



PROJECT NUMBER: 33867.00

5.1



ALTERNATIVE TRANSPORTATION STUDY
Back Bay Refuge Trail Shared Use Path / On Road Facilities
 BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA

5.0 BACK BAY REFUGE TRAIL

The grant application identified BBRT as an option to provide non-motorized land access. A significant portion of the BBRT would utilize the City-owned, but not built, Nimmo Parkway ROW and existing ROW along Sandbridge Road to construct an off-road shared use path (SUP) facility from Albuquerque Drive to Sandpiper Road (see Figures 5.2.A – 5.2.J). The BBRT would connect to existing residential neighborhoods in the Red Mill and Lago Mar area, and would extend existing SUP facilities. The BBRT would link these developed areas to BBNWR, FCSP, and Little Island Park, providing off-road access where none currently exists.

5.1 Shared Use Path

◆ Scoping/Planning

Design to 30% Conceptual

Within the existing Nimmo ROW from Albuquerque Drive to Sandbridge Road, a 10' wide SUP would be aligned to minimize impacts to wetlands, while remaining at-grade to the extent possible. In addition to minimizing wetland and property impacts, this approach also would create a slightly meandering path alignment for an enhanced user experience.

One section of the BBRT would traverse an area occupied by bald cypress (*Taxodium distichum*) adjacent to Ashville Bridge Creek, and would include an elevated 14' wide timber pile boardwalk to avoid fill impacts to this sensitive ecosystem. A 150' bridge would span the creek to maintain navigation by small watercraft with 3' clearance. Two other small sections of boardwalk also would be included to cross minor water features.

East of the point where the Nimmo ROW intersects Sandbridge Road, the BBRT would cross Sandbridge Road and then continue on a shared use path along the south side of the road to Sandpiper Road. Figure 5.2.G shows the proposed crosswalk improvements, which include high visibility crosswalk markings, crosswalk warning signs, and pedestrian level lighting. The location of this crossing was considered in the context of sight distances, roadway geometry, and existing land

uses. An alignment of the SUP on the north side of Sandbridge Road was also considered for this segment; however, the south side of the roadway was chosen as the preferred alignment, based on connections to existing land uses such as realty companies and outdoor rental enterprises.

It is noted that the City currently has a safety improvement project underway to straighten mainline curves, widen shoulders, and add shared use paths to both sides of Sandbridge Road (CIP 2.078.000: Sandbridge Road - Nimmo VII-A). This CIP may advance the construction of the Sandbridge Road segment of the BBRT if funding becomes available.

◆ Schematic Design

Design Criteria

Early in the planning process the study team developed a design criteria sheet for the BBRT using the standards and guidance included in the American Association of State Highway and Transportation Officials (AASHTO), Americans with Disabilities Act (ADA), the United States Access Board, and Virginia Department of Transportation (VDOT) Road Design Manual.

The proposed trail elevation generally follows the existing grade in order to minimize impacts to the surrounding wetlands and does not account directly for sea level rise. While the City policy for major infrastructure projects is to consider a 1.5' sea level rise (and in highly critical cases 3'), the proposed trail would not be considered major infrastructure. Furthermore, it is anticipated that the proposed trail could be replaced in the future by the extension of Nimmo Parkway through this corridor and, therefore, warrants the proposed economical design approach.



Sandbridge Road
Shared Use Path Photo Simulation

TABLE 5.1: BBRT SUP DESIGN CRITERIA

DESIGN ELEMENT	DESIRED	MIN/MAX
AASHTO GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES 2012 VDOT ROAD DESIGN MANUAL 2015		
SUP Width	10'	8'
SUP Bridge/Boardwalk	14'	14'
Minimum Shoulder Width (Graded)	3'	2' (6:1)
Clear Zone		
Lateral Obstructions	3'	-
Lateral Obstructions (Smooth)	5'	-
@ Slope > (3:1)	5' ¹	-
Separation between Path and Roadway	10'	5' ²
Minimum Radius		
⊘ Radius @ 18 mph	60'	-
⊘ Radius @ 12 mph (Minimum) ³	27'	-
Cross Slope	1%	2%
Maximum Longitudinal Grade	5%	-
Vertical Clearance	10'	8'
OTHER DESIGN CRITERIA		
Design Vehicle	H5	
Elevation		
Nimmo Pkwy ROW	3.0'	
Sandbridge Rd	4.0'	

¹If the distance is less than 5' then engineering judgement should be used to determine necessity of physical barrier (fence).

²VDOT minimum is 3'. If the distance is less than 5' then engineering judgement should be used to determine necessity of physical barrier (fence).

³Design speed lower than 18 mph may be appropriate where environmental or physical constraints exist.

Surfacing

Alternative surface options include unpaved paths (crushed stone, stabilized earth, etc.) and paved paths (asphalt and concrete). While unpaved paths represent the lowest trail construction cost alternative, these surfaces require wheeled users to use a greater effort to travel when compared to paved surfaces and are more susceptible to erosion resulting from heavy runoff and/or flooding. Asphalt and concrete pavements provide good all-weather quality surfaces for riders and help mitigate erosion concerns when compared to unpaved surfaces. Although concrete provides the longest service life, its initial construction cost is the highest, particularly when considering areas that are difficult to access. For these reasons, this study assumes an asphalt surface which provides a smooth riding surface and is resistant to drainage and flooding impacts, all at a reasonable construction cost.

Structures

The BBRT would include raised structures in segments where the trail encounters low lying areas prone to elevated water levels, sensitive wetland features, and larger waterways, Ashville Bridge Creek. At these various locations, the trail would transition from an at-grade trail onto either a boardwalk or bridge structure. The boardwalks would be fully timber structures including railing, decking, stringers, and pile supported bents repetitively spaced over the low lying and wetland areas. The bridge structure would provide a clear span across Ashville Bridge Creek. The bridge would have a similar timber railing and decking, but would be supported by steel girders and concrete piers on concrete piles on each side of the creek.



The trail structures would be designed in accordance with the 2009 AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges. The trail structures would provide a 14' wide clear opening between railing posts. In addition to the required 90 psf pedestrian loading, the structures would also be designed to accommodate an H5 vehicle, which is roughly equivalent to a heavy duty pick-up truck.

Other Capital Needs

- Trailheads

The BBRT would include a trailhead where it meets along Atwoodtown Road. The trailhead would include a kiosk with wayfinding, benches, trash receptacles, and bicycle repair station. Parking would be provided on-street. A second trailhead would be provided near where the trail meets Sandbridge Road, and a third one at the intersection of Sandbridge Road and Sandpiper Road.

- Wayfinding

The BBRT system, including both SUP and on-road facilities, would include a comprehensive wayfinding sign system. The wayfinding would guide trail users to BBNWR and FCSP, trailheads, and intermediate destinations. An important aspect of the wayfinding would be user-friendly mapping with trail distances to intermediate and final destinations.



Wayfinding Sign Example

ALTERNATIVE TRANSPORTATION STUDY
BACK BAY NATIONAL WILDLIFE REFUGE

• Stormwater

Where the SUP is asphalt on grade, drainage facilities would be incorporated into the system. With the trail in such a low-lying area, water needs to be captured or allowed to flow easily to minimize flood conditions. The preliminary design includes drainage features for stormwater management.

◆ Cost Estimate

The construction cost estimate for the BBRT is based on current local 2015 unit prices and actual costs for recent similar projects. Costs for the trail would generally entail clearing, grading, paving, timber pile boardwalk, bridge abutments and spans, pavement markings, signs, stormwater management, and mitigation. This preliminary cost estimate based on 30% plans is intended for use in capital budgeting and funding; it includes a 20% contingency and does not include utility relocation costs.

◆ Benefit Analysis

As depicted in Table 5.3, the BBRT SUP either mostly meets or completely meets each of the MOEs. The scores represent averaged values from the TAC screening and final screening described in Chapters 3 and 4.

TABLE 5.2: BBRT SUP SUMMARY COST ESTIMATE

ITEM	TOTAL COST			
	WITHIN NIMMO ROW		ALONG SANDBRIDGE RD	
Construction				
Site Preparation		\$296,300		\$194,700
Earthwork		\$170,700		\$119,600
Boardwalk	(800 LF)	\$991,000	(500 LF)	\$600,000
Bridge	(150 LF)	\$671,000		\$0
Trailside Features		\$224,500		\$111,500
Contingency (20%)		\$541,900		\$248,700
Design (8%)		\$260,100		\$119,400
TOTAL		\$3,511,200		\$1,611,600
RIGHT-OF-WAY	AREA (ACRES)	TOTAL COST	AREA (ACRES)	TOTAL COST
Private: ROW	0.00	\$0	0.00	\$0
Private: Construction Easement	0.05	\$1,500	0.00	\$0
Federal: ROW	0.00	\$0	0.57	\$2,000
Federal: Construction Easement	0.20	\$1,500	0.25	\$1,500
SUBTOTAL		\$3,514,200		\$1,615,100
OTHER	AREA (ACRES)	AREA (ACRES)		
Wetland Impact	1.32		1.54	
Wetland Mitigation		\$84,000		
Permitting		\$75,000		

TABLE 5.3: MEASURES OF EFFECTIVENESS - BBRT SUP

MEASURES OF EFFECTIVENESS - BBRT SUP	SCORE
VISITOR MOBILITY	
Reduce Traffic Congestion	1
Enhanced Visitor Mobility, Accessibility and Safety	3
Improve Visitor Education, Recreation and Health Benefits	3
ENVIRONMENTAL BENEFITS	
Protection of Sensitive Natural, Cultural and Historical Resources	2
Reduced Pollution	0
OPERATIONAL EFFICIENCY AND FINANCIAL SUSTAINABILITY OF ALTERNATIVES	
Effectiveness in meeting BBNWR Goals	3
Financial Plan - Development and Operational Costs	2
Potential Funding Sources	3
CONSTRUCTION/OPERABILITY	
Project Phasing and Sequence Limitations Project Phasing and Sequence Limitations	2
Limitations on Transportation Operation	3
SCORING SYSTEM: 0=DOES NOT MEET CRITERIA, 1=SLIGHTLY MEETS CRITERIA, 2=MOSTLY MEETS CRITERIA, 3=COMPLETELY MEETS CRITERIA	

Visitor Mobility

- **Reduce Traffic Congestion**

By linking Red Mill and Lago Mar to the Refuge, the BBRT SUP would give the FWS a viable opportunity to encourage visitors to get out of their cars and use the trail to access the Refuge. This would represent a measurable change in the transportation options for visitors and residents. Nevertheless, the reduction in vehicle trips into the Refuge and along Sandpiper road will likely be modest at an estimated 13 vehicles on a daily basis. Along with other bicycle/pedestrian improvements described herein, this facility could contribute to a 1% change in mode split (people who would ordinarily drive to the refuge opting instead to use the BBRT).

