Appendix D:
Alternatives Analysis

526 EAST
LOWCOUNTRY
CORRIDOR

TECHNICAL MEMORANDUM:

ALTERNATIVES ANALYSIS

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REFERENCES

I-526 LCC EAST Travel Time Reliability Analysis Technical Memorandum
I-526 EAST Corridor Study-Microsimulation Model Development and Calibration Report

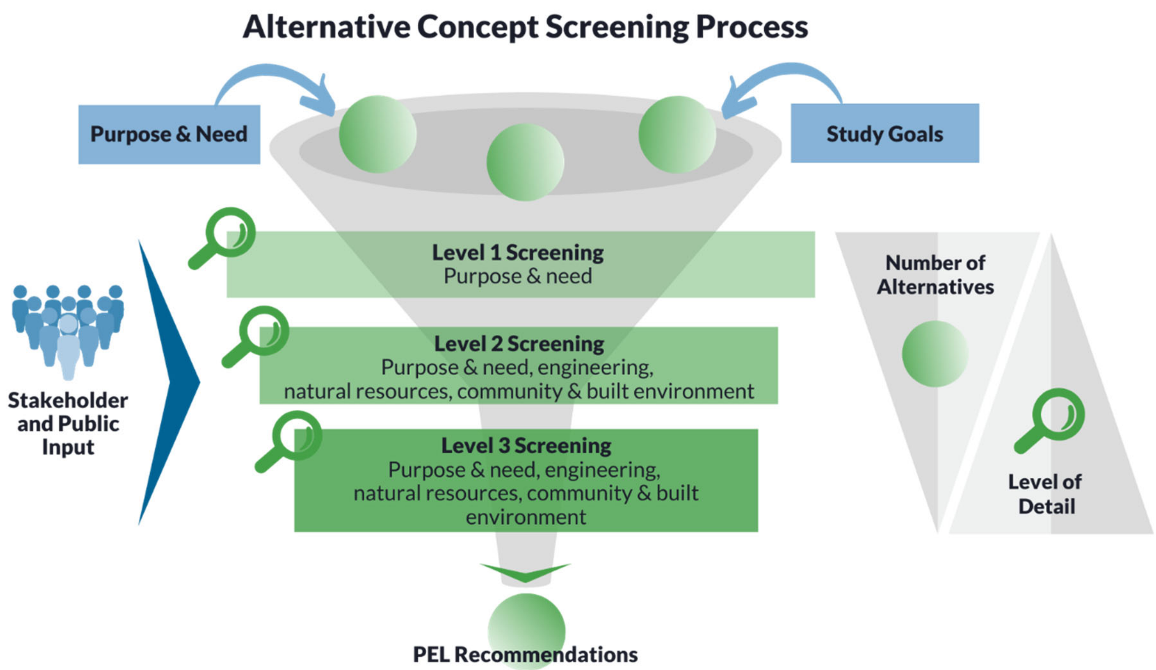
ACRONYMS AND ABBREVIATIONS

BCDCOG	Berkeley, Charleston, and Dorchester Council of Governments
CHATS	Charleston Area Transportation Study
CMP	CHATS Congestion Management Process Report
Don Holt bridge	Don N. Holt Bridge over the Cooper River
EFH	Essential Fish Habitats
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
HOT	High-Occupancy Toll
HOV	High-Occupancy Vehicle
I-26	Interstate 26
I-526	Interstate 526
ITS	Intelligent Transportation Systems
LCC	Lowcountry Corridor
LOS	Level of service
LTP	Live to Play
mph	miles per hour
MUSC	Medical University of South Carolina
NEPA	National Environmental Policy Act
PEL	Planning and Environmental Linkages
PIM	Public Information Meeting
ROW	Right-of-way
SCDOT	South Carolina Department of Transportation
TAZ	Traffic Analysis Zone
TDM	Travel Demand Model
TSMO	Transportation Systems and Management Operations
V/C	Volume to Capacity
VMT	Vehicle Miles Traveled
Wando bridge	James B. Edwards Bridge over the Wando River

1.0 Introduction

The South Carolina Department of Transportation (SCDOT) is conducting a Planning and Environmental Linkages (PEL) study for the Interstate 526 (I-526) Lowcountry Corridor (LCC) EAST project. The study corridor extends along I-526 from Virginia Avenue in North Charleston to U.S. 17 in Mount Pleasant, South Carolina. This technical memorandum describes the development of the conceptual alternatives using the purpose and need, study goals, and input received through outreach opportunities. This memorandum also details the multilevel I-526 LCC EAST PEL Alternative Concept Screening Process (**Figure 1.1**). This multilevel screening process will result in recommendations to be carried forward into the National Environmental Policy Act (NEPA) phase of project development.

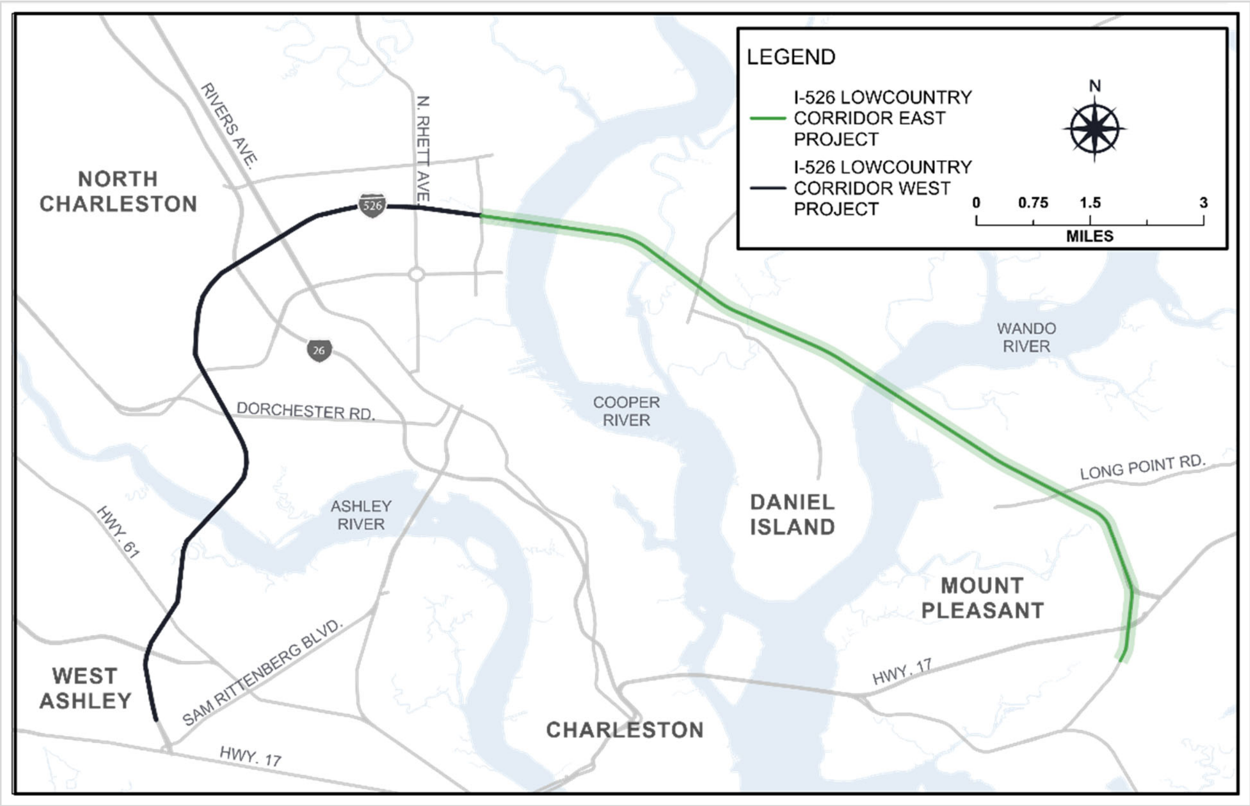
Figure 1.1: I-526 EAST PEL Alternative Concept Screening Process



1.1 Study Area

The I-526 LCC EAST corridor is approximately 10 miles long and includes the Don N. Holt bridge over the Cooper River (referred to as the Don Holt bridge) and the James B. Edwards bridge over the Wando River (referred to as the Wando bridge), which are significant river crossings for the region. **Figure 1.2** illustrates the study corridor and surrounding the greater Charleston region.

Figure 1.2: Study Corridor and Greater Charleston Region



2.0 Alternative Concept Development and Screening Process Methodology

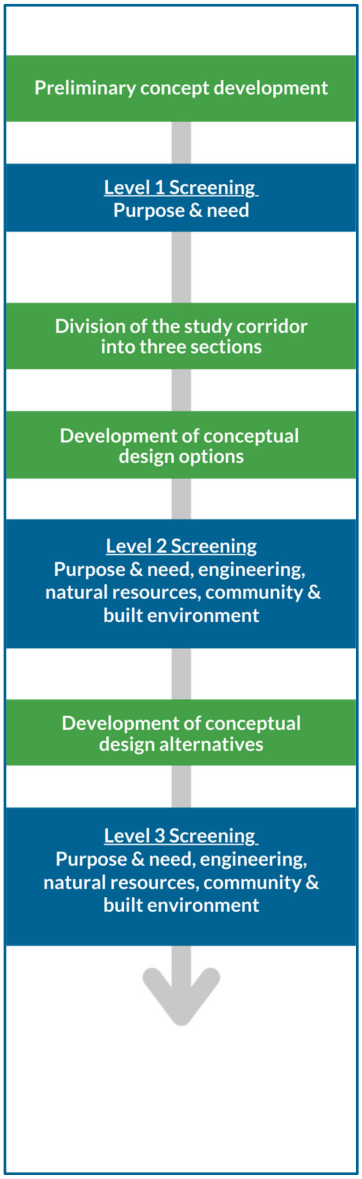
2.1 Alternative Concept Screening Process Methodology

This PEL study uses a multilevel screening—the I-526 LCC EAST PEL Alternative Concept Screening Process—to identify, evaluate, and refine concepts at a planning level, resulting in the identification of reasonable alternatives to carry forward into the NEPA process.

