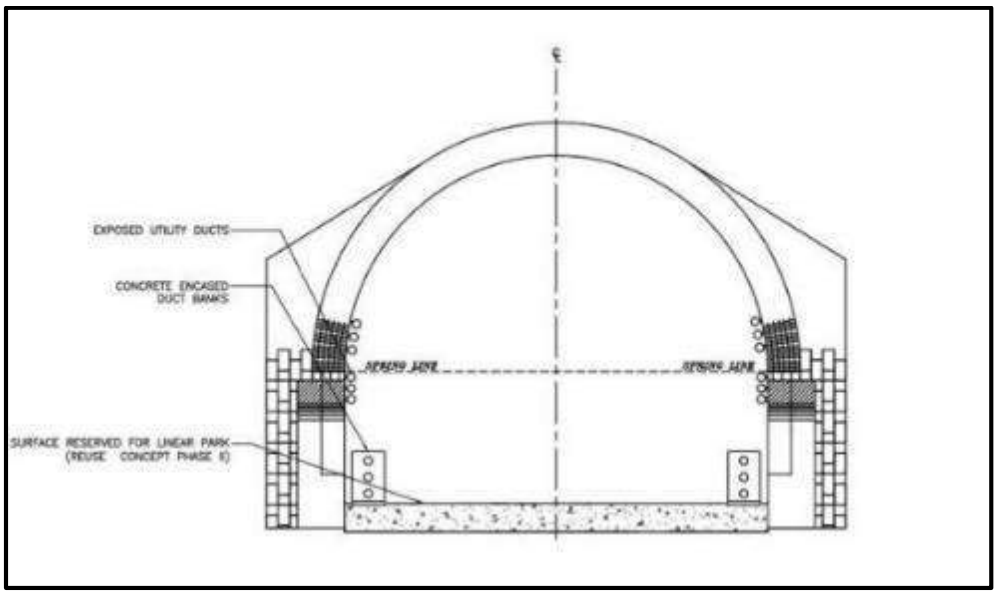
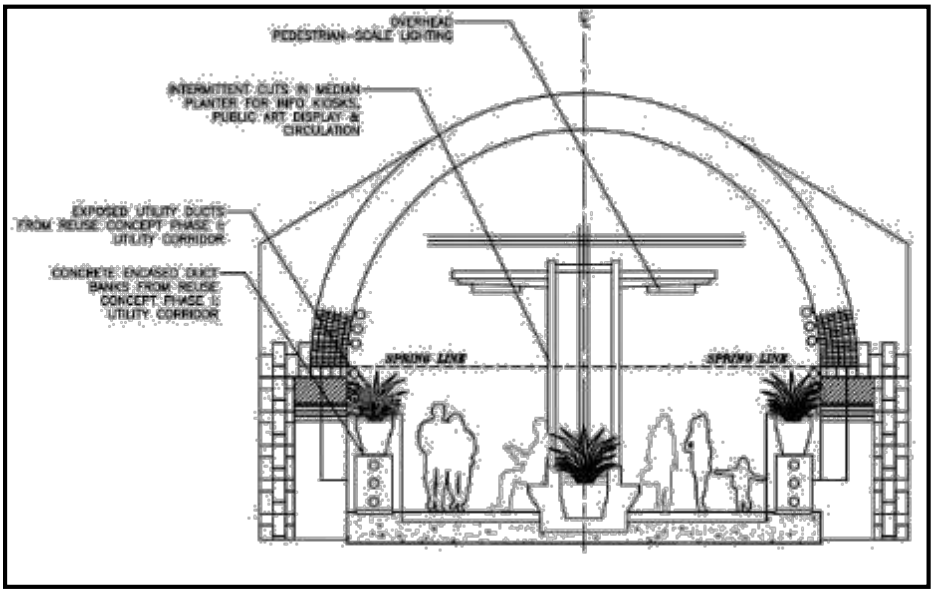


Figure 22: Linear Park Concept



H. Evaluation and Identification of Preferred Alternative

Table 9 provides a comparison of the four alternatives based on 52 engineering and environmental evaluation criteria developed for this project. Subsequent to this DEIS, the Public Hearing, and end of the comment period for this DEIS, FRA in coordination with MDOT and Amtrak will identify a Preferred Alternative for the B&P Tunnel Project.

The Preferred Alternative could be Alternative 1: No Build, Alternative 3A, Alternative 3B, Alternative 3C, or some refinement of any of these alternatives. The identification of the Preferred Alternative will be based on an assessment of how the Preferred Alternative meets Purpose and Need, an assessment of rail operations, engineering, transportation, cost, construction, an assessment of all environmental impacts, and on public and agency comments received. The evaluation and identification of the preferred alternative will be included in the Final EIS.