- **Enhanced Visitor Mobility, Accessibility and Safety**

The SUP would provide a high benefit to visitor mobility, by providing a direct off-road link between residential areas and Sandbridge. Currently, the lack of accommodations for cyclists and pedestrians limits the number of people who visit BBNWR and FCSP by bicycle or on foot. The trail would reduce the number of bicycles traveling on narrow, rural roads by providing a travelway families could use safely.

- **Improve Visitor Education, Recreation and Health Benefits**

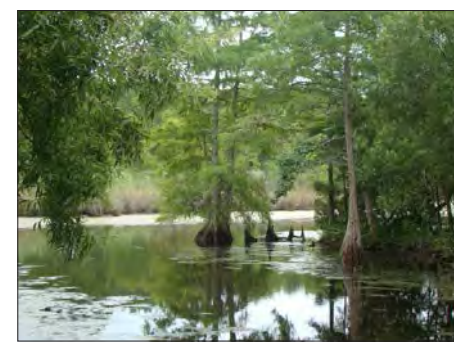
The SUP would provide a high benefit to the visitor experience by improving the active transportation option and eliminating the stress of driving a shared roadway condition on certain segments of the trip. The trail wayfinding could provide additional information about the Refuge during the trip. The system expands the reach of the Refuge experience to users not currently able to access the park. The SUP would also convey safety benefits, by providing an off-road option for bicyclists and pedestrians, thereby removing them from the narrow Sandbridge Road.

Environmental Benefits

- **Protection of Sensitive Natural, Cultural and Historical Resources**

The overall environmental benefits of the SUP would be positive. While approximately three acres of wetlands would be impacted by fill for the trail bed, these impacts would occur primarily to lower quality, emergent wetlands previously disturbed and maintained as part of existing utilities and road shoulders. Where higher quality wetlands with standing water occur, the trail would be elevated on a boardwalk to minimize impacts. Wetlands would be mitigated to insure a no net-loss of functional value. No impacts to cultural or historical resources would be expected.

Another valuable environmental benefit would be public awareness of the importance of natural resources. By visually extending the Refuge experience, and by providing access through and adjacent to sensitive wetlands and cypress habitat, the SUP would rely on viewshed preservation, and would provide an active tool to support such preservation.



- **Reduced Pollution**

The SUP will contribute to water quality through stormwater treatment measures as part of the design and construction of the path. Over the long term, this trail would offer environmentally sustainable benefits by removing vehicles from the road and reducing impacts of vehicle emissions and noise; however, for this study the value is considered negligible.

◆ Operational Efficiency and Financial Sustainability of Alternatives

- **Effectiveness in meeting BBNWR Goals**

BBNWR goals are identified in the September 2010 Comprehensive Conservation Plan. By providing a sustainable and non-motorized means of access to the refuge, the SUP would support BBNWR goals for habitat preservation, and would especially support goals for enhanced opportunities for wildlife viewing and appreciation of natural resources and conservation.

- **Financial Plan - Development and Operational Costs**

Construction of the SUP would require substantial capital investment, but it would rely primarily on use of existing ROW, much of which has previously been cleared and requires minimal grading. The SUP has been designed at schematic level to avoid and minimize wetland impacts. The operability of the trail would require maintenance in the form of clearing vegetation and obstructions, repaving, and bridge and boardwalk maintenance, as well as police patrol and enforcement activities.

The Rails-to-Trails Conservancy Northeast Regional Office has published a maintenance and operations guide that provides guidance and case study examples for a wide range of trail projects. It is a valuable resource for types, frequency, and cost of maintenance and operational activities. Based on examples cited, annual trail O&M costs will likely fall in the \$7,000 to \$9,000 per mile range; the BBRT would require an annual approximate cost of \$24,000 to maintain.

- **Potential Funding Sources**

Section 11.1 of this report identifies a range of sources that could be used to help fund the development of the BBRT SUP. In particular, the Transportation Alternatives Program (TAP), Congestion Mitigation and Air Quality Improvement Program (CMAQ), and the Federal Lands Access Program (FLAP) offer high potential for funding this type of improvement.

◆ Constructability/Operability

• Project Phasing and Sequence Limitations

Because the BBRT SUP will be constructed primarily within existing ROW (much of which is already cleared), the project faces minimal constructability issues. The project involves work in and around wetlands, and includes a bridge at Ashville Creek Bridge, but the study team has designed the path to avoid and minimize impacts. The amount of available ROW will facilitate construction staging and sequencing.

If needed due to funding limitations, the BBRT SUP could be constructed in phases. While this would limit the short-term mobility benefits of the trail, logical termini could likely be established to develop two or more viable phases.

• Limitations on Transportation Operation

The SUP involves minimal limitations on transportation operations. These primarily are in association with crossings of existing roadways, including the proposed crossing of Sandbridge Road. The study team has reviewed options for these crossing locations, in the context of minimizing impacts to the transportation system.

◆ Conclusion

The BBRT SUP represents a significant investment in the area’s overall transportation system, and would convey substantial benefits in meeting the goals of this study, BBNWR, and the City in general. By connecting to existing trail facilities, the SUP would provide an important link between developed areas and the destinations at BBNWR, FCSP, and Sandbridge. As described, this would be achieved in an environmentally sustainable manner. The facility would dramatically improve visitor mobility and experience.



TABLE 5.4: BBRT SUP PROJECT SCHEDULE

PROJECT MILESTONES	PROJECT SCHEDULE BACK BAY REFUGE TRAIL (BBRT) SUP															
	YEAR 1				YEAR 2				YEAR 3				YEAR 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Procure Funding																
Design Services																
Permitting																
ROW Acquisition																
Utility Relocation																
Construction																

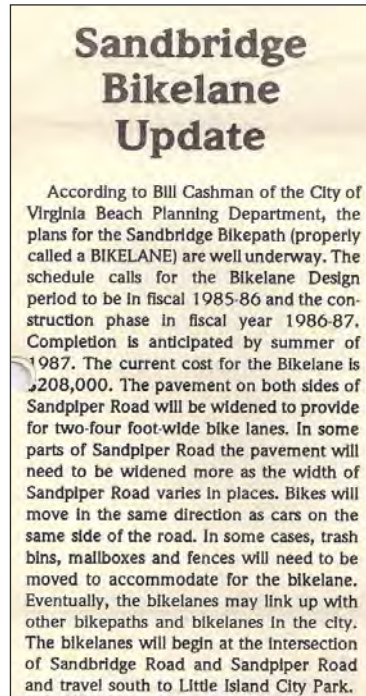
Project Schedule Notes:
 1. ROW acquisition is required from the Federal Government and private property owners.

“ THE SHARED USE PATH WOULD
 DRAMATICALLY IMPROVE VISITOR
 MOBILITY AND EXPERIENCE. ”

5.2 BBRT On-Road Facilities

The shared-use path brings pedestrians and bikes to the Sandbridge community but does not get them to BBNWR. Since Sandbridge is almost completely built out, there is no feasible opportunity to build a shared use path through the community to BBNWR.

The primary connection from Sandbridge Road to BBNWR would follow on-road bike lanes along Sandpiper Road. The City widened the road to add these bike lanes in 1986, as shown at right, but the markings have deteriorated and disappeared over time. Restoring these bike lane markings would be justified, regardless of this study.



From the January 1986 Newsletter for the Sandbridge Civic League



Sandfiddler Road

A bike route along Sandfiddler Road could be a more comfortable setting for some cyclists, with car traffic that is slower and at a lower volume. The study team evaluated several treatments along Sandfiddler Road, including making it one-way, but none of these treatments was satisfactory for a variety of reasons. Besides its advantages for cyclists and pedestrians, Sandfiddler Road is narrower, and sand blows constantly onto it, despite efforts to clean it. As a result, the preferred solution would be to place BIKE ROUTE signs only, with no pavement improvements or markings.

At the west end of BBRT, Atwoodtown Road and Lotus Road provide an on-road connection from the BBRT to both BBNWR administrative offices and the future Visitor Contact Station on Sandbridge Road and New Bridge Road. Completing this spur requires a path and boardwalk over Ashville Bridge Creek to connect two pieces of Atwoodtown Road. Both roads are low-volume, low-speed roads with some sections of narrow pavement, and both already are heavily used by recreational cyclists.

◆ Scoping/Planning

Limited improvements to Sandpiper Road and Sandfiddler Road would also help complete the BBRT. Sandpiper Road currently has the pavement width for bike lanes on both sides of the road, which are unmarked and, in some places, obstructed by landscaping or driveway aprons. Limited clearing of obstructions, driveway apron

improvements, and the addition of pavement markings would formalize these bike lanes and provide on-road north-south access from the Sandbridge Resort area to BBNWR and FCSP. Sandfiddler Road is a low-speed, low-volume street that would provide an optional on-road access with the addition of wayfinding signs.

Lotus Drive and Atwoodtown Road are low-speed, low-volume streets that would provide an important link in the overall BBRT system. Connectivity could be provided by bridging Ashville Bridge Creek with a boardwalk parallel to the utilities in the Atwoodtown Road ROW. Limited roadside clearing for sight distances, along with wayfinding signs, would make these roads an integral part of the BBRT; although parts of these roads might limit their use to confident road cyclists.

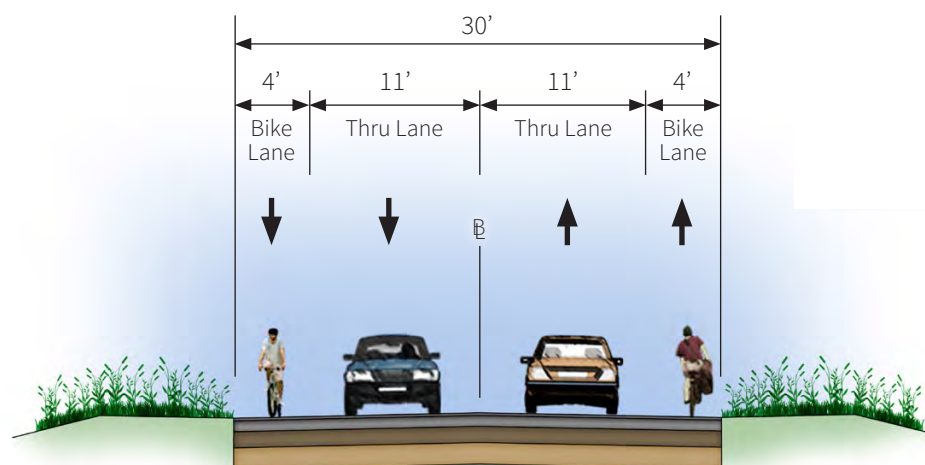
◆ Schematic Design

Figure 5.3.A shows the proposed improvements to Sandpiper Road, which would result in 4' wide bike lanes and 11' wide vehicular travel lanes. The figure also depicts typical intersection markings, typical crosswalk improvements, and the locations of needed obstruction removal and driveway apron improvements.