The multilevel screening approach starts with the identification of the range of concepts detailed in **Chapter 6, Preliminary Concept Development**. In the first level of this screening process, the evaluation uses a qualitative and quantitative methodology to compare each concept against the baseline and future No-build condition to determine whether the concept meets the purpose and need or is fatally flawed. As concepts progress through each level of the screening process, the level of detail in analyses and refinement in engineering design increases. The three-level process is shown in Error! Reference source not found. and further described below:

- **Preliminary Concept Development:** The range of infrastructure improvement concepts and transportation system and management operations (TSMO) strategies to be evaluated in the I-526 LCC EAST PEL study are identified.
- **Level 1 Screening:** A high-level, qualitative, and quantitative screening is conducted to identify concepts that do not meet the purpose and need.
- **Division of the Study Corridor:** The corridor was evaluatedin three sections based on engineering and environmental constraints which are largely driven by the approaches to the Don Holt and Wando bridges. Reducing the relative scale of the corridor into smaller sections allowed

Figure 2.1: I-526 LCC EAST PEL Alternative Concept Development and Screening Process



engineering experts to evaluate potential design and construction constraints more efficiently and at a localized level. The three sections were reconnected at the corridor-wide level in later phases of screening. The sections are shown in **Figure 4.2** and summarized below:

— **Section 1:** Virginia Avenue to Nowell Creek (mile marker 23)

— **Section 2:** Nowell Creek (mile marker 23) to the west of Long Point Road near Shoals Drive (mile marker 27)

— **Section 3:** West of Long Point Road near Shoals Drive (mile marker 27) to U.S. 17 in Mount Pleasant

- **Development of Conceptual Design Options**: After the Level 1 screening, the remaining concepts are refined into more developed conceptual design options within each section to undergo the Level 2 screening.
- **Level 2 Screening** is a more detailed screening that compares and scores each of the conceptual design options against the No-build. A Level 2 screening of each of the conceptual design options will determine which options have the highest potential to meet the project's purpose and need. The Level 2 screening also evaluates engineering criteria and impacts to natural resources and communities and the built environment. The screening criteria for Level 2 is divided into four major categories:

  Purpose and Need (quantitative based on additional traffic analysis)

  Engineering (qualitative based on engineering evaluation)

  Natural Resources (quantitative based on potential impacts to resources)

  Communities and Built Environment (quantitative based on potential impacts)

- **Development of Conceptual Design Alternatives:** Each of the remaining options from Sections 1, 2, and 3 are evaluated based on design to determine how each of the options could be connected to create the conceptual end-to-end alternatives.
- **Level 3 Screening** is an evaluation of the corridor-wide conceptual design alternatives compared against the No-build. The screening criteria for Level 3 is divided into four major categories, similar to Level 2.

  Purpose and Need (quantitative based on additional traffic analysis)

  Engineering (qualitative based on engineering evaluation)

  Natural Resources (quantitative based on potential impacts to resources)

  Communities and Built Environment (quantitative based on potential impacts)

3.0 Purpose and Need

3.1 Purpose of the Project

The purpose of transportation improvements along this corridor is to reduce congestion and improve travel time reliability[1] on I-526 from Virginia Avenue in North Charleston to U.S. 17 in Mount Pleasant.

Travelers on the I-526 LCC EAST corridor currently experience heavy congestion, delay, and unreliable travel times. As detailed in Section 4.2, forecasted population growth[2] and economic development in the region will result in an increase in traffic volumes, congestion, and more delays. Improvements considered for implementation should provide an acceptable volume-to-capacity (V/C) ratio, reduced vehicle hours of delay (VHD), increased average speeds, and more reliable travel times.

3.2 Need for Improvements

Transportation improvements are needed to address the congestion and travel time issues in the corridor. Mobility and roadway deficiencies that contribute to the congestion and unreliable travel times are summarized below:

- **Mobility:** The high volume of people, goods, and services moving through the corridor has increased congestion, impeded travel time and reliability, and increased incidents along the corridor. The key issues are:
  — Traffic-related congestion resulting from high demand and limited capacity.
  — Overcapacity facilities resulting from the demand exceeding capacity.
  — Unreliable travel times resulting from incidents.
  — Congestion-related crashes on I-526 as indicated by the documented number of rear-end crashes in the corridor.

- **Roadway Deficiency:** The existing roadway, bridges, and interchange ramps along the corridor have geometric deficiencies that do not accommodate existing and future traffic volumes. The key roadway deficiencies are:
  — Inadequate shoulder widths, resulting in unsafe conditions for incident management or disabled vehicles.
  — Insufficient acceleration/deceleration ramp lengths resulting in merge and diverge conflicts.
  — Tightly curved ramps (existing loop ramp radius is less than the minimum required for the design speed)

[1] Travel time reliability is the comparison of free-flow conditions to congested conditions
[2] Population forecasts were developed from the CHATS Interim Travel Demand Model

3.3 Study Goals

The following goals were developed in conjunction with the SCDOT project management team and input from the public. While the goals are not study needs or the study's purpose, they provide guidance for alternatives development and evaluation throughout the PEL process. The following goals have been established for the I-526 LCC EAST PEL.

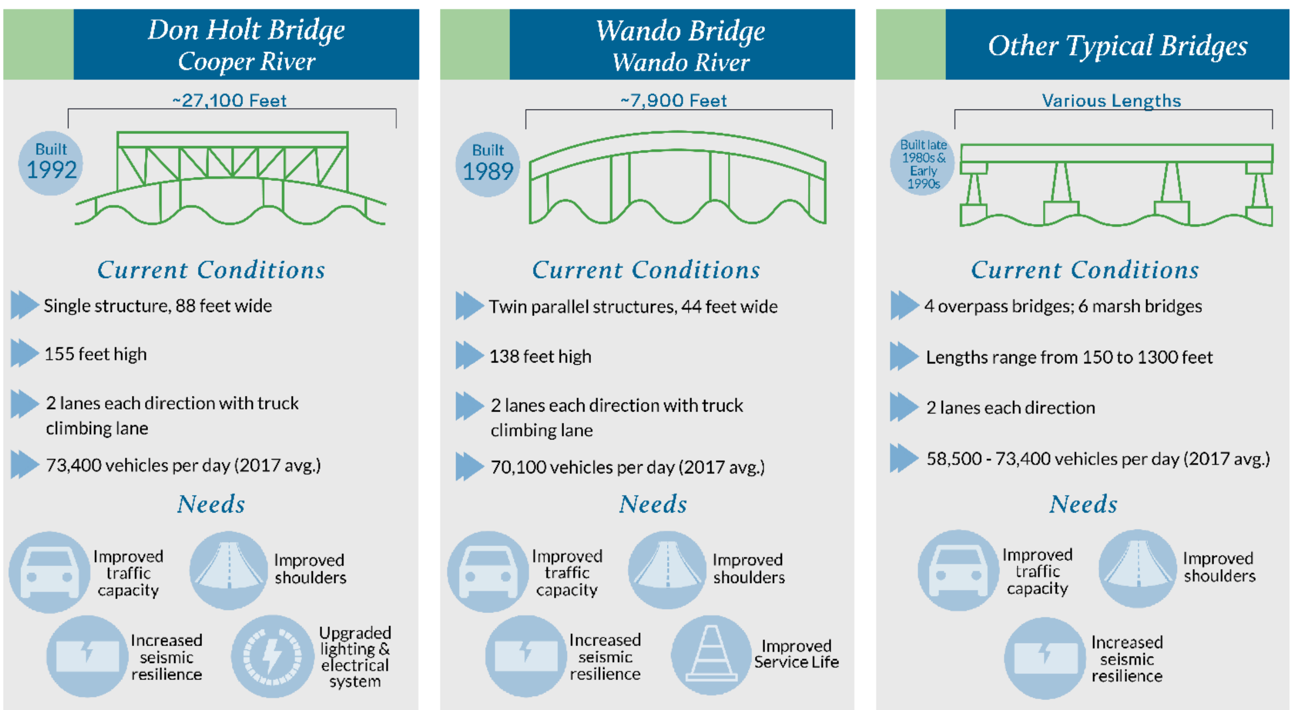
- **COMPATABILITY:** Align with local land use plans and projects. If recommendations align with local land use or transportation plans identified in the BCDCOG Existing and Committed projects, then they support this goal area.
- **DEMAND:** Improve roadway infrastructure to accommodate increased traffic volumes. If recommendations are expected to increase the ability of the corridor to accommodate or better manage estimated travel demand, they are assumed to support the project goal.
- **SAFETY:** Reduce congestion-related incidents throughout the corridor. If congestion is improved, it is assumed that this crash rate should improve by improving safer driving conditions.
- **MULTIMODAL:** Enhance mobility for people and goods through the corridor. This includes modes other than single-occupancy vehicles, such as carpool, transit, walk, bike, or truck. If the recommendations are designed to support such modes, they support this goal area.
- **SEISMIC:** Improve seismic resiliency of the infrastructure. If roadways or bridges are modified or reconstructed, it is assumed that new infrastructure will be built to current, improved seismic standards, supporting this goal area.
- **TECHNOLOGY:** Accommodate future transportation technologies, including vehicle technologies, communications technologies, system monitoring systems, driver information, and traffic operations technologies. If the recommendations support these technologies, they are supportive of this goal area.
- **CONNECTIVITY:** Improve connections with area ports, rail intermodal facilities, and transit assets. If the recommendations are designed to provide new or improved connections to intermodal assets, they support this goal area.

4.0 Existing and Future Conditions

The I-526 LCC EAST corridor is an approximately 10-mile segment of I-526 connecting North Charleston, Daniel Island, and Mount Pleasant. I-526 is an interstate facility that provides a partial beltway around Charleston and acts as a bypass for traffic on U.S. 17 through downtown Charleston.

I-526 serves the Charleston metropolitan region as a major commuter corridor and economic connector in the Lowcountry, linking the goods to and from South Carolina Port Authority's Wando Welch Terminal with Interstate 26 (I-26) and other integral components of the state's freight network. The corridor is also heavily used by tourists traveling to Sullivan's Island, Isle of Palms, and other Charleston-area destinations. Land uses adjacent to I-526 are predominantly commercial, industrial, residential, or undevelopable. The urban nature of the study corridor coupled with the two large bridges presents multiple challenges with a wide range of constraints. **Figure 4.1** illustrates the existing bridge structures in the I-526 LCC EAST corridor.