Table 9: Summary of Potential Engineering and Environmental Impacts

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Operations	**1. Travel Time Between Baltimore Penn Station and Gwynns Falls Bridge (southbound/northbound)**	Minutes: Seconds	Amtrak Acela 5:43/6:10 Amtrak Regional 5:50/6:19 MARC 5:50/6:14	Amtrak Acela 3:59/4:02 Amtrak Regional 4:19/4:19 MARC 4:56/4:17	Amtrak Acela 3:24/3:25 Amtrak Regional 3:43/3:34 MARC 4:22/3:56	Amtrak Acela 3:27/3:27 Amtrak Regional 3:46/3:37 MARC 4:33/4:04
	2. Travel Time Savings over Alternative 1 (southbound/northbound)	Minutes: Seconds	Not Applicable	Amtrak Acela 1:56 Amtrak Regional 1:46 MARC 1:26	Amtrak Acela 2:32 Amtrak Regional 2:26 MARC 1:53	Amtrak Acela 2:30 Amtrak Regional 2:23 MARC 1:44
	3. Value of Time Savings for All Passengers[8]	Dollars per year	Not Applicable	$32.5 Million per Year	$43.4 Million per Year	$42.3 Million per Year
	4. Lowest Design Speed within the Alignment	MPH	30 mph	50 mph	50 mph	50 mph
	5. Maximum Design Speed along the Alignment	MPH	75 mph	100 mph	100 mph	100 mph
	6. Average Operating Speed (southbound/northbound)	MPH	Amtrak Acela 35/34 mph Amtrak Regional 34/34 mph MARC 34/34 mph	Amtrak Acela 54/56 mph Amtrak Regional 50/52 mph MARC 44/52 mph	Amtrak Acela 63/66 mph Amtrak Regional 57/63 mph MARC 49/57 mph	Amtrak Acela 65/68 mph Amtrak Regional 59/65 mph MARC 49/57 mph
	7. Operational Flexibility and Reliability	High Medium Low	Low – only two tracks in common bore	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks

[8] 2040 Projected ridership, 2015 dollars

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	8. Meets Projected Year 2040 Level of Service for Amtrak/ MARC/ Freight	Yes/No	No – two tracks does not accommodate projected level of service; does not accommodate double-stack freight	Yes	Yes	Yes
Engineering	**9. Length of Alignment between Baltimore Penn Station and Gwynns Falls Bridge**	Miles	3.5 Miles	3.66 Miles	3.66 Miles	3.83 Miles
	10. Length of Tunnel	Miles	1.42 Miles	1.91 Miles	2.03 Miles	2.23 Miles
	11. Steepest Vertical Grade	% Grade	1.3%	2.0%	2.0%	2.0%
	12. Ability to Meet Current Project Design Criteria: Passenger (P) and Freight (F)	High Medium Low	Low (P) Low (F) Two tracks in a single bore; does not accommodate double-stack freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight
	13. Depth of Tunnel	Average Depth in Feet	15 foot average depth	130 foot average depth	130 foot average depth	140 foot average depth
	14. Extent of Major Utility Relocations	Minor Moderate Major Severe	None	Major – Relocations in the general vicinity of tunnel portals	Severe – Relocations extend significant distances outside of tunnel portal areas	Major - Relocations in the general vicinity of tunnel portals
Transportation	**15. Estimated Number of On-Street Parking Spaces Lost**	# Spaces	0	0	150	40
	16. Requires Reconstruction of West Baltimore MARC Station	Yes/No	No	No	Yes	Yes
	17. West Baltimore MARC Station in proximity to Existing MARC Parking	Yes/No	Yes	Yes	Yes	Yes

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	18. Allows for High-Level Platforms for West Baltimore MARC Station between Franklin and Mulberry Streets	Yes/No	No	No	Yes	Yes
Cost	**19. Capital Cost Estimate**	YOE $	$0	$ 3.7 Billion	$ 4.0 Billion	$ 4.2 Billion
Construction	**20. Impacts to Existing Amtrak Operations during Construction/ Rehabilitation**	Minor Moderate Major Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.
	21. Impacts to Existing MARC Operations During Construction/ Rehabilitation	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.
	22. Impacts to Existing LRT Operations During Construction/ Rehabilitation	Minor Moderate Severe	None – Construction would be contained within existing tunnel.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.
	23. Impacts to Existing NEC Freight Rail Operations	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off	Minor – Most work would be performed without affecting	Minor – Most work would be performed without affecting	Minor – Most work would be performed without affecting