TABLE 5.5: BBRT ON-ROAD FACILITIES COST ESTIMATE

ITEM	TOTAL COST
ATWOODTOWN RD BOARDWALK	
Construction	
Site Preparation	\$38,200
Earthwork	\$20,000
Trail Construction (230 LF)	\$19,000
Boardwalk (100 LF)	\$140,000
Trailside Features	\$16,000
Contingency (25%)	\$58,300
Design (15%)	\$43,800
TOTAL	\$335,300
SANDPIPER ROAD	
Construction	
Site Preparation	\$18,500
Signs and Pavement Markings	\$29,100
Contingency (25%)	\$11,900
Design (10%)	\$6,000
TOTAL	\$65,500

Typical Section



Other Capital Needs

• **Wayfinding**

The BBRT system, including both SUP and on-road facilities, would include a comprehensive wayfinding sign system. The wayfinding would guide trail users to BBNWR and FCSP, trailheads, and intermediate destinations. An important aspect of the wayfinding would be user-friendly mapping with trail distances to intermediate and final destinations.



Wayfinding Sign Example

◆ **Cost Estimate**

The construction cost estimate for the BBRT is based on current local 2015 unit prices and actual costs for recent similar projects. Costs for the on-road facilities would generally entail clearing for sight distances, pavement markings, signs, removal of obstructions, and driveway apron adjustments. This planning-level cost is intended for use in capital budgeting and funding; it includes a 25% contingency and does not include utility relocation costs. Because the project will be included as a component when the City resurfaces the roadway, the costs of the bike lane will be minimal.

◆ **Benefit Analysis**

As depicted in Table 5.6, the BBRT On-Road Facilities either mostly meets or completely meets most of the MOEs, and slightly meets one MOE. The scores represent averaged values from the TAC screening and final screening described in Chapters 3 and 4.

Visitor Mobility

• **Reduce Traffic Congestion**

The lack of existing on-road facilities limit the number of people who visit BBNWR and FCSP by bicycle or on foot. Yet, 2014 counts indicate that 16% of refuge visitors arrive by one of these modes. By linking to the future Visitor Contact Station, the BBRT on-road facilities would give the FWS a viable opportunity to encourage visitors to get out of their cars and use the trail to access the Refuge. This would represent a measurable change in the transportation options for visitors.

Nevertheless, the reduction in vehicle trips into the Refuge and along Sandpiper Road will likely be modest. The study team estimates that 100-300 people will use the BBRT On-Road Facilities daily, with up to 75-125 of these being refuge visitors. Along with other bicycle/pedestrian improvements described herein, this facility could contribute to a 1% change in mode split from Sandbridge Road (people who would ordinarily drive to the refuge opting instead to use the BBRT). During peak season, an average 255 cars enter Back Bay Refuge daily, so the proposed facilities could reduce that number by 38 cars per day, a 15% modal split for the Refuge.

• **Enhanced Visitor Mobility, Accessibility, and Safety**

The on-road facilities would provide a high benefit to visitor mobility, by providing a designated link between sections of SUPs and destinations including BBNWR, FCSP, Little Island Park, and the future Visitor Contact Station. Bike lanes provide a designated space within the roadway section, offset from automobiles. Concerns for the speed differential between automobiles and cyclists have been expressed. VDOT crash data from

2010 to June 2015 shows no reported crashes involving bikes or pedestrians along Sandpiper Road. (https://public.tableau.com/profile/tien.simmons#!/vizhome/Crashtools8_2/Main) This track record suggests that restoring the bike lane markings will not create undue problems for cyclists, pedestrians, or motorists, even if the number of cyclists and pedestrians increases some.



Shared Use On-Road Facility Example

TABLE 5.6: MEASURES OF EFFECTIVENESS - ON-ROAD FACILITIES

MEASURES OF EFFECTIVENESS - BBRT ON-ROAD FACILITIES SERVICE		SCORE
VISITOR MOBILITY		
Reduce Traffic Congestion		0
Enhanced Visitor Mobility, Accessibility and Safety		3
Improve Visitor Education, Recreation and Health Benefits		3
ENVIRONMENTAL BENEFITS		
Protection of Sensitive Natural, Cultural and Historical Resources		3
Reduced Pollution		0
OPERATIONAL EFFICIENCY AND FINANCIAL SUSTAINABILITY OF ALTERNATIVES		
Effectiveness in meeting BBNWR Goals		3
Financial Plan - Development and Operational Costs		3
Potential Funding Sources		3
CONSTRUCTION/OPERABILITY		
Project Phasing and Sequence Limitations Project Phasing and Sequence Limitations		3
Limitations on Transportation Operation		3
SCORING SYSTEM: 0-DOES NOT MEET CRITERIA, 1=SLIGHTLY MEETS CRITERIA, 2=MOSTLY MEETS CRITERIA, 3=COMPLETELY MEETS CRITERIA		

• **Improve Visitor Education, Recreation and Health Benefits**

The on-road facilities would provide a high benefit to the visitor experience by offering an active transportation option and eliminating the stress of driving certain segments of the trip. The trail wayfinding could also provide additional information about the Refuge during the trip. The system expands the reach of the Refuge experience to users not currently able to access the park. The on-road facilities would provide a safety benefit by clearing and formalizing bike lanes.

Environmental Benefits

• **Protection of Sensitive Natural, Cultural and Historical Resources**

The overall environmental benefits of the on-road facilities would be positive. On-road facilities would not require impacts to sensitive natural resources such as wetlands or dunes. The facilities would not impact wetlands or other resources. By visually extending the Refuge experience, the on-road facilities would rely on viewshed preservation, and would provide an active tool to support such preservation.

• **Reduced Pollution**

The trail would remove vehicles from the road, although few vehicles, reducing impacts of vehicle emissions, polluted runoff, and noise.

◆ **Operational Efficiency and Financial Sustainability of Alternatives**

• **Effectiveness in Meeting BBNWR Goals**

BBNWR goals are identified in the September 2010 Comprehensive Conservation Plan. By providing a sustainable and non-motorized means of access to the Refuge, the on-road facilities would support BBNWR goals for habitat preservation, and would support goals for enhanced opportunities for wildlife viewing and appreciation of natural resources and conservation.

• **Financial Plan - Development and Operational Costs**

Construction of the on-road facilities would require relatively low capital investment, and would rely primarily on use of existing ROW and existing asphalt. The operability of the on-road facility would require maintenance in the form of clearing vegetation and obstructions, repainting, repaving, and sign maintenance, as well as police patrol and enforcement activities. This would be included in the normal street maintenance. The current maintenance schedule calls for Sandpiper Road to be swept monthly. It is recommended that from April through October that this sweeping occur biweekly.

• **Potential Funding Sources**

Section 11.1 of this report identifies a range of potential sources that could be used to help fund the BBRT On-Road Facilities. In particular, the Transportation Alternatives Program (TAP), Congestion Mitigation and Air Quality Improvement Program (CMAQ), and the Federal Lands Access

Program (FLAP) offer high potential for funding this type of improvement.

◆ **Constructability/Operability**

• **Project Phasing and Sequence Limitations**

Because the BBRT On-Road Facilities will be constructed within existing ROW and on existing asphalt, the project faces minimal constructability issues. The project involves work in and around existing driveway entrances, and will need to include measures to maintain access and minimize temporary impacts to private property. The nature of the construction (mainly pavement markings and signs) minimizes the need for staging and sequencing.

If needed, the BBRT On-Road Facilities could be constructed in phases. In fact, each element of this project (Sandpiper Road, Lotus Drive, Atwoodtown Road, and Sandfiddler Road) could be completed as an individual phase.

• **Limitations on Transportation Operation**

The on-road facilities involve minimal limitations on transportation operations, because of the nature of the improvements. However, the large number of driveway crossings will require timing and construction measures to minimize impacts to vehicular access.

• **Schedule**

Restoring the bike lanes on Sandpiper Road will not be a standalone project. The City of Virginia Beach systematically uses actual road and pavement conditions to determine when a road segment needs repaving, and Public Works estimates that

Sandpiper Road is about five years out. The bike lane restriping should coordinate with that effort to limit the costs for restoring the bike lanes. That timing also might coordinate well with the time line for building the BBRT shared-use path.

◆ **Conclusion**

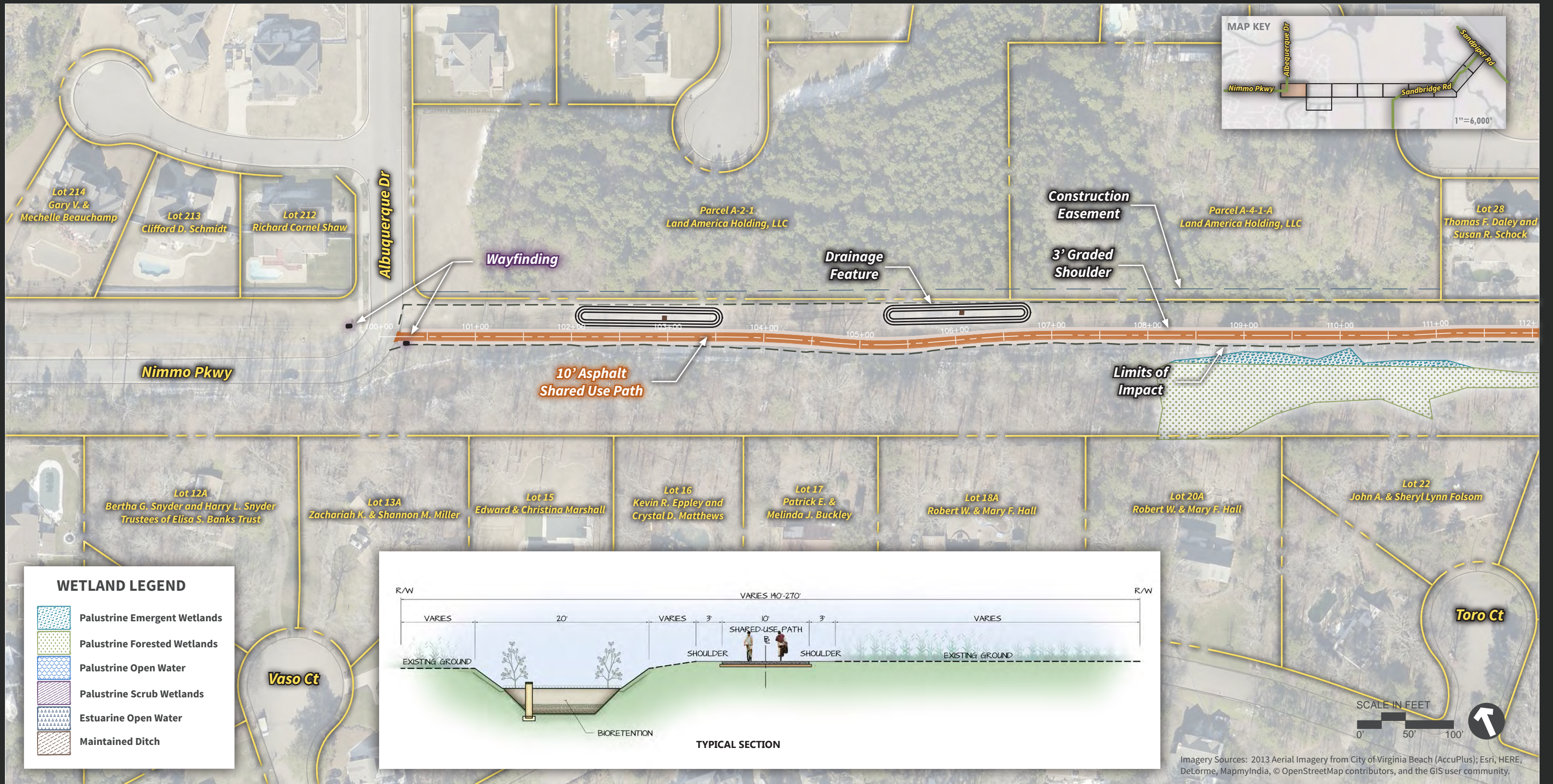
As a relatively low-cost investment when included with the regularly programmed pavement maintenance, the BBRT on-road facilities would convey considerable benefits and help complete the overall alternative transportation system. The Sandpiper Road facilities entail restoring bike lanes that already exist. The shared road enhancements on Lotus Drive, Atwoodtown Road, and Sandfiddler Road would form important system links, and provide additional options for users.