Figure 4.1: Existing Bridge Characteristics on I-526 LCC EAST Corridor

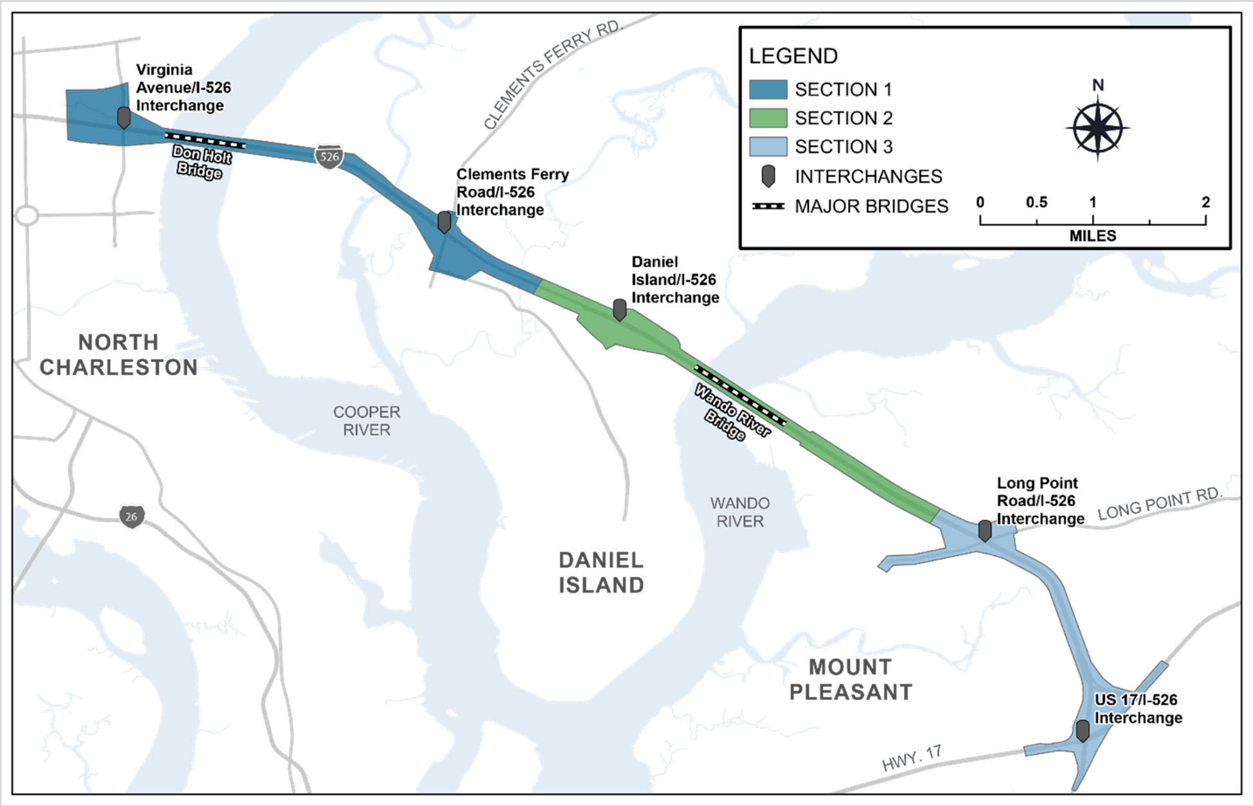


Source: CDM Smith, 2020

4.1 EXISTING I-526 FACILITY

The existing I-526 facility consists of two general-purpose lanes in each direction, separated by a variable, 34- to 60-foot-wide median (**Figure 4.2**). Truck climbing lanes are provided across the Don Holt and Wando bridges. This segment of I-526 includes 5 interchanges, and approximately 60 percent of the project corridor is on elevated structure. I-526 is a hurricane evacuation route for the coastal communities of the Town of Mount Pleasant, Isle of Palms, and Daniel Island areas.

Figure 4.2: I-526 LCC EAST Corridor



4.1.1 Existing Interchanges

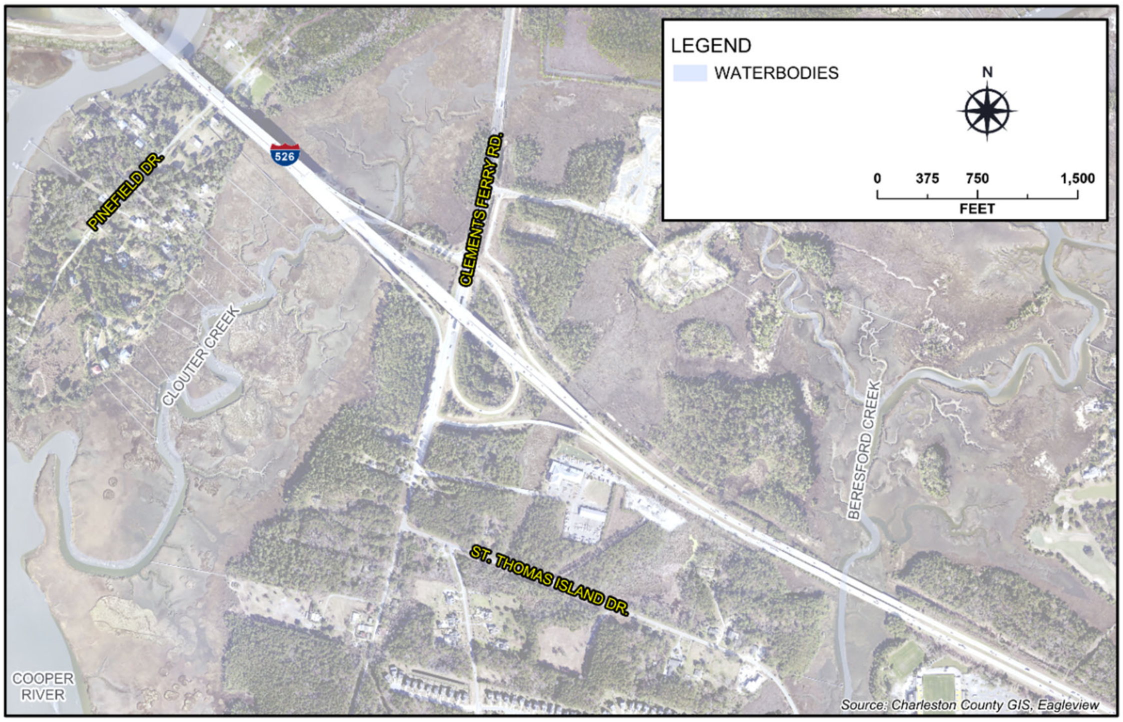
There are five interchanges within the project corridor:

- **Virginia Avenue** is a partial access interchange consisting of a westbound entrance ramp and an eastbound exit ramp (**Figure 4.3**). Virginia Avenue traffic bound for eastbound I-526 must enter I-526 headed westbound and exit at North Rhett Avenue via the loop ramp and re-enter I-526 headed eastbound. Westbound I-526 drivers desiring to exit at Virginia Avenue must continue west past Virginia Avenue and exit at North Rhett Avenue, re-enter headed eastbound toward Virginia Avenue, and exit at Virginia Avenue.

Figure 4.3: Virginia Avenue Interchange

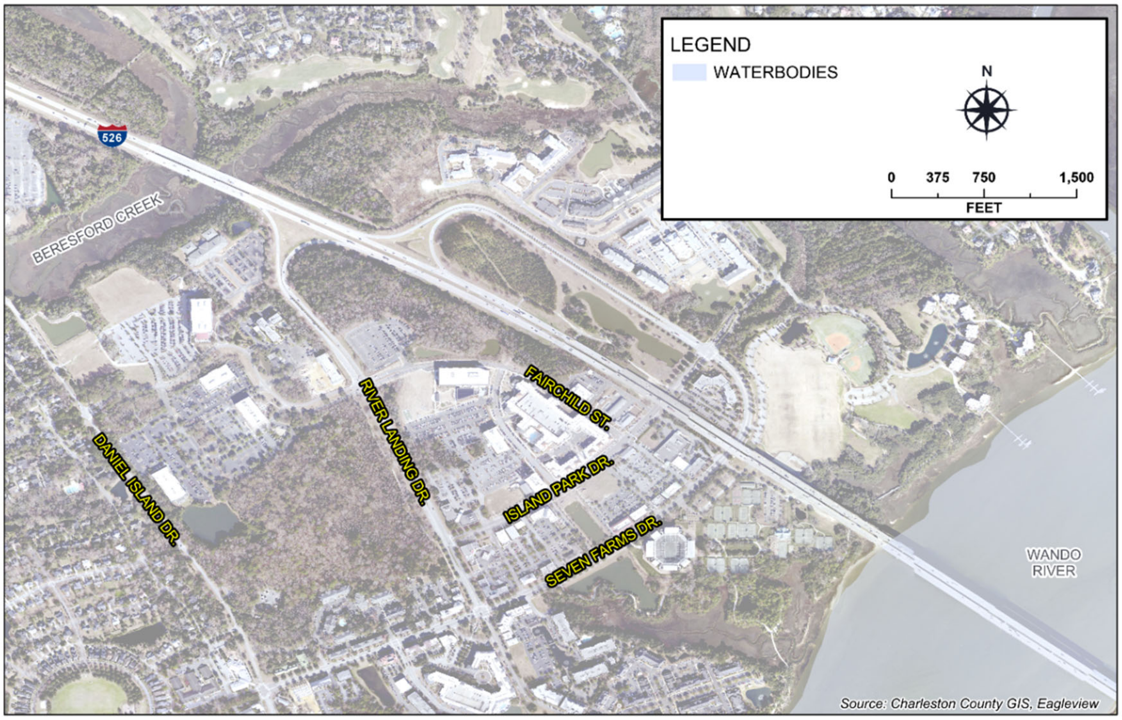
- **Clements Ferry Road (S-33)** is a full-access interchange with one directional exit ramp to southbound Clements Ferry Road (S-33), three diagonal ramps, and one directional loop ramp, exiting from I-526 eastbound to Clements Ferry Road (S-33) northbound (**Figure 4.4**).

Figure 4.4: Clements Ferry Road Interchange



- **River Landing Drive/Seven Farms Drive** (Daniel Island Interchange) is a full-access interchange consisting of four directional ramps (**Figure 4.5**).

Figure 4.5: River Landing Drive/Seven Farms Drive (Daniel Island Interchange)

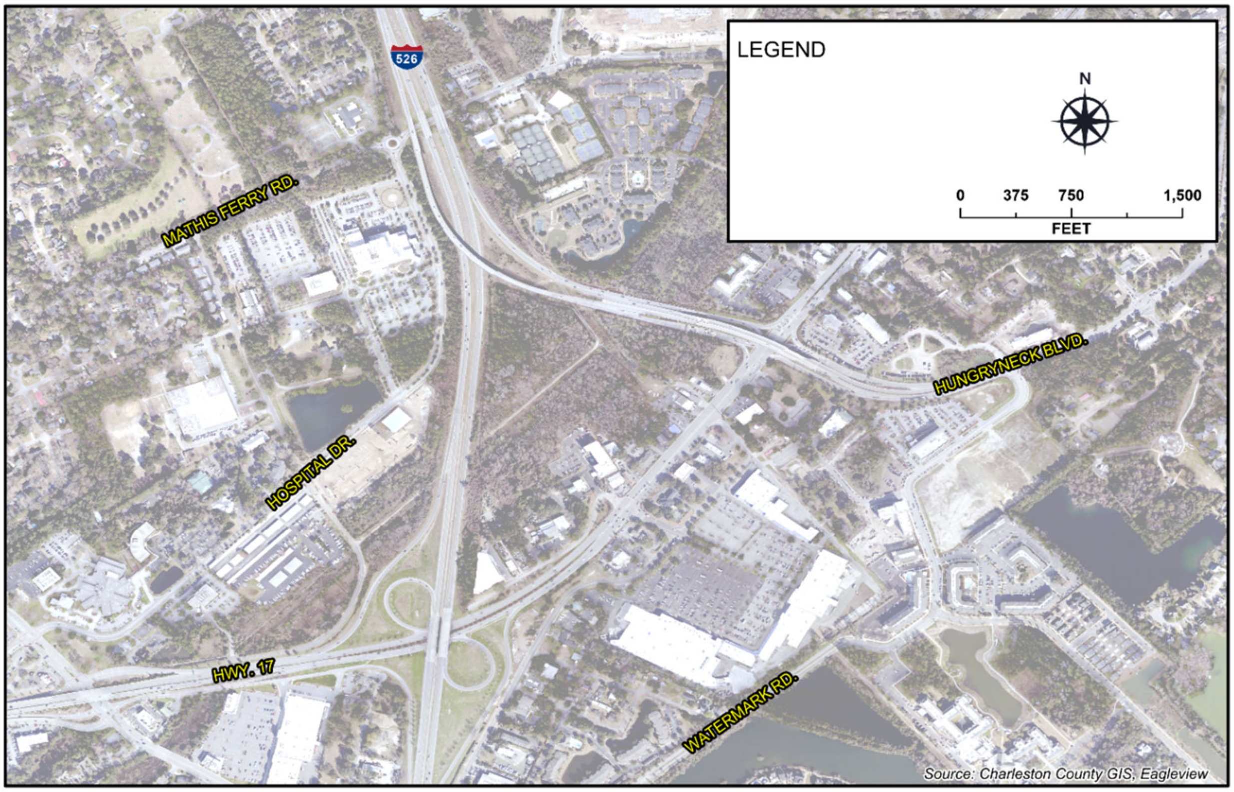


- **Long Point Road (S-97)** is a full-access interchange consisting of two diagonal ramps, two directional ramps, and two directional loop ramps (**Figure 4.6**).

