

Potomac Yard Metrorail Station Concept Development Study

Technical Memorandum Analysis of Station Location Alternatives April 15, 2009 Working Draft

Purpose of This Analysis

This analysis examined potential locations for a new infill Metrorail station at Potomac Yard. The analysis considered seven alternatives and addressed the station sites' relationship to development in Potomac Yard and Potomac Greens, necessary modifications to Metrorail track and systems to accommodate a station at each site, and the resulting estimated Metrorail construction costs. The resulting information was intended to assist in selecting a site if the City elects to build a new Metrorail station.

Station Background

The construction of an infill station in Potomac Yard was anticipated when WMATA planned the Metrorail Adopted Regional System. At the time the Blue and Yellow Line tracks were built through the RF&P Railroad Potomac Yard, a station was not justified, but Metrorail planners recognized the potential for the yard's future development. They identified the site for a station to be added later, and the tracks there were designed to accommodate a station that would meet WMATA's design criteria. The *Final Environmental Impact Statement, Metropolitan Washington Regional Rapid Rail Transit System*, August 1975, cites the provision for this future station. The City of Alexandria subsequently acquired land at this site, and it is now called the reserved site.

Since then, several planning and development efforts have discussed a Potomac Yard Metrorail station. In the mid-1980s, the Alexandria 2020 plan included the addition of a station and proposed approximately 16 million square feet of mixed-use development for Potomac Yard. The plan was not formally submitted to the City of Alexandria for approval. A 1997 station study by the then-owner of the yard developed conceptual designs for three alternative station sites at and slightly east and west of the reserved site. While the current zoning approvals for Potomac Yard do not require the construction of a Metrorail station, the approvals did require the reservation of land for a station. In addition, the existing zoning approvals require the property owners to participate in a special tax district to assist in financing station construction.

In 2008, the City of Alexandria created the 20-member Potomac Yard Planning Advisory Group (PYPAG) as part of the analysis of possible additional density for Landbay F. A basic principle of the group is that any redevelopment for Landbay F should be transit-oriented, mixed-use, and urban development. In addition, the City created a five-member Metrorail Station Feasibility Work Group comprising the mayor and one member each from the City Council, the Planning Commission, the Transportation Commission, and the Potomac Yard Planning Advisory Group.

Transit-Land Use Relationship

A general smart growth and transit-oriented development principle is that higher density and a mix of uses should be located within close walking and commuting distance of a transit station. Therefore, this analysis of alternative station sites considered possible density within the commonly accepted walking distances of a quarter mile and a half mile from a Metrorail station. Transit ridership is also greatly influenced by factors such as an appropriate mix of uses (office, residential, and retail), density, parking policies, pricing and rider subsidies, connectivity, and the quality of the pedestrian realm. The planning currently being conducted through the PYPAG addresses these factors.

There are challenges to locating a Metrorail station close to development in Potomac Yard. Figure 1 shows the Potomac Yard development concept. Approximately half the land within a quarter mile of most of the alternative station sites cannot be developed due to such constraints as environmental characteristics and the presence of railroad tracks and National Park Service property. There is a Federal Aviation Administration (FAA) flight path restriction on much of the central portion of the yard, which limits building heights to approximately 90 to 100 feet. The CSX railroad line separates the Metrorail tracks from the western portion of Potomac Yard, requiring a pedestrian bridge to the station and adding 200 feet to the station access distance.