Sandpiper Road



Sandfiddler Road



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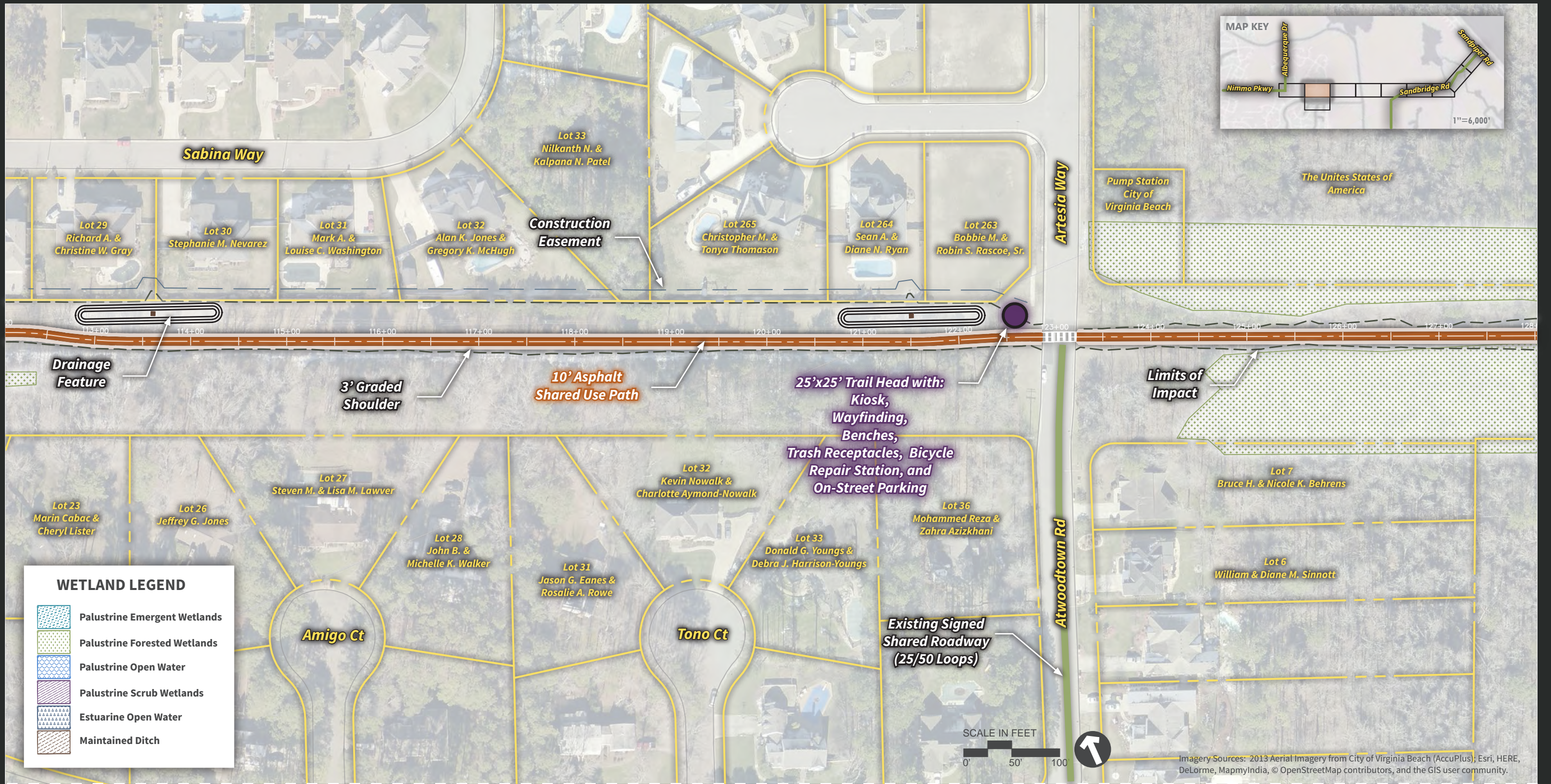
5.2.A

ALTERNATIVE TRANSPORTATION STUDY

Back Bay Refuge Trail

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Matchline - See Figure 4.3.C

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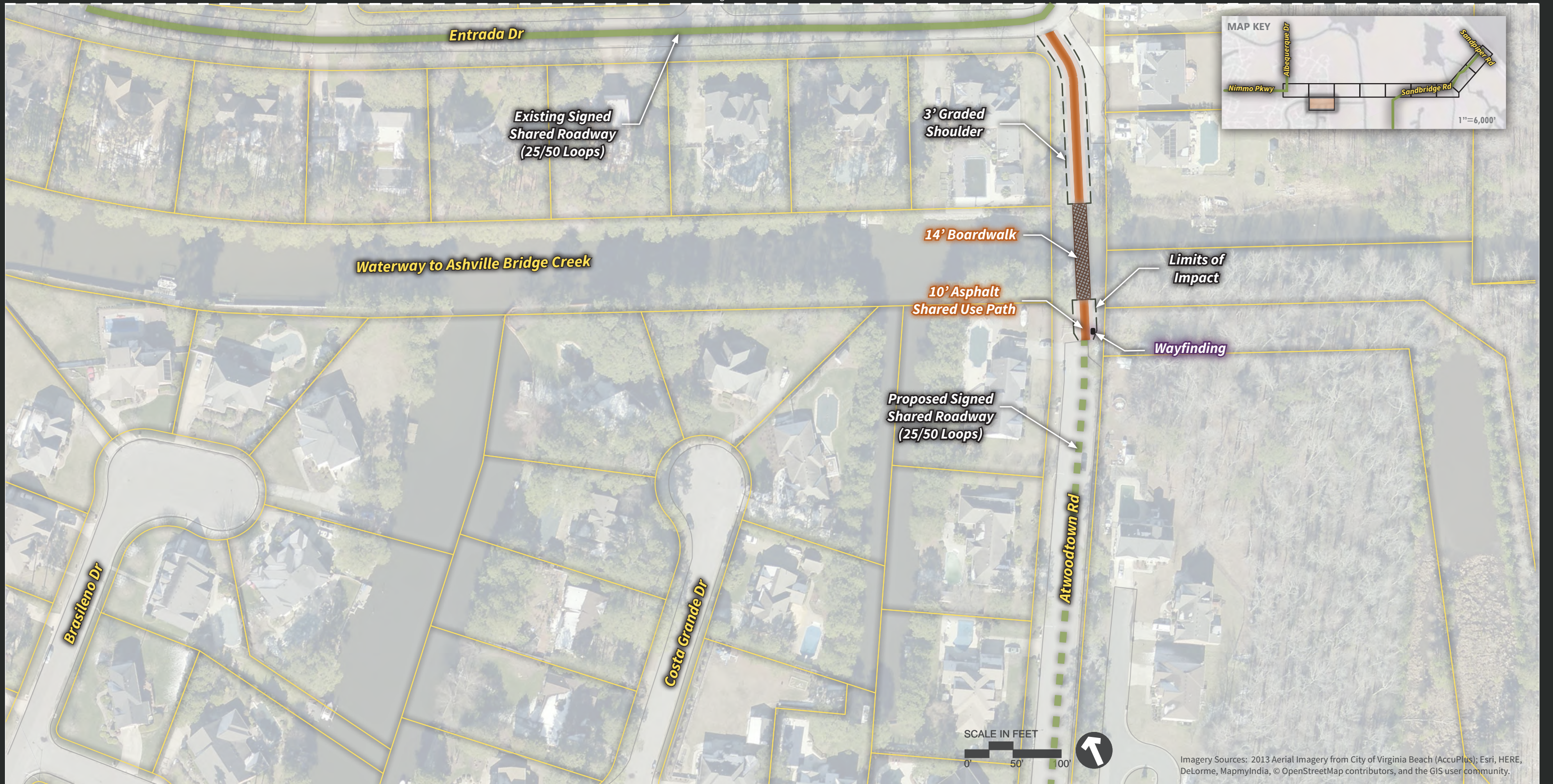
5.2.B



ALTERNATIVE TRANSPORTATION STUDY

Back Bay Refuge Trail

BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA



Imagery Sources: 2013 Aerial Imagery from City of Virginia Beach (AccuPlus); Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