Figure 4.6: Long Point Road (S-97) Interchange

- **U.S. 17** consists of two interchange areas (**Figure 4.7**). The northern area consists of east and westbound flyover ramps accessing north U.S. 17/Hungry Neck Boulevard. The southern interchange area at the project terminus is a full-access interchange with U.S. 17 (Johnnie Dodds Boulevard), consisting of two directional ramps, one diagonal ramp, and two directional loop ramps.

Figure 4.7: U.S. 17 Interchange



4.1.2 Existing Crossroads

- **Virginia Avenue** is a five-lane curb and gutter section crossing under I-526 with a sidewalk on both sides of the roadway.
- **Clements Ferry Road (S-33)** is a five-lane open-shoulder roadway crossing under I-526.
- **River Landing Drive/Seven Farms Drive (Daniel Island Interchange)**. Seven Farms Drive is a three-lane curb and gutter section with parking on both sides crossing under I-526. Landscaped verges separate sidewalk on both sides of the roadway. River Landing Drive ramps intersect Seven Farms Drive 0.4 miles southwest of I-526. River Landing Drive is a four-lane roadway separated by raised, landscaped medians.
- **Island Park Drive** is a four-lane roadway with curb and gutter paralleling Seven Farms Drive and crossing under I-526. It connects River Landing Drive with Seven Farms Drive.
- **Long Point Road (S-97)** is a five-lane roadway crossing under I-526. Some of the interchange area consists of open shoulder and some has curb, gutter, and sidewalk. There are decorative street lighting and landscaping within the interchange area.

- **U.S. 17 (Johnnie Dodds Boulevard)** is a four- to six-lane roadway with curb and gutter on both sides and sidewalk on the south side through the interchange, separated by a raised landscaped median. Decorative street lighting is located in the median, and street lighting on mast arms is located behind the sidewalk within the interchange area.

4.1.3 Functional Classification and Design Speed

Functional roadway classifications are based on the facility's current use as defined by SCDOT and depicted on the functional classification maps on the SCDOT GIS mapping website as of July 2018. The posted speed limit varies along the project corridor, ranging from 55 to 65 miles per hour (mph). The posted speed limit is 60 mph from west of Virginia Avenue to approximately 0.5 miles east of the Clements Ferry Road interchange. At this point, the posted speed limit is 65 mph and continues to the bridge crossing Mathis Ferry Road. After crossing Mathis Ferry Road, the posted speed limit changes to 55 mph until I-526 ends at U.S. 17. **Figure 4.8** depicts the posted speed limit along I-526 within the project limits. **Table 4.1** presents a description of the functional classification, posted speed limit, and recommended design speed for each roadway included in this project. Recommended posted speed limits are based on the facility's current posted speed limit and proposed design speed.

Figure 4.8: Posted Speed Limits within I-526 LCC EAST Corridor

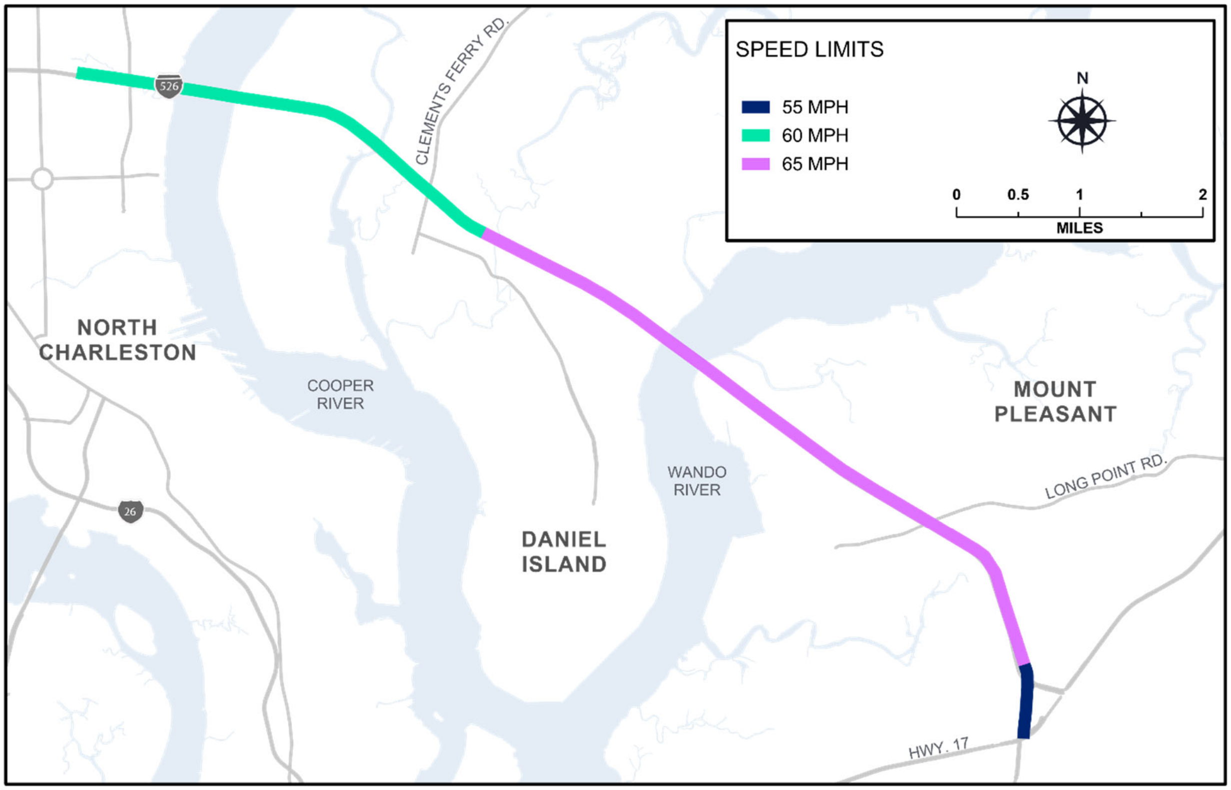


Table 4.1: Functional Classification, Posted Speed Limit, Recommended Design Speed, Recommended Posted Speed Limit

Roadway	Functional Classification	Current Posted Speed Limit	Design Speed	Recommended Posted Speed Limit
I-526	Interstate (Freeway/Expressway)	Varies 55 to 65 mph	65 mph	Varies 55 to 65 mph
Virginia Avenue (South of eastbound exit ramp)	Collector (Major)	40 mph	45 mph	40 mph
Virginia Avenue (North of eastbound exit ramp)	Arterial (Minor) (Urban Multilane)	40 mph	45 mph	40 mph
Clements Ferry Road (S-33) (South of I-526)	Collector (Major)	40 mph	45 mph	40 mph
Clements Ferry Road (S-33) (North of I-526)	Arterial (Minor) (Urban Multilane)	40 mph	45 mph	40 mph
Seven Farms Drive	Collector (Major)	30 mph	30 mph	30 mph
Island Park Drive	Local Group 4	35 mph	35 mph	35 mph
River Landing Drive	Local Group 4	35 mph	35 mph	35 mph
Long Point Road (S-97)	Arterial (Urban Multilane)	45 mph	45 mph	45 mph
U.S. 17 (I-526 interchange area)	Freeway/Expressway	45 mph	45 mph[1]	45 mph
U.S. 17 (Hungryneck Boulevard interchange area)	Arterial (Principal)	45 mph	45 mph	45 mph

1. Based on construction plans (file numbers 10.036997A and 10.037229A), the design speed for this roadway was 45 mph. The proposed design speed is consistent with these plans.

4.2 Demographic Trends and Forecasts

The Charleston region has experienced higher than average growth—almost three times faster than the national average—with 26 new people moving to the region each day[3] Population growth is projected to continue in the Charleston area based on the Berkeley, Charleston, and Dorchester Council of Governments (BCDCOG) Charleston Area Transportation Study (CHATS) Interim Regional Travel Demand Model (TDM), which forecasts various traffic analysis zones (TAZs) from 2015 to 2040. The project team collaborated with SCDOT to forecast additional growth to estimate 2050 travel demand (**Figure 4.9**). More information regarding the CHATS Interim Regional TDM received from BCDCOG is detailed in the Traffic Forecasting Technical Memorandum developed for the I-526 LCC EAST PEL Study.

The Daniel Island TAZ is expected to see the largest percent growth in population from 2015 to 2050, with over a 506 percent increase. The Wando Terminal TAZ is expected to see the lowest percent growth in population for TAZs adjacent to the I-526 study corridor, at about 32 percent growth. Employment in the Charleston region is also forecast to increase by almost 51 percent by 2050. Tourism and container cargo volume at the Port of Charleston are also forecast to increase substantially.

4.2.1 Traffic Growth

Relative to population, employment, and economic growth in the Charleston region, traffic volumes have been steadily increasing on the I-526 LCC EAST corridor at multiple locations (**Figure 4.10**). Based on forecasts from the CHATS Interim TDM for 2050, average annual daily traffic (AADT) and truck volumes are forecasted to increase by 72 percent and 68 percent, respectively.

[3] "2019: EXACTLY HOW MANY PEOPLE MOVE INTO THE CHARLESTON REGION EACH DAY?" Charleston Regional Development Alliance, https://www.crda.org/news/2019-exactly-how-many-people-move-into-the-charleston-region-each-day/ .