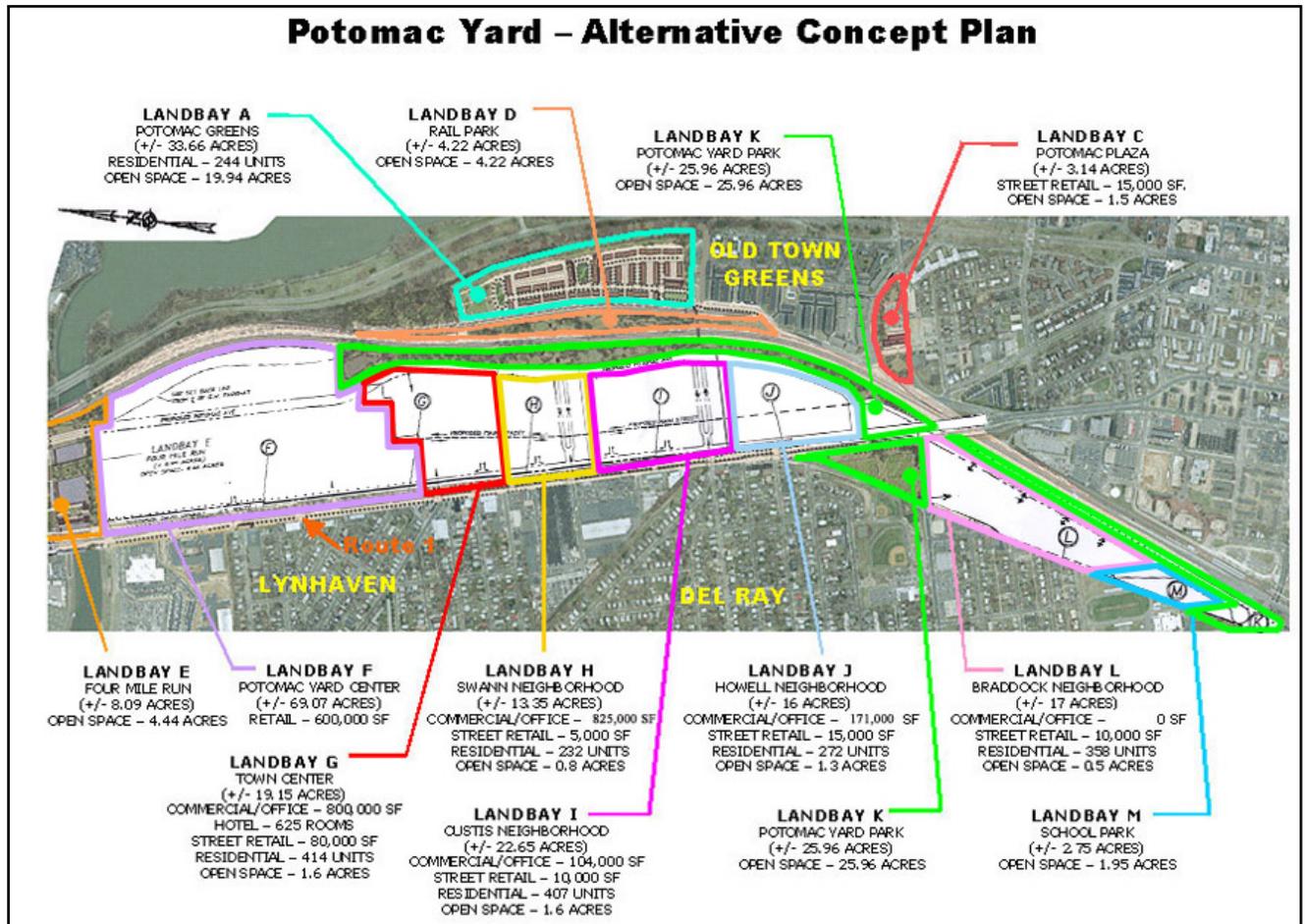
Table 1 lists the development maximums permitted by the current Coordinated Development District (CDD) zoning for Potomac Yard and Potomac Greens (including the existing retail center).

Table 1

Use Maximums per Current CDD:				
Landbay	Residential (Units)	Office * (sf)	Retail (sf)	Hotel (rooms)
F	0	0	600,000	0
G	414	800,000	80,000	625
H	232	825,000	5,000	0
I	407	104,000	10,000	0
J	272	171,000	15,000	0
L	358	0	10,000	0
TOTAL	1,683	1,900,000	720,000	625

* Office use can be converted to Retail Use with City Council approval through the DSUP process

Figure 1



The existing retail center in Landbay F contains approximately 600,000 square feet of retail, which is the maximum amount of development permitted with the existing zoning. Therefore, any additional density will require a rezoning of the site and associated approvals. The range of density for Landbay F the PYPAG has discussed is a floor-area ratio of approximately 2.5.

Metrorail Design Requirements

A new station at any location must comply with WMATA's adopted Metrorail design criteria. If a station is built at a site other than the reserved site, the Metrorail tracks and systems would have to be modified to comply with the design criteria as well. Complying with the design criteria would require more construction at some sites than at others, and the extent of construction would affect the cost of the station of each alternative.

Station

The design criteria address a variety of station characteristics, including safety, capacity, ADA-compliant accessibility, architectural and aesthetic qualities, operating economy, maintainability, and commonality among system components. The station platform must be 600 feet long, the same as all Metrorail stations, to accommodate an eight-car train. Depending upon the characteristics of the station site, a station can have a single center platform between the tracks or a pair of side platforms on the outside of the tracks. Elevators, escalators, and stairs must meet capacity and safety requirements for vertical circulation. Space in the station must provide not only for passenger circulation but also for Metrorail operating system equipment and station maintenance functions. A station in a tunnel would require air-conditioning, ventilation, and fire-protection systems to meet standards and codes.