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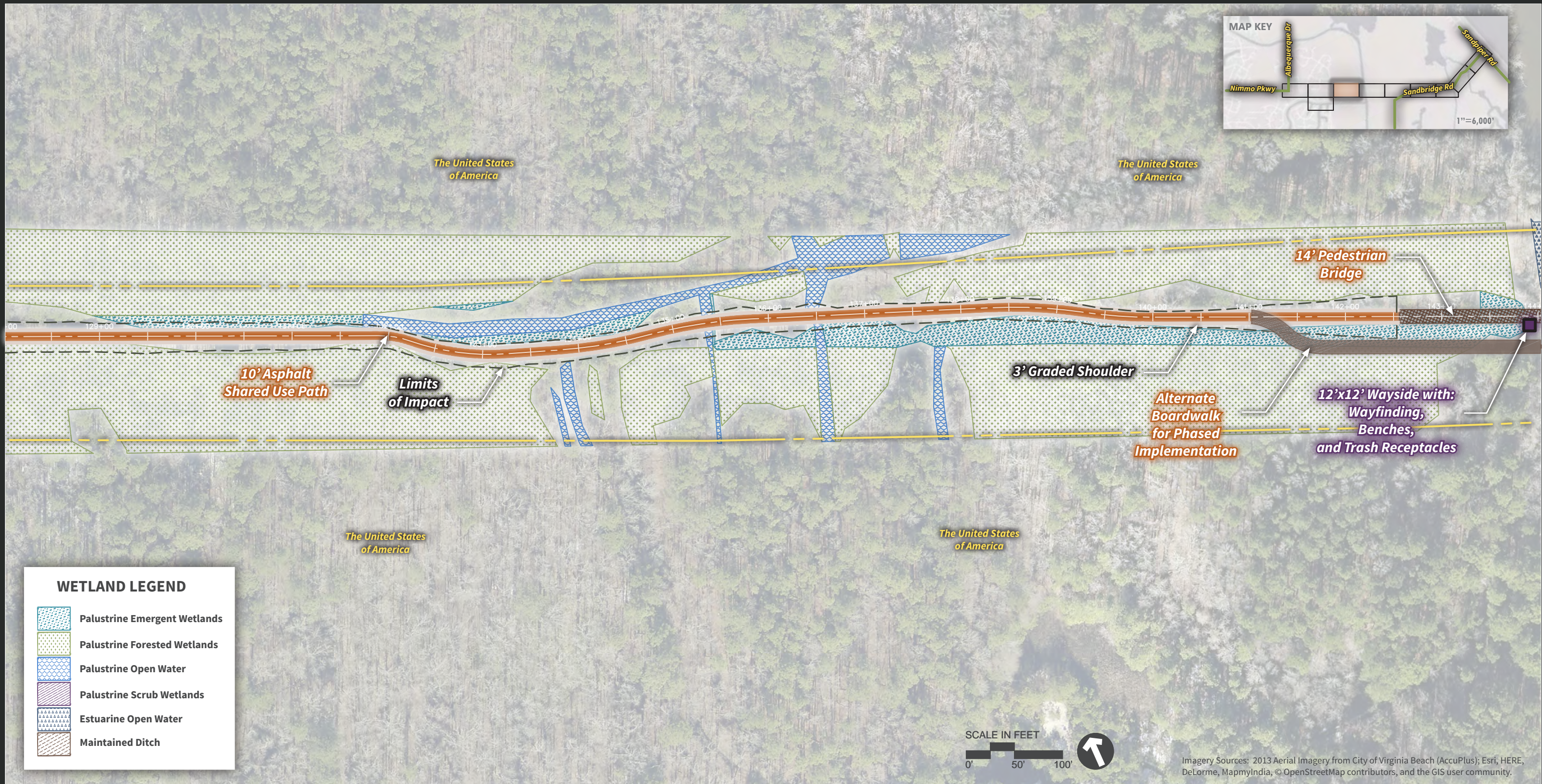
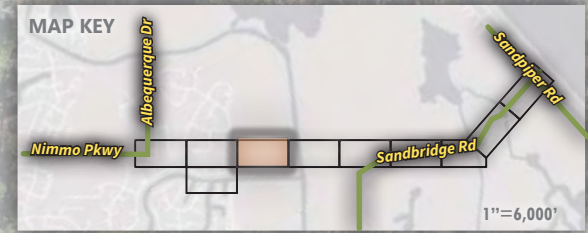
5.2.C

ALTERNATIVE TRANSPORTATION STUDY

Back Bay Refuge Trail

BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA





WETLAND LEGEND

	Palustrine Emergent Wetlands
	Palustrine Forested Wetlands
	Palustrine Open Water
	Palustrine Scrub Wetlands
	Estuarine Open Water
	Maintained Ditch



Imagery Sources: 2013 Aerial Imagery from City of Virginia Beach (AccuPlus); Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

PROJECT NUMBER: 33867.00

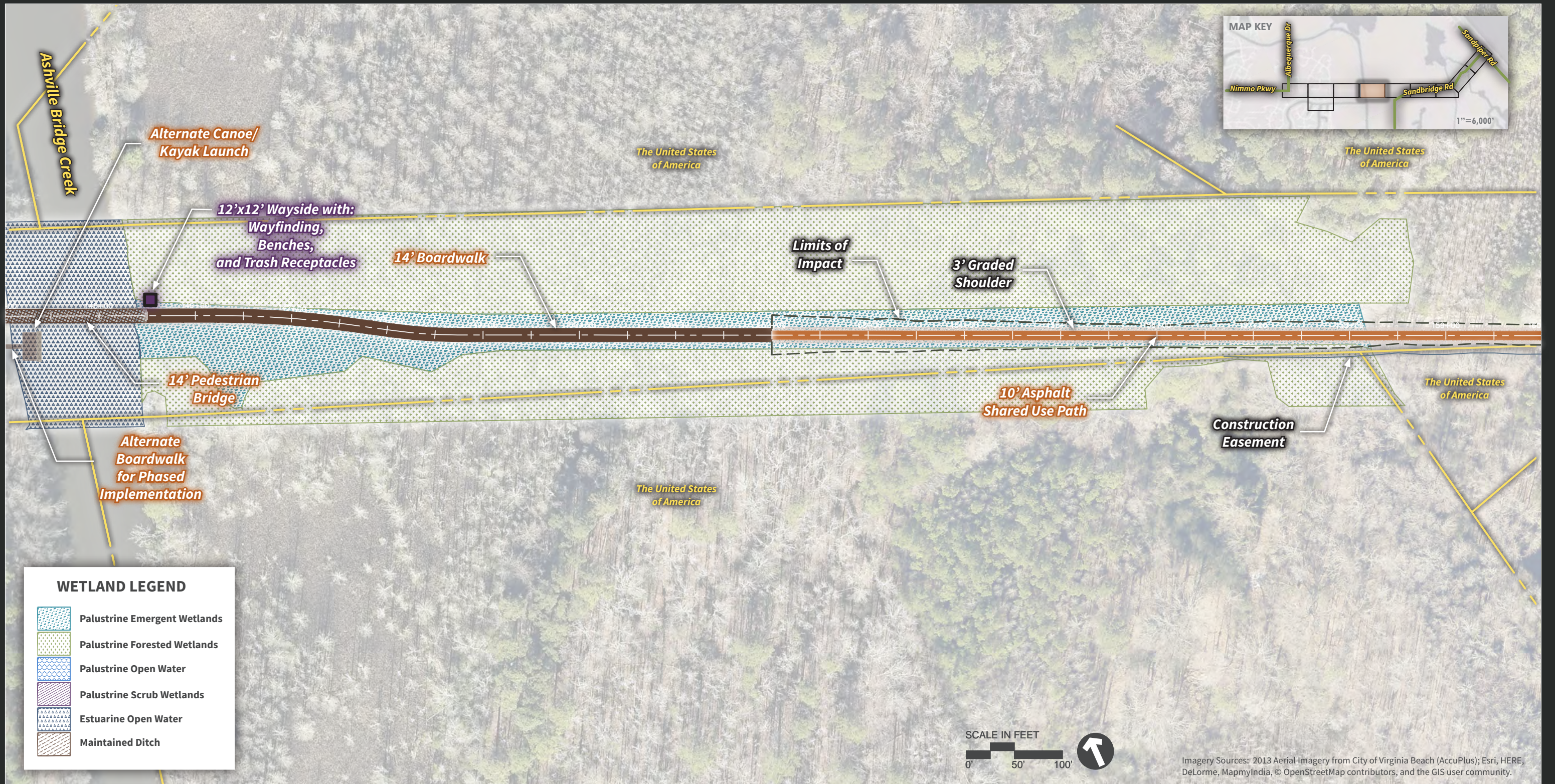
5.2.D

ALTERNATIVE TRANSPORTATION STUDY

Back Bay Refuge Trail

BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA





PROJECT NUMBER: 33867.00

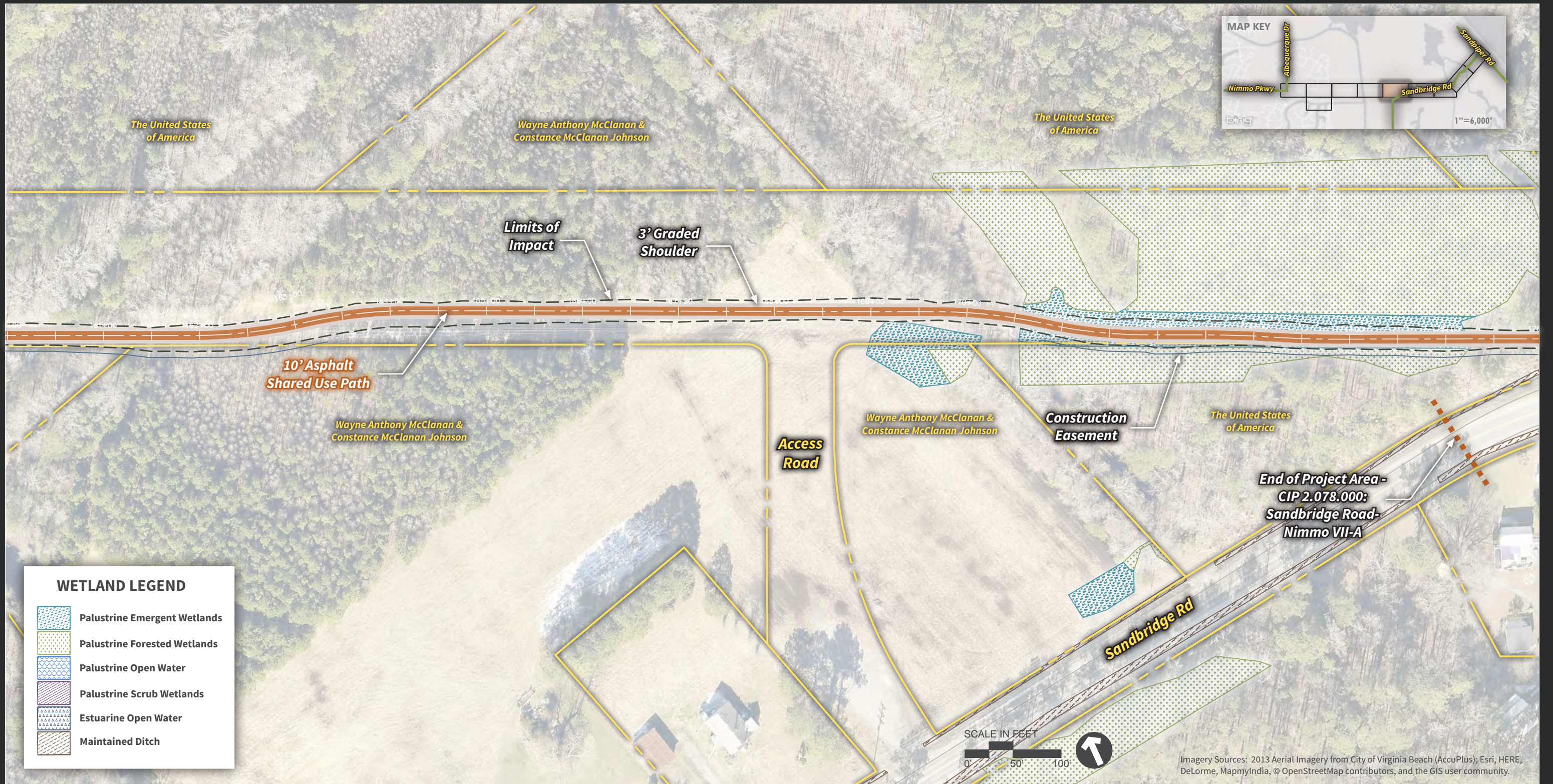
5.2.E



ALTERNATIVE TRANSPORTATION STUDY

Back Bay Refuge Trail

BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA



Imagery Sources: 2013 Aerial Imagery from City of Virginia Beach (AccuPlus); Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