Figure 4.9: Population, Employment, and Economic Growth in Charleston Region

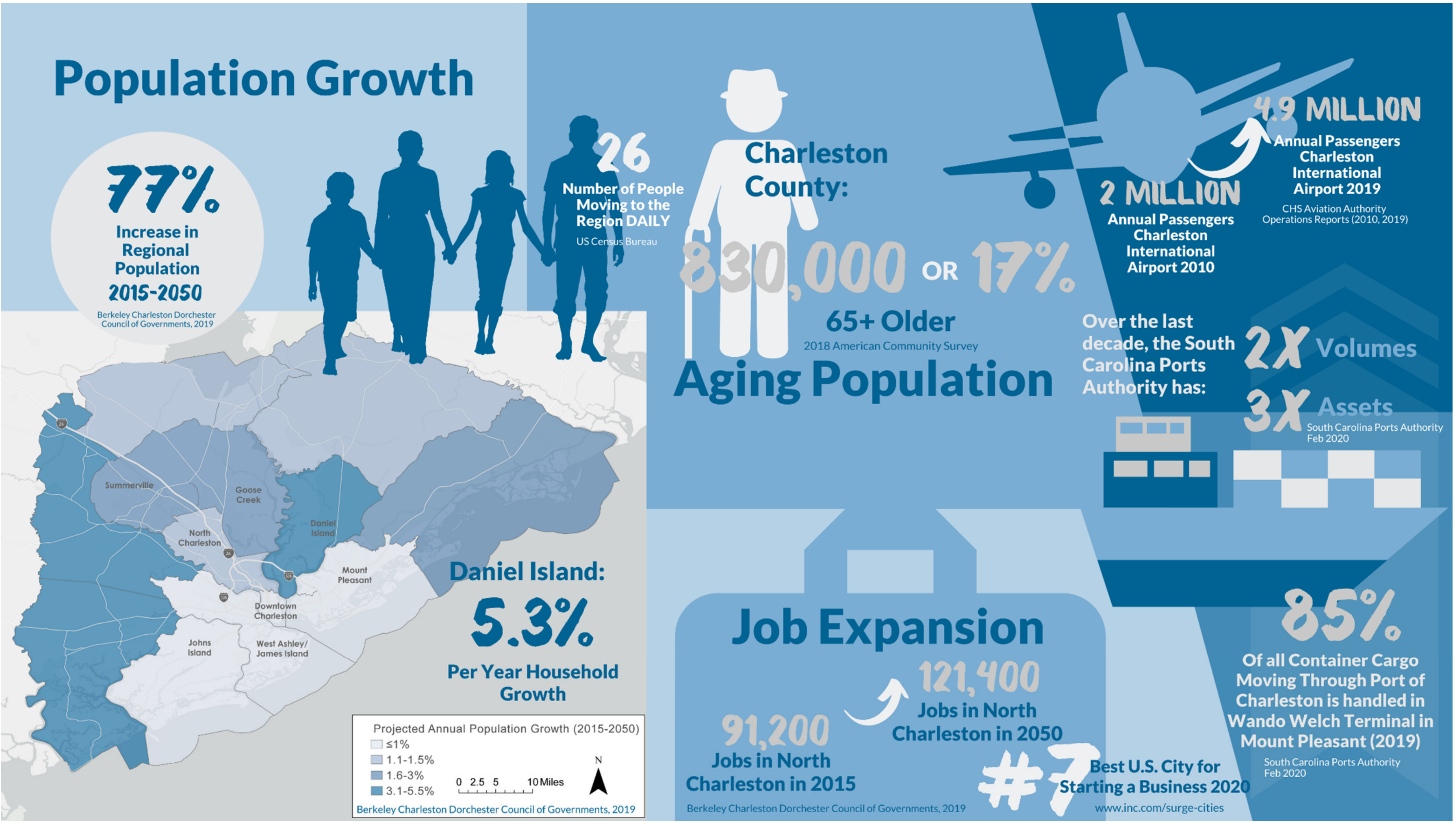
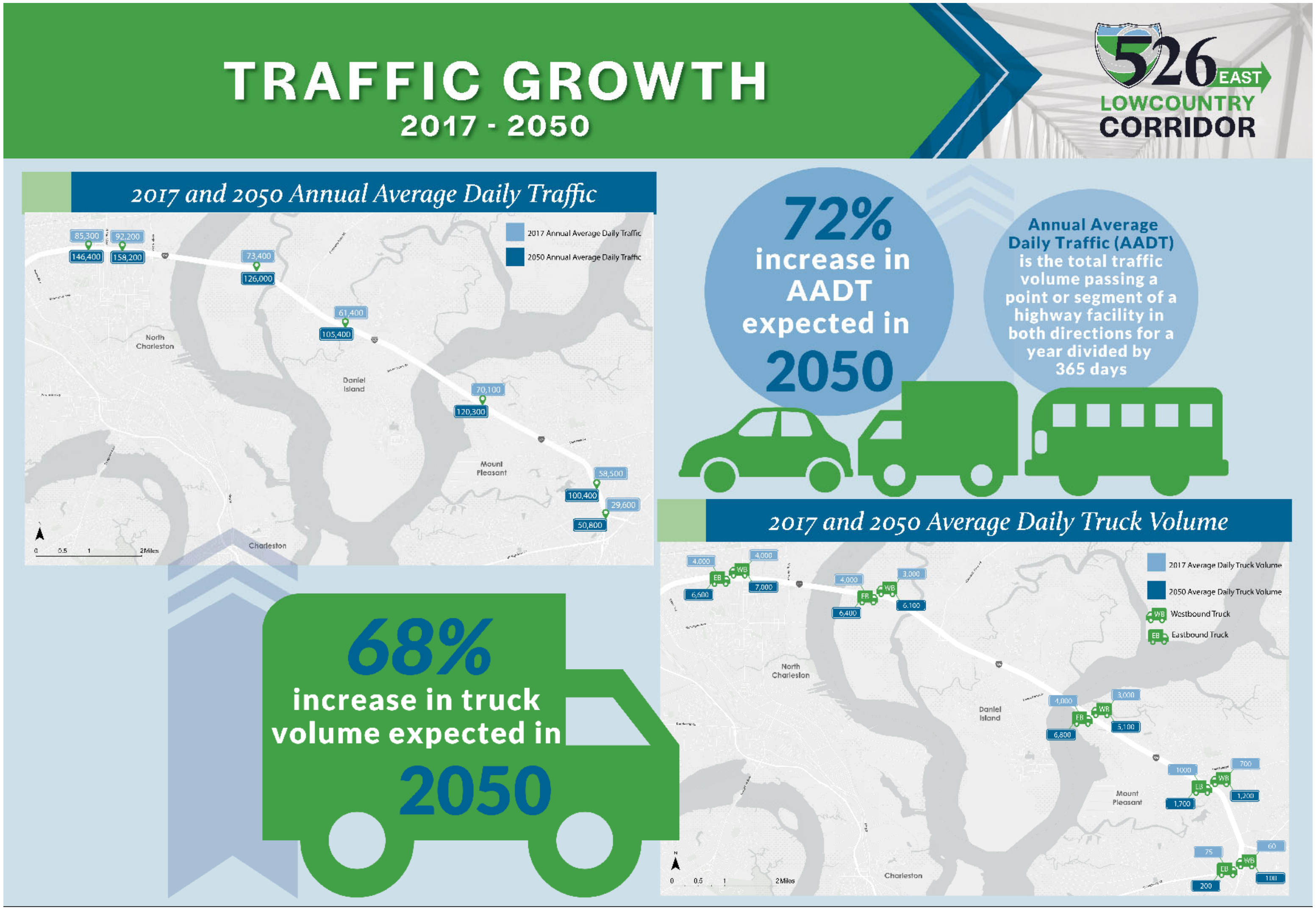
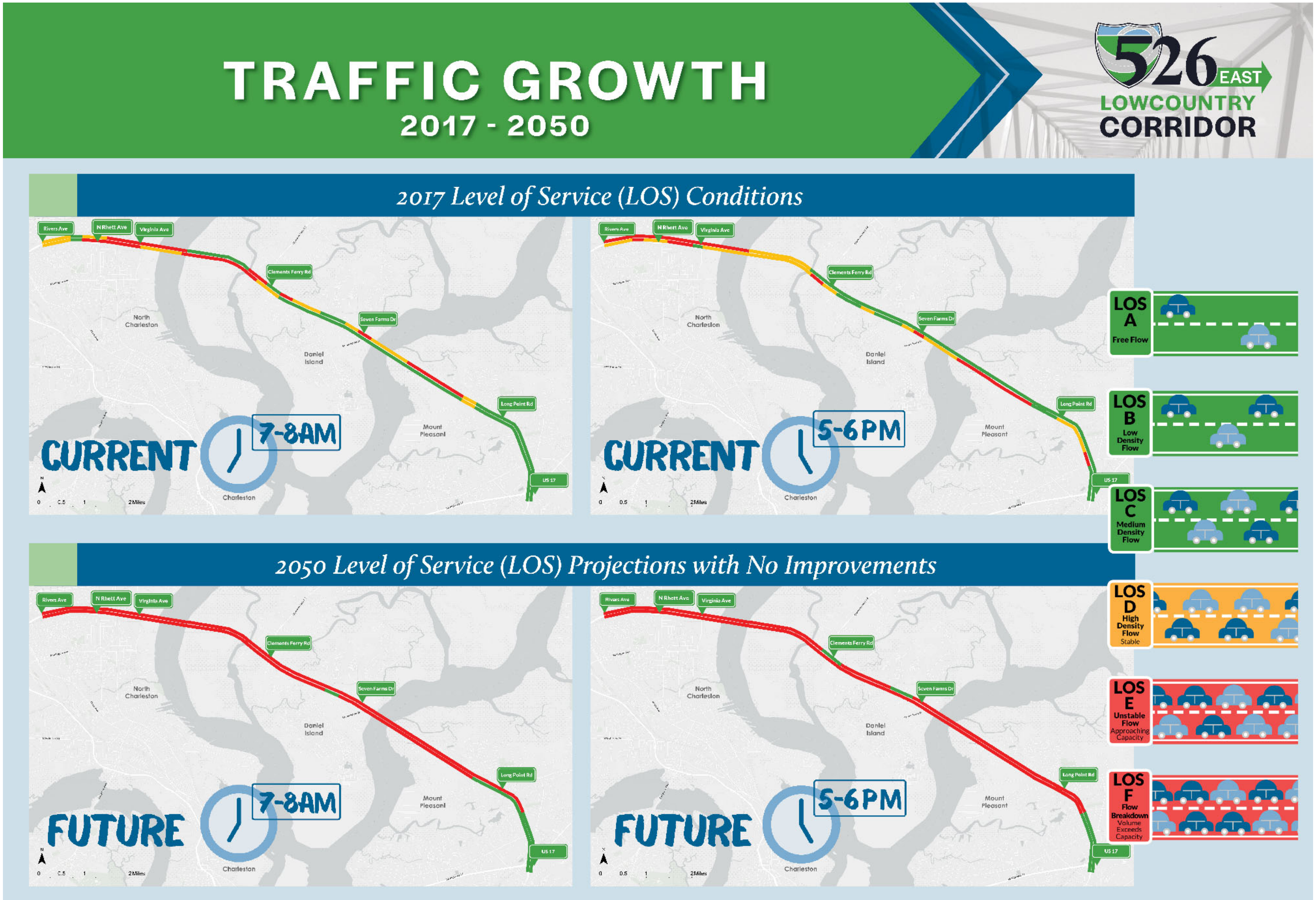