Tracks

The tracks through a station must be straight, a condition called tangent track. Tracks cannot be curved at a station because the platform edges would need to be set back to clear the rail cars, creating safety concerns because of the resulting wide gap between the platform edges and rail car doors. The tangent track must be 730 feet long at a station; 600 feet for the platform plus 65 feet at each end to provide proper alignment of trains entering and leaving the station.

Any new Metrorail tracks or existing-track modifications to accommodate a station must comply with design criteria for track grade and curvature. The maximum acceptable grade is 4 percent, a rise or fall of 4 feet for every 100 feet of track. The minimum acceptable curve radius is 1,000 feet, which allows a train speed limit through the curve of 45 miles per hour, the lowest speed limit allowed in the Metrorail system. Every connection between a tangent and a curve is a spiral, a gradual track transition from straight to curved. These design criteria are based upon safety and rider comfort.

A double crossover, an X-shaped track connection between the two running tracks that would allow trains to move from one track to the other, would need to be added north of a new station. This crossover would be needed to maintain Metrorail operations during station construction and would provide operational flexibility.

Metrorail Operating Systems

The addition of a station would require modifications to the systems that support Metrorail train operations. Trains accelerating from a stop at the station would increase the traction power required. Upgrades to the DC traction power system would include the addition of a supplemental rectifier-transformer unit to the existing traction power substation to serve a station at a nearby site; a new traction power substation would be needed to serve a station farther away. New composite contact rail (the third rail) would be installed, replacing steel contact rail where necessary.

The automatic train control system (ATC) would require changes and additions to accommodate any necessary track realignment and to implement programmed stops at the station. Ductbanks will be required for cabling to integrate the new equipment circuits into the existing system. Wayside signals, switch machines, speed command loops, and interlocking control equipment will be required to operate trains through the new double crossover.

A new station would need several communications systems for operations and customer safety. This would include such as elements as modifications to the carrier transmission system, a public address system, a fire and intrusion-detection system, and closed-circuit television systems for surveillance.

Construction Sequence

The steps in station construction are extremely important for an infill station. Because construction of the new station and connecting tracks would be near operating trains, the potential would exist for this construction to affect Metrorail operations. Safety must be assured, and major service disruptions are not acceptable, so the station and tracks must be designed to be built without interfering with regular Metrorail operations.

To allow construction to occur without affecting operations, trains on the Blue and Yellow Lines would operate on a single track through the station site from about 8:00 p.m. until system closing five days a week for some period of time. Some construction activities would need to occur at night when the Metrorail system is not operating, which limits the construction shift to only a few hours at a time. Some steps in the construction sequence will require shutting down Metrorail operations through this rail segment for some time period, but a shut-down must be for the shortest time possible to avoid inconveniencing riders.

Potomac Yard-Specific Requirements

The Potomac Yard station would have specific requirements created by the immediate physical setting. The ability to expand the station site or realign the Metrorail tracks is limited because CSX freight railroad tracks are located on the west and National Park Service land and the Potomac Greens neighborhood abut the Metrorail tracks on the east. Access from the west to a station built on the existing tracks must be by a pedestrian bridge that would have to be high enough to provide at least 23 feet of clearance over the CSX tracks. Any new Metrorail tracks that crossed above the CSX tracks would have to provide the same clearance.

Capital Cost Estimates

The alternatives' capital costs were estimated in 2012 dollars, assuming that 2012 would be the midpoint of construction. Capital costs will be a function of the type and extent of construction necessary, not only for the station but also for necessary track modifications and changes and additions to Metrorail systems. Capital cost estimates developed in this analysis are order-of-magnitude and concept-level because detailed designs have not yet been prepared. Cost estimates are expressed here as ranges and include contingency factors because they are conceptual and based upon general design concepts.

These cost estimates are based upon recent rail transit system construction costs nationally as well as construction costs in the Washington, DC metropolitan area. The cost estimates include all construction-related costs from project inception through completion, including planning, design, engineering, construction management, and station commissioning. The costs estimates do not include land acquisition, major utility relocation, permits, fees, financing, or costs imposed by unforeseen conditions, such as geotechnical conditions or hazmat remediation.