PROJECT NUMBER: 33867.00

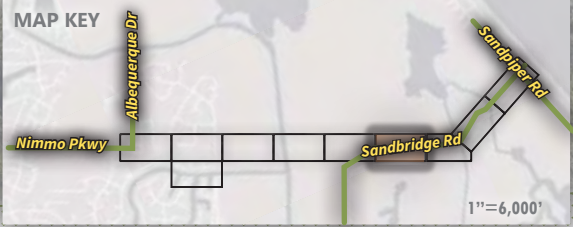
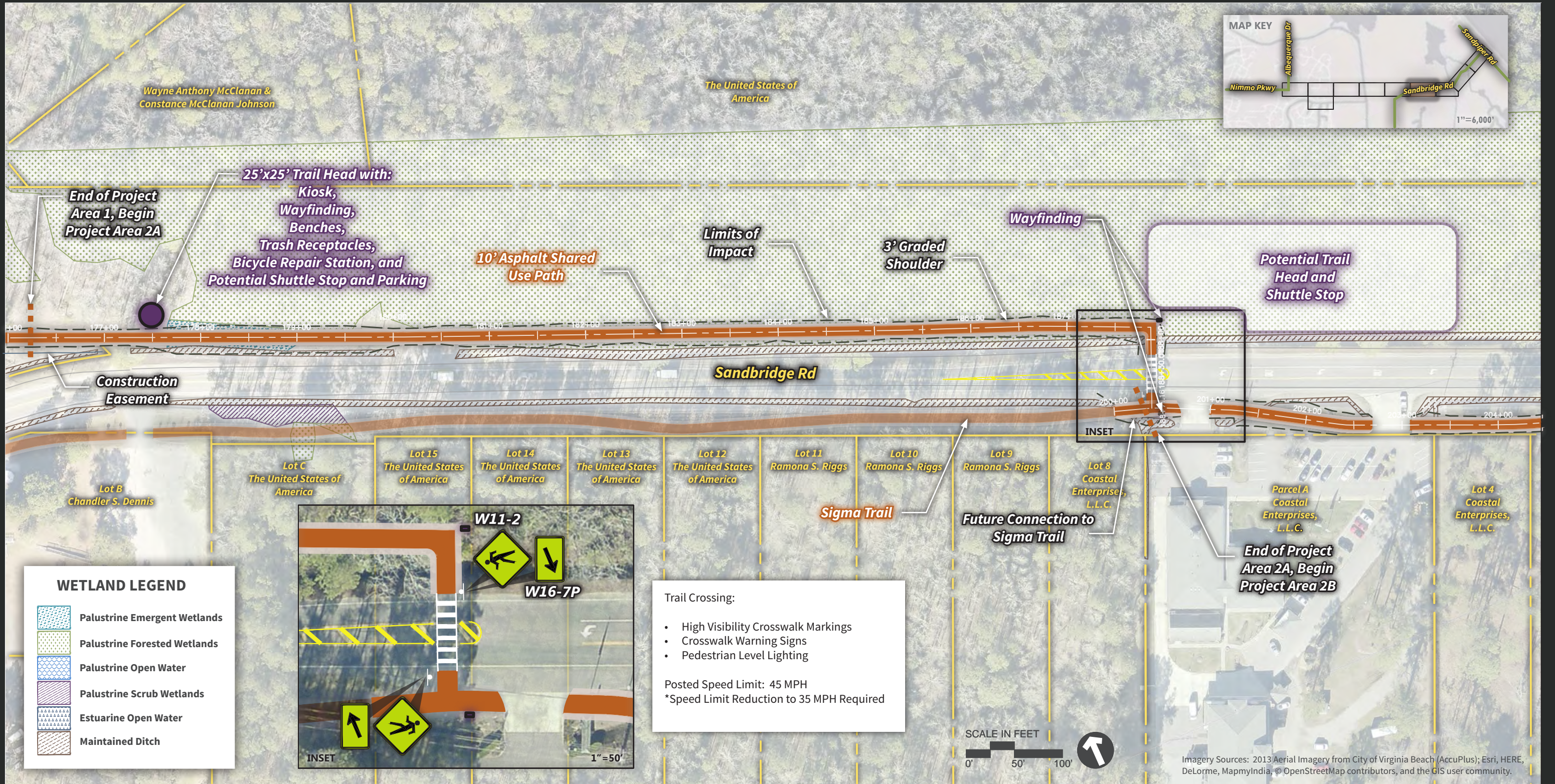
5.2.F

ALTERNATIVE TRANSPORTATION STUDY

Back Bay Refuge Trail

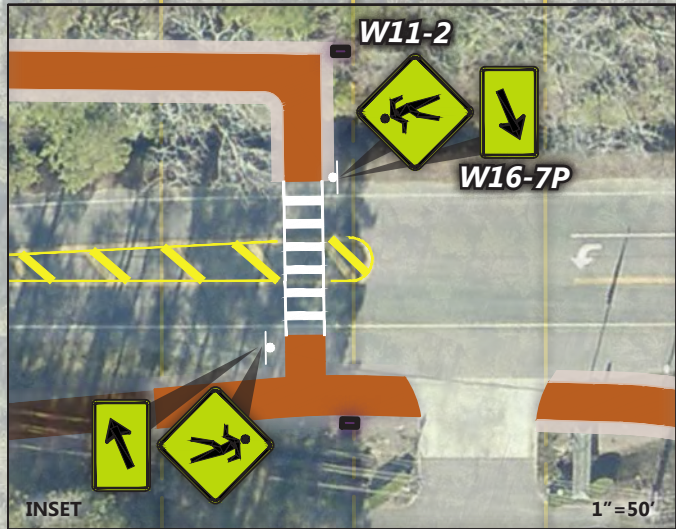
BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA





WETLAND LEGEND

	Palustrine Emergent Wetlands
	Palustrine Forested Wetlands
	Palustrine Open Water
	Palustrine Scrub Wetlands
	Estuarine Open Water
	Maintained Ditch



Trail Crossing:

- High Visibility Crosswalk Markings
- Crosswalk Warning Signs
- Pedestrian Level Lighting

Posted Speed Limit: 45 MPH
 *Speed Limit Reduction to 35 MPH Required



Imagery Sources: 2013 Aerial Imagery from City of Virginia Beach (AccuPlus); Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