Figure 4.10: Traffic Growth 2017–2050 on I-526 LCC EAST Corridor




TRAFFIC GROWTH
2017 - 2050
526 EAST
LOWCOUNTRY CORRIDOR
2017 Level of Service (LOS) Conditions
CURRENT
7-8AM
CURRENT
5-6PM
2050 Level of Service (LOS) Projections with No Improvements
FUTURE
7-8AM
FUTURE
5-6PM
Rivers Ave
N Rhett Ave
Virginia Ave
Clements Ferry Rd
Seven Farms Dr
Long Point Rd
US 17
North Charleston
Daniel Island
Mount Pleasant
Charleston
LOS A Free Flow
LOS B Low Density Flow
LOS C Medium Density Flow
LOS D High Density Flow Stable
LOS E Unstable Flow Approaching Capacity
LOS F Flow Breakdown Volume Exceeds Capacity

5.0 Preliminary Concept Development

When developing alternatives as part of a PEL study, it is important to consider solutions or alternatives from prior studies such as the *CHATS 2040 Long Range Transportation Plan (2019)* and the *CHATS Congestion Management Process Report (2019)*. In addition, the potential solutions need to be evaluated from a "blank slate" point of view to be certain other potential solutions are uncovered that may have been overlooked or not evaluated. Thus, the concepts cover a wide scope and include previously considered and new alternatives, accounting for the study data obtained and subsequent analysis.

Concepts were developed using a combination of the existing and future transportation conditions analyses; review of previous plans and studies related to the study area; and public and stakeholder input to address the purpose, need, and goals of the study. The concepts are broken into the following categories and discussed further in the following section:

- No-build
- Infrastructure Improvements
  - Alternative Alignments
  - Mainline Improvements
  - Interchange/Ramp Improvements

5.1 No-build

The No-build is the baseline condition against which all alternative concepts were compared. The No-build concept provides a foundation for a comparison of traffic, environmental, and human conditions with potential build concepts. The No-build, also referred to as Existing Plus Committed, consists of the existing roadways as well as regional roadway network improvements programmed for funding and construction, as well as forecast land uses through the year 2050. This scenario estimates travel conditions without the completion of a build alternative on the I-526 LCC EAST corridor. This includes the CHATS Metropolitan Planning Organization's (MPO) existing plus committed roadway projects identified through local transportation plans and anticipated land developments in the CHATS study area.

The No-build scenario for I-526 LCC EAST includes four general-purpose lanes with two lanes in each direction, along with the existing truck climbing lanes on the Don Holt and Wando bridges in each direction, bringing the total lane count to six in these areas of the corridor.

The CHATS Interim Regional TDM was used to establish the baseline performance condition of the No-build concept. TDMs are macroscopic models that assist in the decision-making process by forecasting future traffic conditions based on forecast demographic data at a regional level. In the Level 1 screening, V/C ratio, vehicle hours of delay (VHD), average speed, and total two-way vehicle miles traveled were used to compare the performance of each concept to the No-build. V/C ratio, VHD, and average travel speed are all mobility performance metrics, and vehicle miles of travel (VMT) reflect the estimated total demand (throughput) of vehicles traversing the corridor. The V/C ratio is based on the weighted daily V/C output from the model. The V/C values only consider the I-526 mainline. The baseline performance and demand for the No-build concept are shown in **Table 6.1.**

Table 5.1: TDM Results for the No-build, Corridorwide (Average Daily Conditions)

Scenario	Model Year	Daily Volume to Capacity (V/C)	Daily Vehicle Hours of Delay (vehicle hours)[1]	Daily Average Speed (mph)	Total Two-Way Vehicle Miles Traveled Average Daily[1]
No-build	2050	1.20	10,400	37	1,026,200

Source: CHATS Interim Regional Travel Demand Model
Notes: For planning purposes only. All outputs are for the I-526 mainline only. [1]This data was rounded to the hundreds.

5.2 INFRASTRUCTURE IMPROVEMENT CONCEPTS

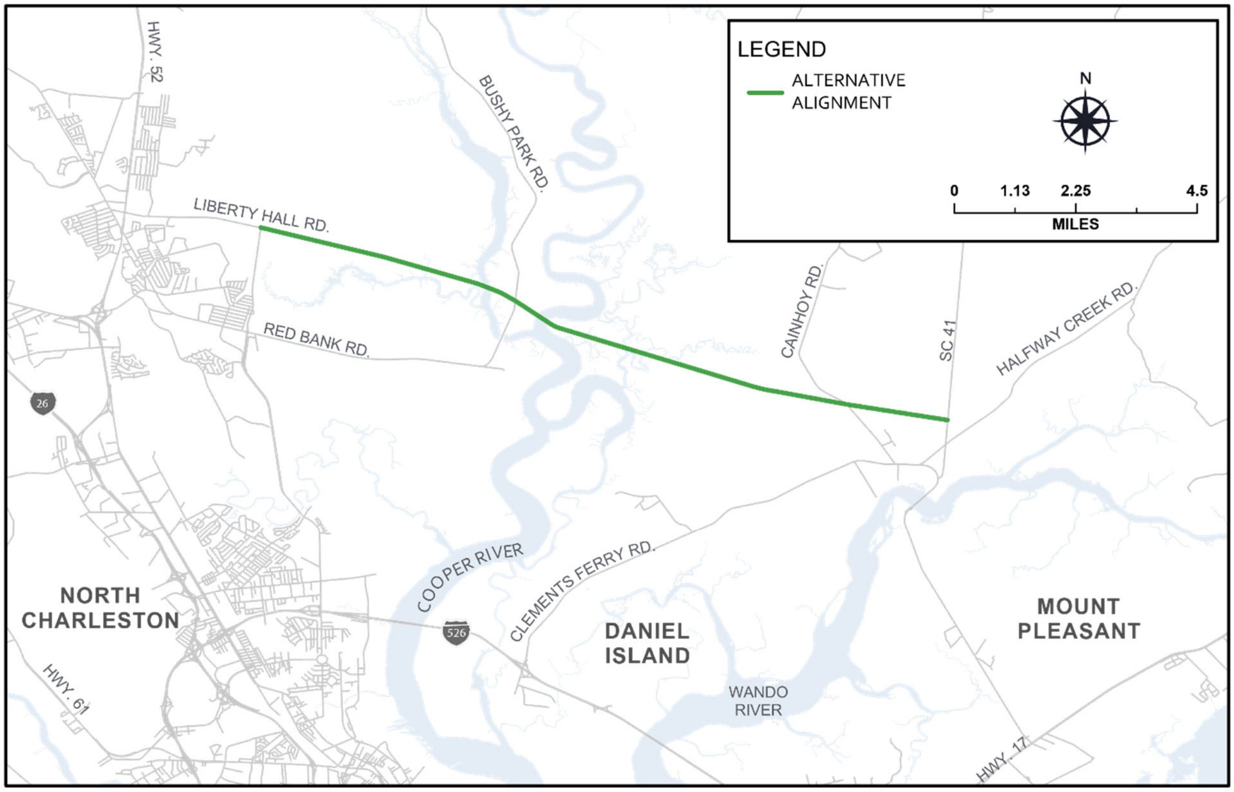
The infrastructure improvement concepts evaluated for the PEL study include a new location alignment route, I-526 mainline improvements or replacements, and interchange/ramp improvements. A summary of the No-build and infrastructure improvement concepts is listed in **Table 6.2**.

The input and feedback from the public and stakeholders were used in the development of the concepts evaluated.

5.2.1 New Location Alignment Route

The project team evaluated an alternative route conceptualized to help alleviate congestion by reducing demand on the I-526 mainline from U.S. 17 in Mount Pleasant to Virginia Avenue in North Charleston. This potential alignment would provide additional river crossing capacity in a new location, preventing impacts related to widening the existing facility and expanding the existing ROW. The new location alignment concept evaluated is a 11.3-mile four-lane parallel corridor, with two lanes in each direction (**Figure 6.1**). This would establish a connection from the current eastern terminus of Liberty Hall Road and continue eastward just north of Foster Creek, crossing the Back River with a connection at Bushy Park Road. The alignment then continues east, crossing the Cooper River and terminating at Highway 41. This alignment is listed as a visionary project in the CHATS 2040 Long Range Transportation Plan which provides travel forecasts based on a single future land use growth scenario consistent with current local comprehensive plans. The land use for this scenario was not modified due to land use constraints that would prevent major changes in development along this alignment. Approximately 3.6 miles of the alignment are located within the Naval Weapons Station Joint Base Charleston. Additionally, 3.2 miles of the alignment are located adjacent to water resources, and an additional 1.58 miles are located within the Francis Marion National Forest.

Figure 5.1: New Location Alignment Route Concept



5.2.2 Mainline Improvements

The project team evaluated two scenarios for adding capacity to the existing I-526 mainline. The first mainline improvement concept would add one additional lane in each direction, and the second would add two lanes in each direction to the existing mainline.

5.2.3 Interchange Improvements

Within the limits of the I-526 LCC EAST corridor, there are five existing interchanges. These interchanges are located at Virginia Avenue, Clements Ferry Road, River Landing Drive/Seven Farms Drive (Daniel Island), Long Point Road, and U.S. 17. It is assumed that existing interchange configurations will be maintained, if possible, and only modified if geometric modifications are necessary to accommodate mainline widening or forecast traffic volumes. In addition to these potential interchange improvements, a new dedicated truck ramp concept providing a direct truck connection to the Wando Welch Port terminal is also evaluated. This would allow port-related trucks to avoid local traffic on Long Point Road and improve conditions for both trucks and local traffic. Interchange improvement concepts considered are included in **Table 6.2**.