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	During Construction/ Rehabilitation		peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	freight operations; only final cutover would cause minor impacts.	freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.	freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.
	24. Temporary Community Impacts During Construction	High Medium Low	None	Low – The portal construction area is mostly located in either existing Amtrak ROW or industrial property.	Medium – Portal construction would impact residential and industrial areas east of the existing NEC.	Medium – Portal construction would impact residential and industrial areas west of the existing NEC.
Right-of-Way (ROW)	**25. Surface Right-of-Way Acreage Required, by land use type[9]**	Acres	Residential: 0 Acres Commercial: 0 Acres Industrial: 0 Acres Other: 0 Acres **Total: 0 Acres**	Residential: 0 Acres Commercial: < 0.1 Acres Industrial: 2.5 Acres Other: 5.3 Acres **Total: 7.8 Acres**	Residential: 1.9 Acres Commercial: 3.1 Acres Industrial: 5.1 Acres Other: 7.0 Acres **Total: 17.1 Acres**	Residential: 0.9 Acres Commercial: 1.7 Acres Industrial: 6.2 Acres Other: 7.1 Acres **Total: 15.9 Acres**
	26. Surface Acreage of Roadway LOD	Acres	0 Acres	1.4 Acres	4.0 Acres	5.4 Acres
	27. Estimated Surface Parcels Impacted	# of Parcels	0	10	100	40
	28. Area of Excavation (including open cut)	Acres	0 Acres	10.2 Acres	14.9 Acres	17.1 Acres
	29. Area of Permanent Open Cut	Acres	0 Acres	5.6 Acres	12.5 Acres	12.9 Acres

[9] Does not include existing Amtrak ROW. Includes temporary and permanent

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Community Resources	**30. Estimated Residential Building Displacements**	# Displaced	0	0	48	24
	31. Estimated Business Displacements	# Displaced	0	2	9	10
	32. Estimated Community Facility Displacements[10]	# Displaced	0	0	5	1
	33. Estimated Residential Properties Impacted, but Residence Not Displaced[11]	# of Parcels	0	< 5	15	< 5
	34. Estimated Non-Residential Properties Impacted with No Displacement[3]	# of Parcels	0	< 5	10	10
	35. Right-of-Way Impacts within Minority Population Areas	Acres	0 Acres	5.8 Acres	15.1 Acres	13.9 Acres
	36. Right-of-Way Impacts within Low Income Population Areas	Acres	0 Acres	0.9 Acres	2.4 Acres	5.0 Acres
	37. Impacts to Baltimore City's *West Baltimore MARC Station Master Plan*	Minor Moderate Severe	None – Compatible with West Baltimore MARC Station Master Plan	None – Compatible with West Baltimore MARC Station Master Plan	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.
	38. Parks Potentially Impacted	# of Parks	0	0	1 – Lafayette and Payson Park	0
	39. Estimated Area of Parkland Impacted	Acres	0 Acres	0 Acres	< 0.1 Acres	0 Acres

[10] Includes schools, churches, community centers, libraries, hospitals, police and fire stations
[11] Permanent or temporary impacts to property

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Cultural Resources	**40. Adverse Effects for Historic Properties**	Number of Properties (Number of Contributing Elements)	0	6 (6 contributing historic elements impacted)	8 (87 contributing historic elements impacted)	10 (132 contributing historic elements impacted)
	41. Area of Surface disturbance within Historic District	Acres	0 Acres	12.0 Acres – Monroe-Riggs, Baltimore & Potomac Railroad, and Midtown-Edmondson Historic Districts	25.3 Acres – Edmondson Avenue, Baltimore & Potomac Railroad, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic District	20.3 Acres – Baltimore & Potomac Railroad, Edmondson Avenue, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic Districts
	42. Known Archaeological Resource Sites Impacted	# of Sites	0	0	0	0
Natural Resources	**43. Stream Impacts**	Linear Feet	0 Feet	0 Feet	0 Feet	0 Feet
	44. Wetland Impacts	Acres	0 Acres	0 Acres	0 Acres	0 Acres
	45. Estimated Street Trees Impacted	# of Trees	0	0	2	1
	46. Forested Land Impacted	Acres	0 Acres	1.5 Acres	2.5 Acres	3.7 Acres
	47. 100-Year Flood Plain Impact	Acres	0 Acres	3.5 Acres	3.5 Acres	3.5 Acres
Other Environmental	**48. Use of Section 4(f) Properties**	Number of Properties	0	5	11	10
	49. Hazardous Materials Sites Identified	# of Low, Medium, and High Priority Sites (and Total #)	N/A	57 Low, 29 Med, 6 High (92 Total)	71 Low, 37 Med, 6 High (114 Total)	92 Low, 52 Medium, 9 High (153 Total)
	50. Estimated Number of Buildings with Potential Noise Impacts	# of Buildings, Moderate or Severe	0 Severe 0 Moderate	0 Severe 254 Moderate	175 Severe 1,078 Moderate	111 Severe 979 Moderate

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	51. Estimated Number of Sites with Potential Vibration Impacts	# of Sites	24	69	138	92
	52. Permanent Negative Visual Impacts	Low Medium High	None	Medium – would construct new south tunnel portal and portal ventilation plant in primarily industrial area and construct an intermediate ventilation plant in Reservoir Hill residential area	High – would construct new south tunnel portal, portal ventilation plant, and new tracks in residential area and construct a new intermediate ventilation plant in Reservoir Hill residential area	High – would construct new south tunnel portal, portal ventilation plant, and new tracks in residential area and construct a new intermediate ventilation plant in Reservoir Hill residential area

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