PROJECT NUMBER: 33867.00

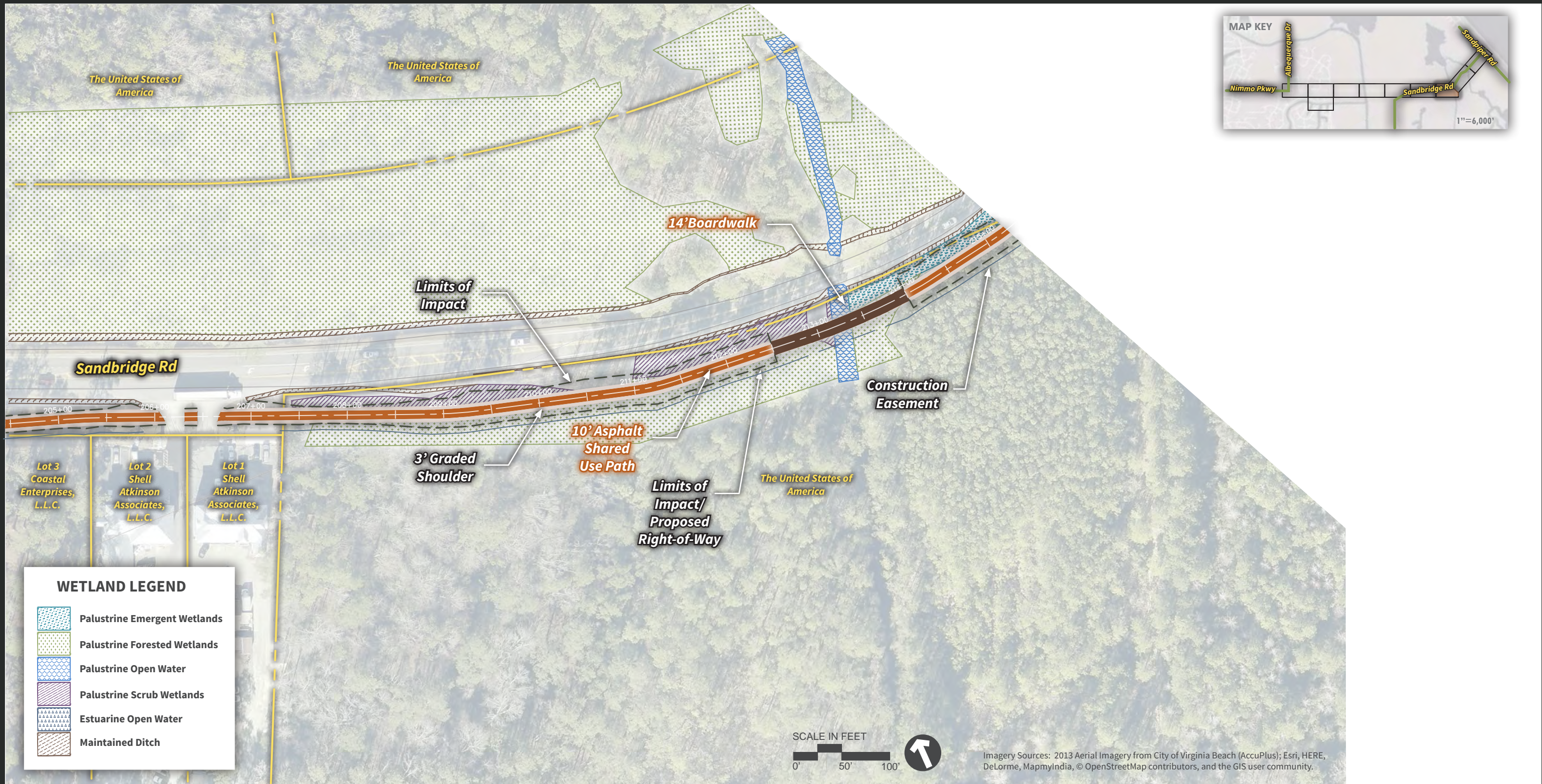
5.2.G



ALTERNATIVE TRANSPORTATION STUDY

Back Bay Refuge Trail

BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA



PROJECT NUMBER: 33867.00

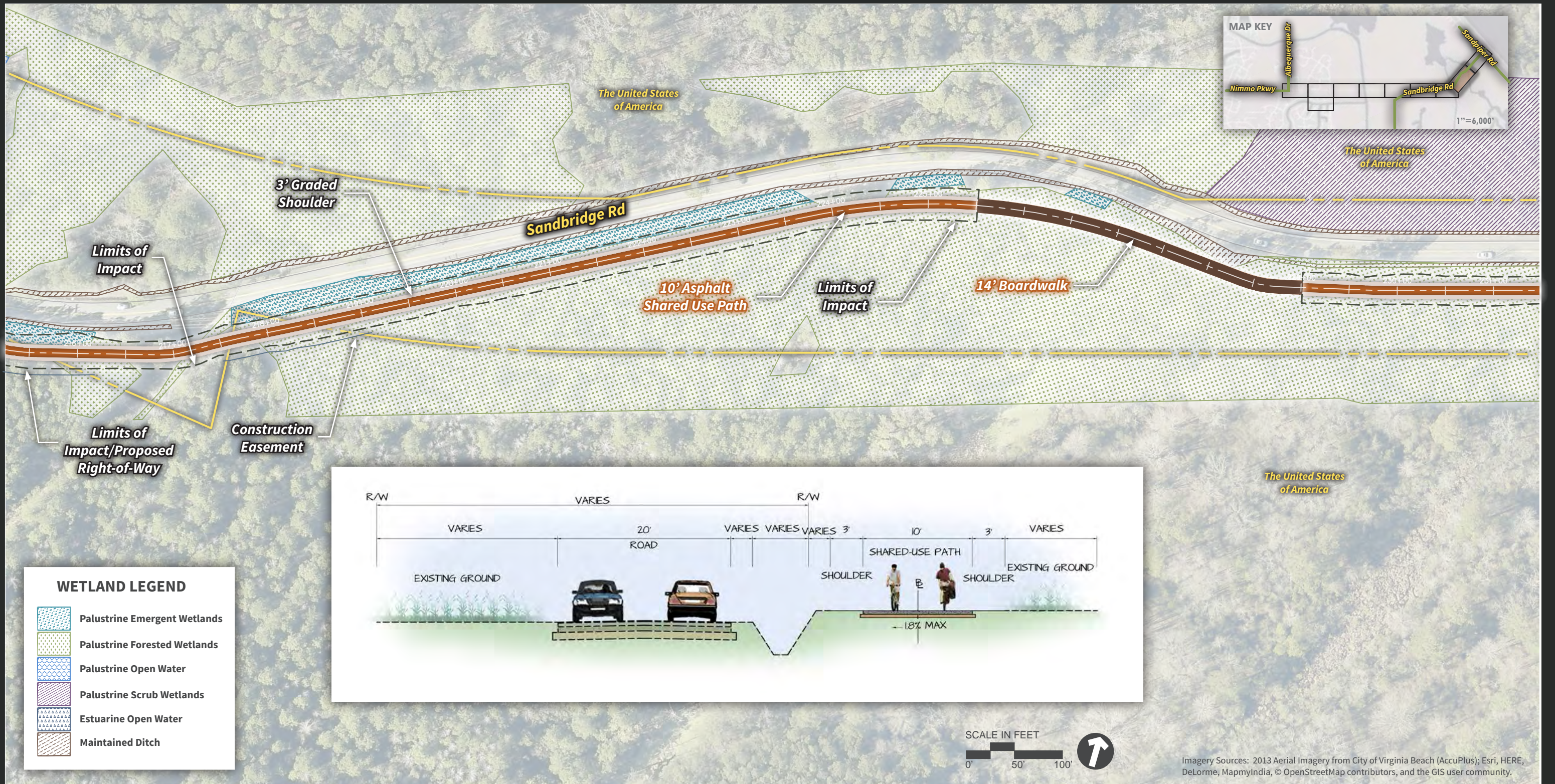
5.2.H

ALTERNATIVE TRANSPORTATION STUDY

Back Bay Refuge Trail

BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA





PROJECT NUMBER: 33867.00

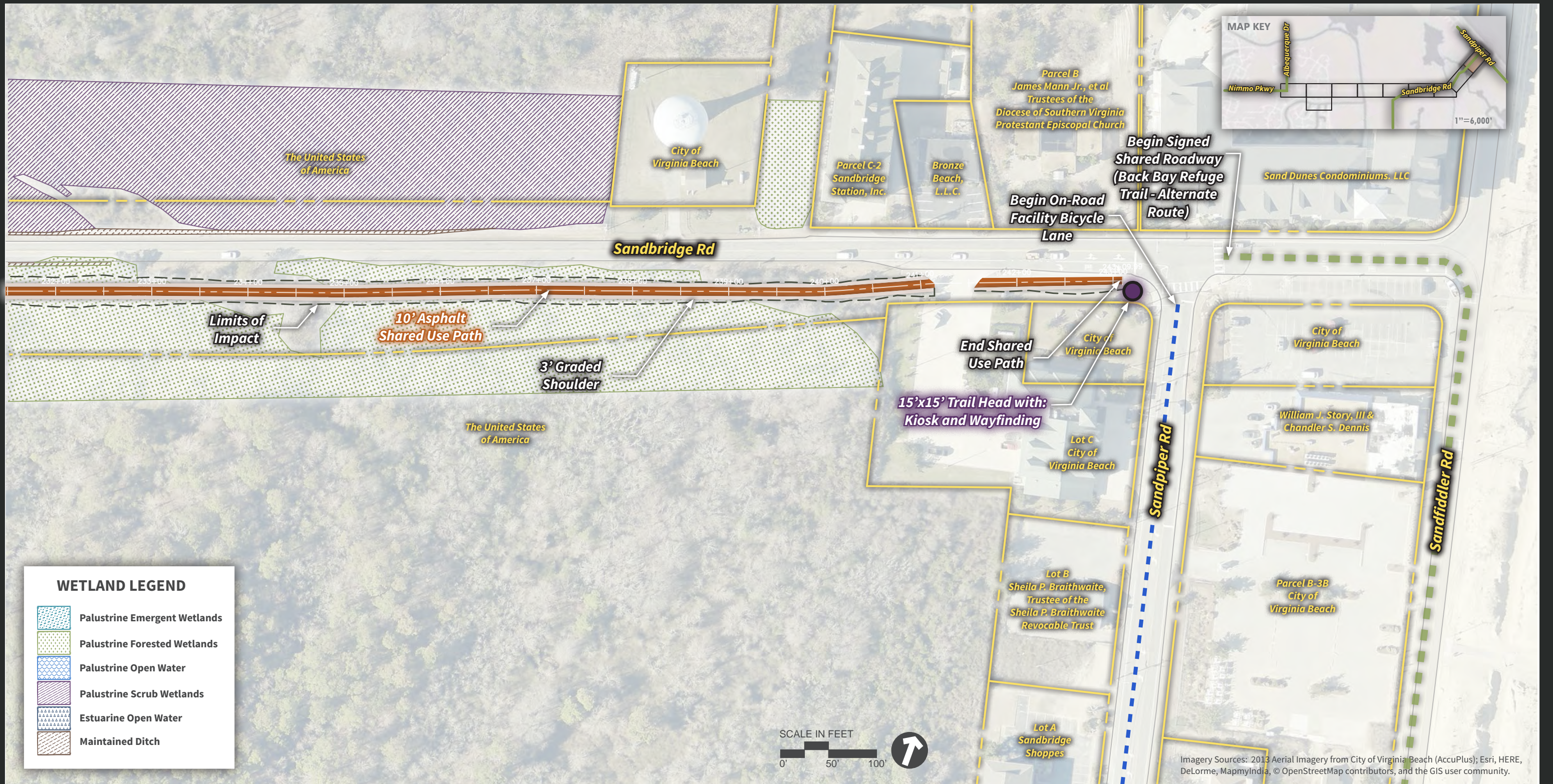
5.2.1

ALTERNATIVE TRANSPORTATION STUDY

Back Bay Refuge Trail

BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA





Imagery Sources: 2013 Aerial Imagery from City of Virginia Beach (AccuPlus); Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