Alternative Station Sites

Figure 2 shows the seven alternatives considered for the station and track alignment. Several alternatives would be on or near the present Metrorail track. Others would be in Landbay F, requiring new tracks that would diverge from the existing tracks.

Reserved Site—Alternative A

In Alternative A, shown in Figure 3, the station would be located at the reserved site. This site is on the existing Metrorail tracks east of the boundary between Landbays G and H.

The site has been reserved for a possible Metrorail station and is owned by the City. The reservation was designed to be accessed primarily from the west and can also be reached from the east. City-wide bus service and kiss-and-ride access would be on the west side of the station, and local bus service would use Potomac Greens Drive on the east. A portion of the station and the associated circulation would be built within Landbay K, the nearly 24-acre linear park along the eastern edge of Potomac Yard.

The nearly complete 227-acre Potomac Greens townhouse development is located east of the site. To the south and west of the reservation is the approximately four-acre Rail Park (Landbay D). Farther west are portions of Landbays G and H. Table 2 shows the land area and development in the station site’s walkshed.

Table 2

	Approximate Development SF*	
	Quarter-Mile Walkshed	Half-Mile Walkshed
Alternative A	3,500,000	10,000,000

* Size of Alexandria residential units estimated at 1,500 sf/unit

The station would be a side-platform station, and an overhead walkway would provide access across the CSX tracks. A station entrance pavilion would be on each side of the station with elevators and escalators providing access to the overhead walkway.

Alternative A would require the least modification of the existing Metrorail facilities because some provisions were made for a station at this site. Because the station would be built directly on the operating tracks, station construction would require single-tracking of Metrorail operations for extended periods of time. The only necessary track modification would be the installation of a double crossover, which could be done by closing the Metrorail line over a weekend. Additional traction power equipment would be needed in the existing traction-power substation near the station site, and additional train-control equipment would need to be installed. The Alternative A capital cost is estimated to be \$140 million to \$180 million in 2012 dollars.

Northern Sites—Alternatives B1, B2, and B3

Because of the limitations on development near the Alternative A site, three alternatives farther north along the Metrorail tracks were considered. Shifting the station farther north would capture more density planned or approved for Landbays F, G, and H compared to the existing reservation site.

The northern alternatives would also serve a larger land area that is outside the flight path with its associated height restrictions. However, the northern alternatives would be less accessible to the residential area to the east. Table 3 shows the land area and development in the Alternative B station’s walkshed.

Table 3

Approximate Development SF*		
	Quarter-Mile Walkshed	Half-Mile Walkshed
Alternative B	5,500,000	14,000,000

* Size of Alexandria residential units estimated at 1,500 sf/unit

Three northern alternative sites, shown in Figure 4, were analyzed. Some station characteristics at the northern locations would be similar to Alternative A. The station would be a side-platform station with an overhead walkway to the west over the CSX tracks. A station entrance pavilion would be on each side of the station with elevators and escalators providing access to the overhead walkway. A new double crossover would be installed farther north, and additional traction power and train control equipment would be needed.

The northern sites differ from Alternative A; they were not designed to accommodate a station and so the existing Metrorail tracks would require modification. Depending upon the exact track alignment, additional right-of-way and the construction of new retaining walls could be needed. A longer sidewalk would be required between the station and Potomac Greens Drive.

Alternative B1

The existing tracks curve where the station would be located in Alternative B1, so the tracks would need to be relocated and reconstructed to create a 730-foot tangent. A tighter track curve would extend eastward north of the station, and new right-of-way would need to be acquired from the National Park Service for the curve. Because of the impacts on the National Park Service property, this is not a viable alternative.

Alternative B2

Alternative B2 was defined to avoid impacts to National Park Service land, and so the station could not be as far north as in Alternative B1. The tracks would still need to be relocated and reconstructed to create a 730-foot tangent. As in Alternative A, station construction would be directly on the operating tracks, and construction would require single-tracking for extended periods of time. Reconstructing the tracks for this alternative would require the demolition of the existing traction power substation and the construction of a new one nearby, adding to the cost. The Alternative B2 capital cost is estimated to be \$150 million to \$200 million in 2012 dollars.

Alternative B3

Alternative B3 would be a new track segment built to straighten curves on the existing tracks. This alternative would require the addition of new track for a longer distance, but it would have a distinct construction advantage—the station would be built on the new tracks, not on the existing ones. Since trains would not be using the tracks at the station while it was being built, potential Metrorail operations disruptions would be less than in Alternative B2, and construction would be more or less unimpeded, improving construction efficiency and reducing costs. After the station was built, the new tracks would be connected to the existing ones. Additional right-of-way would be needed on the east side of the existing right-of-way; the exact extent of the additional right-of-way could be less than shown and would be determined by more-detailed engineering. The Alternative B3 capital cost is estimated to be \$140 million to \$180 million in 2012 dollars.