Table 5.2: No-build and Infrastructure Improvement Concepts

Concept	Description	Primary Reason(s) for Consideration
No-build	The No-build presents the anticipated future condition if no action is taken. This concept includes the planned mobility improvements in the region within the 2040 regional planning horizon as identified in the CHATS MPO 2040 Long Range Transportation Plan.[1]	The No-build provides a baseline to measure all other concepts against concerning mobility, roadway deficiencies, travel time, and environmental features.
Infrastructure Improvements		
Alternative Alignment		
New alignment alternate route	This concept includes the construction of a new location, four-lane facility north of the existing I-526 LCC EAST corridor.	Adding a new facility north of the existing I-526 LCC EAST corridor would provide an alternative route for traffic, which may improve congestion on the existing I-526 LCC EAST corridor and eliminate the need to expand the existing right-of-way.
Mainline Improvements		
One additional general-purpose lane in each direction	This concept includes adding one travel lane in each direction to be used for all vehicle types.	Providing an additional travel lane may help meet current and future travel demand and reduce congestion.
Two additional general-purpose lanes in each direction	This concept includes adding two travel lanes in each direction of travel to be used for all vehicle types.	Providing two additional travel lanes may help meet current and future travel demand and reduce congestion.
Interchange/Ramp Improvements		
Interchange at Virginia Avenue/I-526	This concept involves improvements designed to address compatibility with the I-526 LCC WEST project.	Improvements to the interchange will be required if improvements are made to the I-526 mainline.
Interchange at Clements Ferry Road/I-526	This concept involves keeping the existing interchange configuration while making geometric improvements to meet highway standards.	Improvements to the interchange will be required if improvements are made to the I-526 EAST mainline and will address geometric deficiencies.
Interchange at River Landing Drive/Seven Farms Drive/I-526	This concept involves keeping the existing interchange configuration while making geometric improvements to meet highway standards.	Improvements to the interchange will be required if improvements are made to the I-526 EAST mainline and will address geometric deficiencies.
Interchange at Long Point Road/I-526	This concept involves keeping the existing interchange configuration while making geometric improvements to meet highway standards.	Improvements to the interchange will be required if improvements are made to the I-526 EAST mainline and will address geometric deficiencies.
Interchange at U.S. 17/ I-526	This concept involves keeping the existing interchange configuration while making geometric improvements to meet highway standards.	Improvements to the interchange will be required if improvements are made to the I-526 EAST mainline and will address geometric deficiencies.
Proposed dedicated truck ramp to port	This concept adds a dedicated directional interchange for Wando Welch Terminal-related traffic.	Adding a dedicated truck-only interchange to the port may improve safety and reduce congestion related to trucks at the existing Long Point Road Interchange.

[1] *CHATS MPO 2040 Long Range Transportation Plan, https://www.bcdcog.com/long-range-transportation-plan/*

6.0 TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS CONCEPTS

Transportation Systems Management and Operations (TSMO) is a set of strategies that focus on operational improvements that can maintain and even restore the existing transportation system's performance before extra capacity (e.g., additional lanes) is needed.[4] TSMO strategies are intended to get the most performance out of existing transportation facilities by incorporating comprehensive solutions that can be quickly implemented at relatively low cost. TSMO strategies aim to maximize traveler choices by offering incentives, providing users with information about travel conditions to guide transportation decisions, and encouraging travel behavior changes. Transportation agencies cannot build enough capacity to meet the growing demand due to increased construction costs, ROW constraints, environmental concerns, and societal impacts. These issues pose challenges to adding new general-purpose lanes and to agencies looking for other ways to manage traffic flow on existing facilities. This can be done using TSMO strategies that regulate demand, separate traffic, use available and unused capacity, and coordinate facility operations. TSMO strategies are also incorporated into construction projects to prolong the duration of acceptable performance for users.

In addition to infrastructure improvement concepts, described in Section 6, TSMO strategies were included in the I-526 LCC EAST PEL analysis.

A local source for potential TSMO strategies is the *CHATS Congestion Management Process Report (2019)* (CMP).[5] A CMP is a federally required study that evaluates and monitors congestion-related issues and considers reasonable demand management and operations strategies for a corridor in which single-occupancy vehicle capacity increases are projected. The CMP identifies TSMO type strategies for each major corridor in the region that create a positive benefit in the mobility of that corridor. The strategies recommended for I-526 LCC EAST in the CMP include:

- **Parallel Pedestrian Facilities/Greenways** – Creation or enhancement of greenway trails, sidewalks, pedestrian/bicycle intersection crossings, and encouragement programs to create modal shifts away from motorized transportation to biking and walking modes.
- **Education/Enforcement** – Working with partners to address issues of speeding/dangerous traffic behaviors and improved safety behaviors.
- **Enhanced Operations** – A range of operational management strategies such as improved traffic detection/response, ramp metering, traffic signal prioritization, and other technology-based improvements.

[4] https://ops.fhwa.dot.gov/tsmo/
[5] https://www.bcdcog.com/wp-content/uploads/2015/12/CMP-Report-Final-012819.pdf

- **Bus on Shoulder/Bus Rapid Transit** – Creating a corridor or network of bus routes using at least partially separated ROWs, signal prioritization, and enhanced stop amenities (with fewer stop locations).
- **Congestion Pricing/Tolling** – Creating a high-occupancy vehicle (HOV)/high-occupancy toll (HOT) lane corridor or network that reflects the price of improved mobility on congested roads where built capacity is going to increase (e.g., road widening).

The TSMO-related concepts summarized in **Table 7.1** were identified based on the CMP-recommended strategies, existing and future transportation conditions, and feedback received through public and stakeholder outreach efforts of the I-526 LCC EAST PEL process. The TSMO concepts are organized into two categories: managed lane concepts and operational and travel demand management strategies. Multimodal improvements are also included in this summary.

Managed lane concepts use lanes separate from general-purpose lanes to respond to changing conditions. Some examples of a managed lane include HOV lanes, HOT lanes, dedicated truck, or dedicated transit lanes. **Operational elements** are designed to coordinate daily operations to achieve corridor, regional, or system-wide objectives.[6] Some examples of operational elements are improved traveler messaging (incident, weather, or work zone related information), ramp metering, active variable speed limits, and truck platooning.

Multimodal improvements are elements of the I-526 LCC EAST corridor that may support multimodal transportation movements but do not fully meet the purpose and need on their own. The multimodal improvements listed in **Table 7.1** will be considered and potentially incorporated into the final design of alternatives considered in future phases of project development.

Table 6.1: Transportation Systems Management and Operations Concepts

Concept	Description	Primary Reason(s) for Consideration
Managed Lane Concepts		
Shoulder lane use (existing facility)	This concept would bring the shoulders of I-526 LCC EAST up to current highway standards or construct new shoulders to be used as flexible travel lanes during peak travel periods.	Improving the shoulder width for use as a flexible travel lane could improve travel time and congestion during peak travel periods, accommodate bus traffic, and provide space for first responders to access accident locations safely.
HOV lanes	This concept adds an HOV lane that can only be used by vehicles with more than one passenger.	Adding an HOV lane may increase the person throughput on the facility, potentially reducing congestion.
HOT lanes	This concept includes a reserved lane for single-occupancy vehicles that pay a toll for use while HOV users can access the lane for free.	Adding a toll lane will provide users with a travel option that would provide more reliable travel times and reduce congestion by providing incentives for HOVs.
Congestion pricing	This concept incorporates a toll designed to shift discretionary rush hour highway travel to other transportation modes or off-peak periods, reducing non-commuter demand during peak travel hours.	Charging users to travel during peak travel periods may reduce the demand on I-526 and thereby improve safety, congestion, and travel time reliability.

[6] Federal Highway Administration https://ops.fhwa.dot.gov/publications/managelanes_primer/

Concept	Description	Primary Reason(s) for Consideration
Dedicated truck lanes	This concept adds a travel lane for trucks only.	Adding dedicated truck lanes may improve safety and reduce congestion related to truck movements on and off the interstate.
Dedicated transit lanes	This concept adds a travel lane to the interstate that is for transit only (bus, express bus, bus rapid transit, or other transit technology type).	Adding a dedicated transit lane may decrease travel time and increase efficiency for transit vehicles, promoting travel mode shift away from single-occupancy vehicles and reduce congestion.
Operational and Travel Demand Management Strategies		
Traveler information systems	This concept provides information to travelers in-route so they can plan trips or adjust routes based on roadway conditions such as congestion, incidents, or other unsafe conditions.	Providing travel information may prevent congestion levels from increasing in the event of a weather-related event, work zone, or incident.
Incident management systems	This concept combines a strategy of unified policies, procedures, operations, and communication systems for traffic incident responders.	The implementation of incident management can potentially reduce delay and non-recurring congestion.
Road weather management systems	This concept incorporates road weather management technologies and strategies that include information dissemination, interagency coordination plans, and weather response plans.	Improved weather management may improve safety in extreme weather events.
Work zone management improvements	This concept incorporates a broad range of strategies designed to enhance work zone safety and mobility. Strategies may include variable message signs, traveler information, and automated speed enforcement.	Work zone management may improve safety and mobility in and around construction work zones.
Enhanced lane markings	This element improves the lane markings and striping to interstate standards.	Improved lane markings could improve safety on the interstate.
Ramp metering	This element incorporates managing access to I-526 EAST at interchange on-ramps using ramp traffic signals.	Ramp metering could improve congestion and safety on the highway by managing the volume of traffic entering the highway during peak travel periods.
Accommodation of connected and autonomous vehicles	This element incorporates smart technology infrastructure to accommodate connected and autonomous vehicles.	Accommodating smart technology infrastructure for automated and connected vehicles could improve the future safety, congestion, and travel time reliability of the corridor.
Truck platooning	This concept uses technology such as radar and vehicle-to-vehicle communication to electronically align trucks to reduce gaps between them to maintain a tight formation.	Truck platooning could improve safety and reduce congestion through driving automation.
Park-and-ride	This concept provides locations for people to park their vehicles and transfer to a higher occupancy mode of transportation.	Installation of park-and-ride facilities could improve safety, improve travel time reliability, and reduce congestion.

Concept	Description	Primary Reason(s) for Consideration
Variable Speed Limits (VSL)	This technology uses information based on traffic speed, volume detection, and road weather information systems to determine the appropriate speed for optimal traffic flow.	Reduce congestion-related incidents throughout the corridor and enhance mobility for people and goods throughout the corridor.
Multimodal Improvements		
Add multiuse path along I-526	This element adds a multiuse path for pedestrians and bicycles within the ROW corridor by using a barrier to separate traffic from the path.	A multi-use path accommodation is part of the I-526 LCC WEST corridor project and will be considered as part of the I-526 LCC EAST corridor.
Local bike/pedestrian connections	This element improves non-motorized transportation infrastructure such as bike lanes and sidewalks on local facilities within the study area.	Improving local bike and pedestrian connections within the study area could promote travel mode shift and reduce highway congestion.

6.1 Evaluation of TSMO Strategies

Within the PEL process, the TSMO strategies presented are evaluated at a planning level to guide the project team through the decision-making process. By definition, TSMO strategies are designed to extend the performance life of infrastructure and avoid or prevent construction of new capacity. In the early phase of analysis, it was determined that additional capacity is required in this corridor. Because of the constraints of the existing bridges, it is not possible to retrofit the existing facility with enough mainline capacity through TSMO strategies. This traffic analysis is detailed in Section 8: Level 1 Screening.

Based on the development of the purpose and need and supporting goals, however, the project team progressed a planning-level analysis of TSMO strategies to identify which strategies support project goals and which strategies may have enough benefit to traffic performance to be incorporated into the eventual project design later phases of project development.

To evaluate the potential performance of TSMO strategies at this planning-level analysis, a combination of the I-26 Corridor Management Plan and other case studies are used to report on the anticipated benefit of these strategies. Within the I-26 Corridor Management Plan, and planning level managed lanes modeling analysis was conducted at the regional level. The relative results and recommendations are incorporated into this review. The relative traffic performance assessment is based upon case studies of similar TSMO strategies.