PROJECT NUMBER: 33867.00

5.2.J

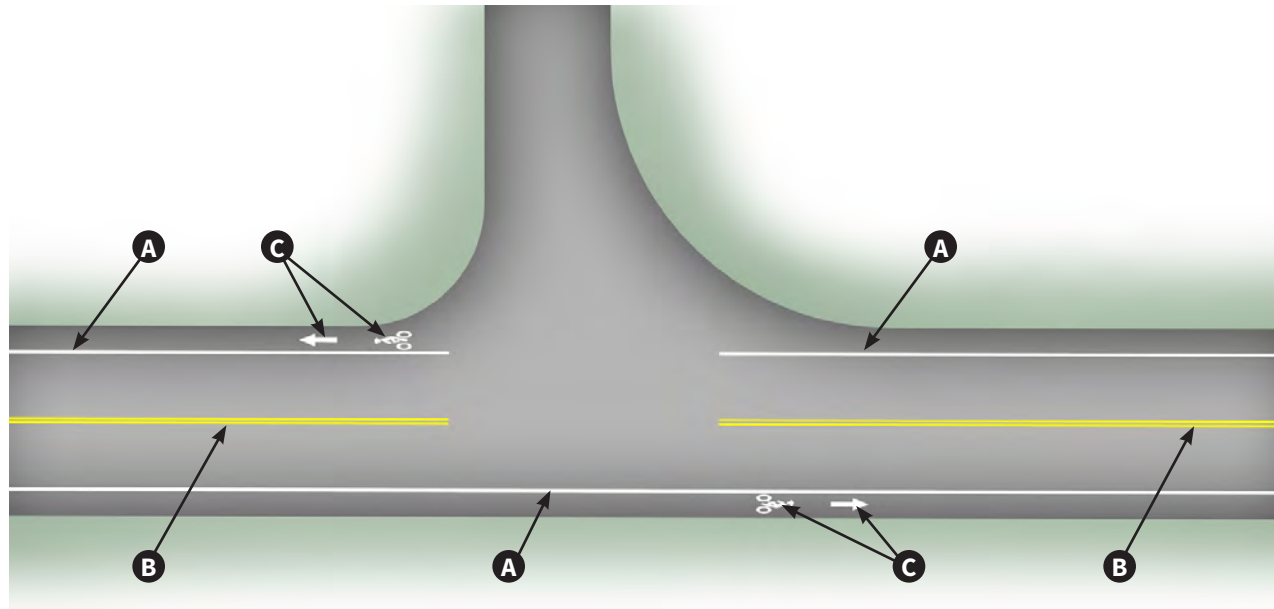


ALTERNATIVE TRANSPORTATION STUDY

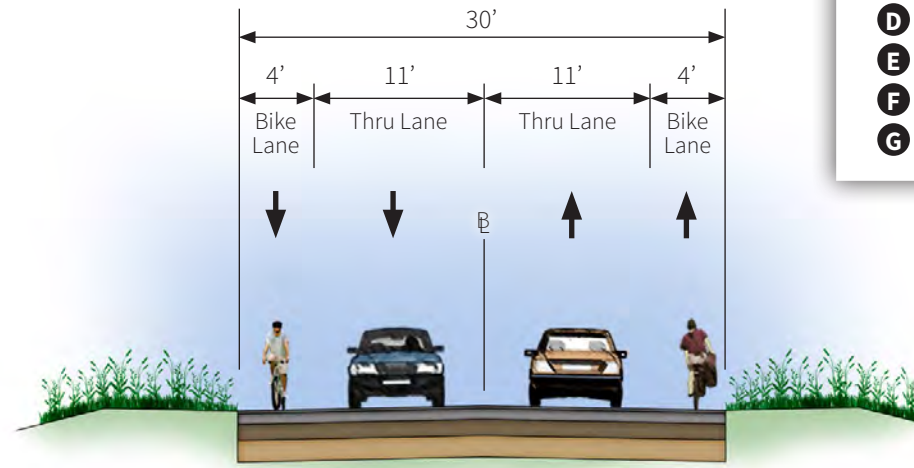
Back Bay Refuge Trail

BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA

Typical T-Intersection



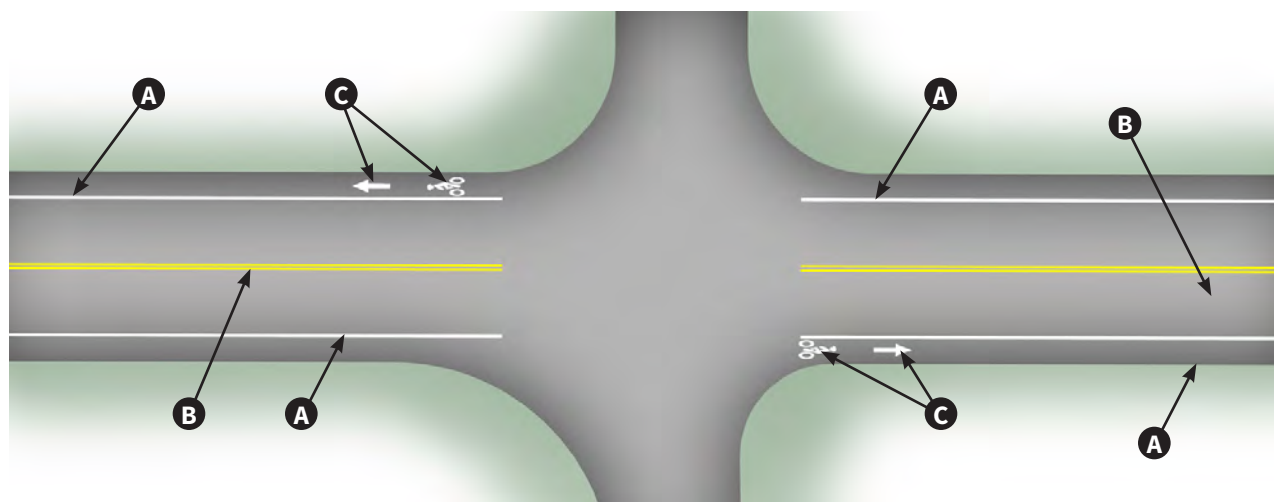
Typical Section



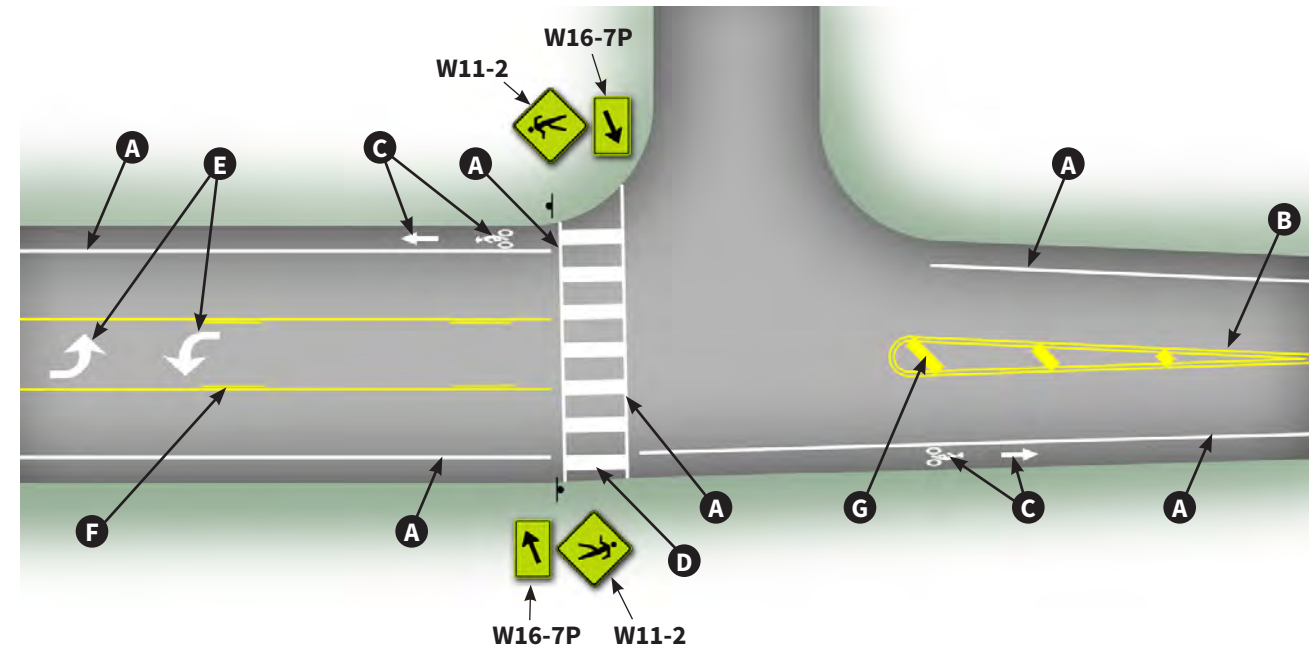
LEGEND

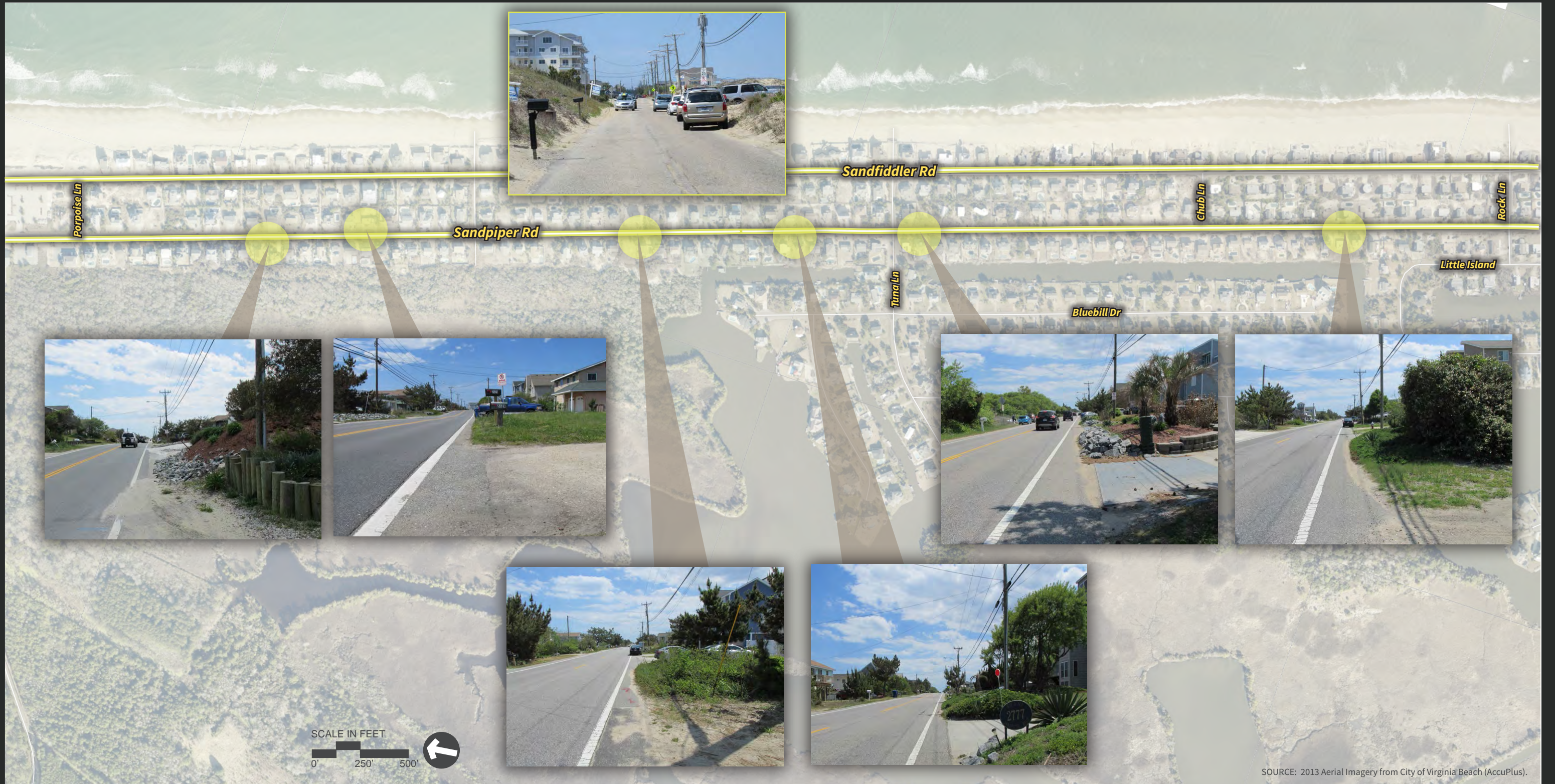
- A** White, 6" Width
- B** Yellow, Double Line: 4" Width and 4" Width @ 4" Spacing
- C** White, Bicycle Lane Symbol and Arrow
- D** White, 2" Width, 4" Spacing, 10' Long
- E** White Elongated Arrows
- F** Yellow, Double Line: 4" Width Solid & 4" Width, 10' Long, 30' Space @ 4" Spacing
- G** Yellow, 24" Width @ 45 Degrees

Typical Intersection



Typical Crosswalk





PROJECT NUMBER: 33867.00

5.3.B



ALTERNATIVE TRANSPORTATION STUDY
Sandpiper Road - Landscaping Locations
 BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA



SOURCE: 2013 Aerial Imagery from City of Virginia Beach (AccuPlus).

PROJECT NUMBER: 33867.00



5.3.C

ALTERNATIVE TRANSPORTATION STUDY

Sandpiper Road - Driveway Locations

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