Landbay F Sites—Alternatives C1, C2, and D

A station in the middle of Landbay F would be closest to the highest amount of development. New buildings could be directly adjacent to the station. Much of Landbay F is not subject to the FAA flight path restriction and could be planned for higher densities, although the amount of additional density will require additional analysis. Landbay G would still be within the quarter-mile walkshed, and Landbay H would still be within the half-mile walkshed. Although access from the east would be challenging, the station would be more accessible to properties and neighborhoods across Route 1.

Three stations in Landbay F, shown in Figure 5, were analyzed.

Station in Tunnel—Alternatives C1 and C2

Table 4 shows the land area and development in the Alternative C station’s walkshed. The development on Landbay F was assumed to be the same in both amount and distribution for all alternatives and does not account for likely density increases for alternatives located in the main body of Potomac Yard. From a land use perspective, providing a station within Potomac Yard is clearly desirable. However, doing so would create engineering, urban design, and cost challenges.

Table 4

	Approximate Development SF*	
	Quarter-Mile Walkshed	Half-Mile Walkshed
Alternative C	10,000,000	14,500,000

* Size of Alexandria residential units estimated at 1,500 sf/unit

A new Metrorail tunnel would run across part of Landbay F beneath one of the north-south streets to be built there, similar to the Metrorail tunnels beneath streets in other urban centers. The station would be a below-grade, center-platform station, and station entrances could be incorporated into nearby buildings. There would be flexibility in station design because the design would not be constrained by the existing Metrorail tracks. The station could be farther north or south along the tunnel beneath Landbay F to create the best connections to new development.

The tunnel alternatives would require extensive construction. New Metrorail tracks would have to be built from north of Four Mile Run to the existing tunnel section near the south end of Potomac Yard, a distance of approximately 1.65 miles. The new tracks would have to cross the CSX railroad tracks twice on elevated structures. North of Four Mile Run, the existing elevated Metrorail track structure would have to be modified and a new structure would be built to carry the Metrorail tracks over both the CSX tracks and Four Mile Run. Modifying the existing structure would require taking the Blue and Yellow lines out of service for an extended period of time. A tunnel portal would be built in Landbay F where the tracks would come down to grade and enter the new tunnel. At the south end of Landbay F, another portal would be built where the tracks would come up to grade and onto a new structure over the CSX tracks. A new traction power substation would be built, potentially in one of the new buildings near the station.

Alternative C1

Although the central segment of Alternative C1 would be in a tunnel, the northern segment would be an elevated Metrorail track structure through the recently built building north of Four Mile Run. This would create unacceptable impacts, and Alternative C1 is not a viable alternative.

Alternative C2

To avoid Alternative C1’s negative impacts, the Alternative C2 tunnel and station would be farther east in Landbay F, allowing the new structure carrying the Metrorail tracks over the CSX tracks and Four Mile Run to diverge from the existing structure farther south and avoid existing buildings. However, as currently defined, this option would significantly impact planned and/or approved development on Landbays G and H.

The Alternative C2 capital cost is estimated to be \$410 million to \$520 million in 2012 dollars. This estimate includes the tunnel, the station, connecting tracks to the north and south, the traction power substation, and the necessary Metrorail operating system modifications.

Elevated Station—Alternative D

The elevated Metrorail line in Alternative D would be built farther east in Landbay F. Table 5 shows the land area and development in the Alternative D station’s walkshed. To limit the visual intrusion of the elevated structure, the line would run north-south in an alley between new buildings. The minimum width of an elevated Metrorail station is 60 feet. The tracks could be at the second- or third-floor level of the adjacent buildings, but more-detailed design analysis of both the Metrorail track structure and the buildings would be necessary to determine this relationship.

Table 5

	Approximate Development SF*	
	Quarter-Mile Walkshed	Half-Mile Walkshed
Alternative D	9,500,000	14,000,000

* Size of Alexandria residential units estimated at 1,500 sf/unit

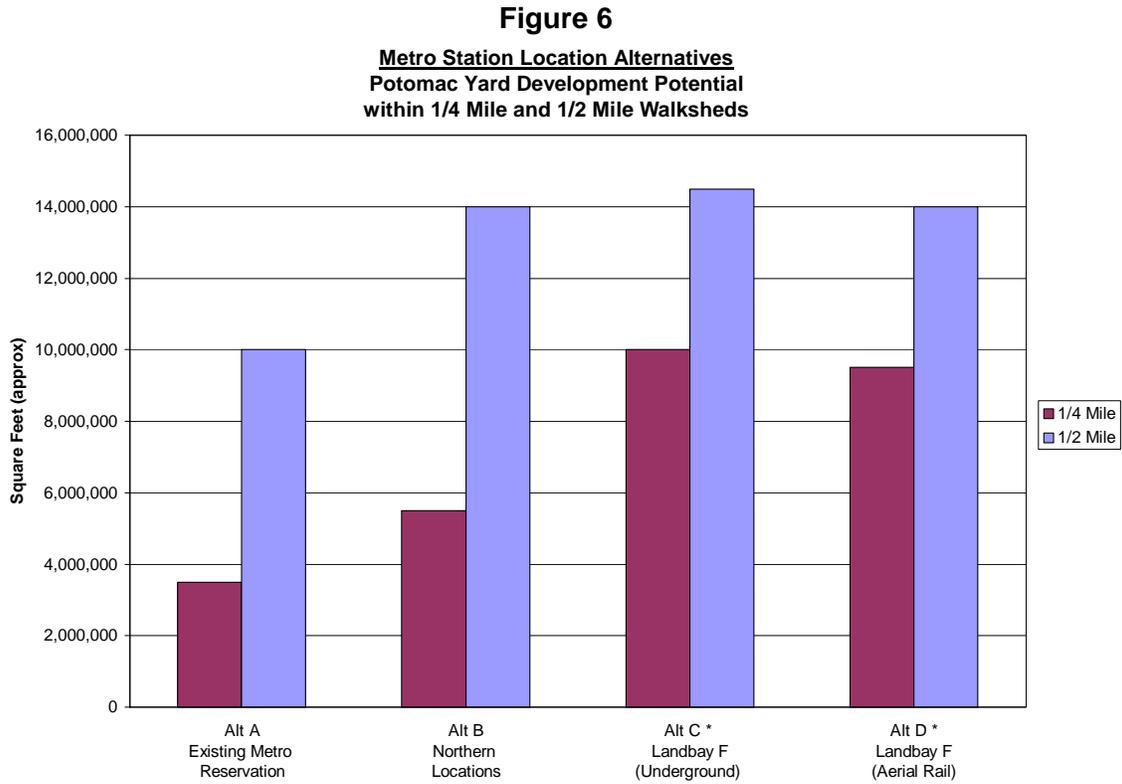
Like the Alternative C station, there would be flexibility in station design, and the station could be located farther north or south. Access to a new elevated station could be through adjacent buildings, potentially creating opportunities for new interior public spaces and retail related to the station entrances.

This alternative would also require extensive construction. New Metrorail tracks would have to cross the CSX railroad tracks twice. At the north end, new structure would carry the Metrorail tracks over the CSX tracks, over Four Mile Run, and into Landbay F. At the south end, the elevated structure would have to connect to the existing tunnel segment. A new traction power substation would be required in this alternative as well, potentially in one of the new buildings near the station.

The Alternative D capital cost is estimated to be \$230 million to \$300 million in 2012 dollars. This estimate includes the elevated structure, the station, connecting tracks to the north and south, the traction power substation, and the necessary Metrorail operating system modifications.

Summary of Alternative Station Site Characteristics

Figure 6 compares the development within the walksheds at the alternative station sites, and Table 6 summarizes selected characteristics of the alternatives.



* **NOTE:** Development for Landbay F was assumed equal (in size and distribution) for each alternative and does not account for likely increases in density for alternatives located within the main body of Potomac Yard.

Table 6

Characteristic	Alternatives						
	A	B1	B2	B3	C1	C2	D
Station Type	At-grade, side platform	Not Viable	At-grade, side platform	At-grade, side platform	Not Viable	In tunnel, center platform	Elevated, center platform
Approximate development within ¼ mile, million square feet	3.5		5.5	5.5		10.0	9.5
Approximate development within ½ mile, million square feet	10.0		14.0	14.0		14.5	14.0
Construction impacts on Metrorail operations	High		High	Medium		Medium	Medium
Preliminary estimated capital cost, million 2012 dollars	140-180		150-200	140-180		410-520	230-300

Note: Some station characteristics will require more detailed analysis in future planning phases. They include environmental impacts, detailed architectural and design characteristics, and operating and maintenance costs.