Each of these recommendations are also assessed for supportiveness of the project goal areas.

- **COMPATABILITY:** Align with local land use plans and projects. If recommendations align with local land use or transportation plans identified in the BCDCOG Existing and Committed projects, they support this goal area.
- **DEMAND:** Improve roadway infrastructure to accommodate increased traffic volumes. If recommendations are expected to increase the ability of the corridor to accommodate or better manage estimated travel demand, they are assumed to support the project goal.
- **SAFETY:** Reduce congestion-related incidents throughout the corridor. If congestion is improved, it is assumed that this crash rate should improve by improving safer driving conditions.

- **MULTIMODAL:** Enhance mobility for people and goods through the corridor. This includes modes other than single-occupancy vehicles, such as carpool, transit, walk, bike, or truck. If the recommendations are designed to support such modes, they support this goal area.
- **SEISMIC:** Improve seismic resiliency of the infrastructure. If roadways or bridges are modified or reconstructed, it is assumed that new infrastructure will be built to current, improved seismic standards, supporting this goal area.
- **TECHNOLOGY:** Accommodate future transportation technologies, including vehicle technologies, communications technologies, system monitoring systems, driver information, and traffic operations technologies. If recommendations support these technologies, they are supportive of this goal area.
- **CONNECTIVITY:** Improve connections with area ports, rail intermodal facilities, and transit assets. If recommendations are designed to provide new or improve connections to intermodal assets, they support this goal area.

Table 7.2 and **Table 7.3**, provides recommended actions for each of these strategies as this project continues through the PEL process and into the NEPA process. This may accomplish additional goals of further improving upon the performance of the infrastructure improvement concepts above and beyond the estimated performance of additional general-purpose lanes. Some TSMO strategies also support prolonging the performance life of a recommended preferred alternative.

Table 6.2: Managed Lanes Analysis and Recommendations

Managed Lane Concept	Description	Findings from Prior Studies	Project Goals Supported	Ability to Standalone & Recommended Action
Shoulder lane use (existing facility)	This concept would bring the shoulders of I-526 LCC EAST up to current highway standards or construct new shoulders to be used as flexible travel lanes during peak travel periods.	A Federal Highway Administration (FHWA) study[7] on implementation of Bus on Shoulder lanes (BOS) has shown decreased travel times, improved mobility, and increased transit reliability. The BOS application results from eight cities across the US showed 3-25 minutes of travel time savings during congested periods.	• COMPATIBILITY • DEMAND • MULTIMODAL • SEISMIC (if new construction) • TECHNOLOGY • CONNECTIVITY	Will carry forward as a design consideration for traffic analysis of the recommended preferred alternative in the NEPA phase to account for ROW and appropriate design of shoulders, etc. [8]
HOV lanes	This concept adds an HOV lane that can only be used by vehicles with more than one passenger.	The I-26 Corridor Management Plan[9] completed in 2020 examined managed lane scenarios along the I-26 and I-526 corridors. The examined scenarios included HOV lanes. This strategy was examined both as a systemwide scenario that included I-26 and I-526 study corridor. The study showed a decrease in vehicle hours traveled and an increase in travel speeds.	• COMPATIBILITY • DEMAND • SEISMIC (if new construction) • TECHNOLOGY	Will not carry forward as a reasonable alternative, as it does not meet the purpose and need of this corridor without regional implementation.
HOT lanes	This concept includes a reserved lane for single-occupancy vehicles that pay a toll for use while HOV users can access the lane for free.	The I-26 Corridor Management Plan[10] completed in 2020 examined managed lane scenarios along the I-26 and I-526 corridors. The examined scenarios included HOT lanes. This strategy was examined both as a systemwide scenario that included I-26 and I-526 study corridors. The study showed a decrease in vehicle hours traveled and an increase in travel speeds.	• COMPATIBILITY • DEMAND • SEISMIC (if new construction) • TECHNOLOGY	Will not carry forward as a reasonable alternative, as it does not meet the purpose and need of this corridor without regional implementation.

[7] Jenior, Pete, Richard G. Dowling, Brandon L. Nevers, and Louis G. Neudorff. *Use of Freeway Shoulders for Travel—Guide for Planning, Evaluating, and Designing Part-Time Shoulder Use as a Traffic Management Strategy*. No. FHWA-HOP-15-023. United States. Federal Highway Administration. Office of Operations, 2016.
[8] The preferred alternative will be identified during NEPA, a separate environmental process outside of this PEL study
[9] I-26 Corridor Management Plan, Traffic Study of Managed Lanes, 2020, CDM Smith
[10] I-26 Corridor Management Plan, Traffic Study of Managed Lanes, 2020, CDM Smith

Managed Lane Concept	Description	Findings from Prior Studies	Project Goals Supported	Ability to Standalone & Recommended Action
Congestion pricing	This concept incorporates a toll designed to shift discretionary rush hour highway travel to other transportation modes or to off-peak periods, reducing non-commuter demand during peak travel hours.	An FHWA study[11] on congestion pricing showed that speeds in Orange County, California during rush hour were 75 percent faster on priced facilities vs free facilities. This case study also showed a 40 percent increase in carpooling with 3+ passengers, however ridership on transit remained steady.	• COMPATIBILITY • DEMAND • SEISMIC (if new construction) • TECHNOLOGY	Will not carry forward as a reasonable alternative, as it does not meet the purpose and need of this corridor without regional implementation.
Dedicated truck lanes	This concept adds a travel lane for trucks only.	An analysis[12] of truck-only lanes in Southern California on SR-60 and I-710 showed that truck-only lanes improve safety by reducing the interaction with other vehicle types. However, the travel time analysis showed mixed results. SR-60, which is uncongested during off-peak hours, did not show travel time savings as peak periods of truck traffic did not align with peak congestion periods of general traffic whereas for a congested corridor like I-710, travel time savings continue throughout the day.	• COMPATIBILITY • DEMAND • SAFETY • MULTIMODAL • SEISMIC (if new construction) • CONNECTIVITY	Will not carry forward as a reasonable alternative, as it does not meet the purpose and need of this corridor without regional implementation. Should regional efforts make dedicated truck lanes a priority, this action will be incorporated into NEPA studies.

[11] DeCorla-Souza, Patrick. *Congestion Pricing A Primer: Overview*. Report No. FHWA-HOP-08-039. Federal Highway Administration. Washington, D.C. (October 2008).
[12] Fischer, Michael J., Dike N. Ahanotu, and Janine M. Waliszewski. "Planning truck-only lanes: Emerging lessons from the Southern California Experience." *Transportation research record* 1833, no. 1 (2003): 73-78.

Table 6.3: Operational and Multimodal Strategies Analysis and Recommendations

Strategy	Description	Findings from Prior Studies	Project Goals Supported	Ability to Standalone & Recommended Action
Traveler information	This concept provides information to travelers in-route so they can plan trips or adjust routes based on roadway conditions such as congestion, incidents, or other unsafe conditions.	Maryland DOT analyzed the impacts of Dynamic Message Signs (DMS) on traffic flow. The study[13] concluded that DMS's overall were able to reduce speeds by -3.13 mph, and speed reduction in 17.1 percent of cases. The traveler information disseminated from DMS showed a 5-20 percent increase of traffic diversion rates on alternate routes.	• COMPATIBILITY • SAFETY • MULTIMODAL • TECHNOLOGY • CONNECTIVITY	Will carry forward as an improvement concept, as it aligns with the purpose and need. This action will be excluded from alternatives comparison as it is a common improvement concept across all infrastructure improvement alternatives.
Incident management	This concept combines a strategy of unified policies, procedures, operations, and communication systems for traffic incident responders.	ITS deployments in Michigan along seven corridors have reduced average incident delay times. A microsimulation study [14] concluded that ITS is most beneficial in high duration and high reduction scenarios.	• COMPATIBILITY • SAFETY • MULTIMODAL • TECHNOLOGY	Will carry forward as an improvement concept, as it aligns with the purpose and need. This action will be excluded from alternatives comparison as it is a common improvement concept across all infrastructure improvement alternatives.
Road weather management	This concept incorporates road weather management technologies and strategies that include information dissemination, interagency coordination plans, and weather response plans.	A case study[15] of seven maintenance regions' operations in Michigan showed that the incident rates decreased for two regions, remained constant for two regions, and increased for two regions. User delay costs during advisory and warning alerts decreased statewide by 25 to 67 percent.	• COMPATIBILITY • SAFETY • MULTIMODAL • TECHNOLOGY	Will carry forward as an improvement concept, as it aligns with the purpose and need of improving travel time reliability. This action will be excluded from alternatives comparison as it is a common improvement concept across all infrastructure improvement alternatives.

[13] Haghani, Ali, Masoud Hamedi, Robin Fish, and Azadeh Nouruzi. *Evaluation of dynamic message signs and their potential impact on traffic flow*. No. MD-13-SP109B4C. Maryland. State Highway Administration. Office of Policy & Research, 2013.

[14] Oh, Jun-Seok, Valerian Kwigizile, Zhanbo Sun, Matthew L. Clark, Aous Hammad Kurdi, and Matthew J. Wiersma. *Costs and benefits of MDOT intelligent transportation system deployments*. No. RC-1631. Michigan. Dept. of Transportation, 2015.

[15] Toth, Christopher, Michael Waisley, Jeremy Schroeder, Murat Omay, Collin Castle, and Steve Cook. *Michigan Department of Transportation (MDOT) weather responsive traveler information (Wx-TINFO) system implementation project*. No. FHWA-JPO-16-323. United States. Department of Transportation. Intelligent Transportation Systems Joint Program Office, 2016.

Strategy	Description	Findings from Prior Studies	Project Goals Supported	Ability to Standalone & Recommended Action
Work zone management	This concept incorporates a broad range of strategies designed to enhance work zone safety and mobility. Strategies may include variable message signs, traveler information, and automated speed enforcement.	A microscopic simulation study[16] concluded that implementing dynamic late merge for work zones on I-65 in Birmingham, Alabama area reduced traffic delays by 50 percent for demand exceeding 4000 veh/hr.	• SAFETY • TECHNOLOGY	Will carry forward as an improvement concept, as it aligns with the purpose and need. This action will be excluded from alternatives comparison as it is a common improvement concept across all infrastructure improvement alternatives.
Enhanced lane markings	This element improves the lane markings and striping to interstate standard.	A 2015 study[17] concluded that installing wet-reflective pavement markings on freeways reduces crashes by 12.9 percent with a benefit-to-cost ratio of 1.45. Another 2011 study[15] concluded that installing wider lane markings with resurfacing reduces fatal crashes by 4 percent with a benefit-to-cost ratio of 11.5.	• SAFETY • TECHNOLOGY	Will carry forward as an improvement concept. This action will be excluded from alternative comparison as it is a common improvement concept across all infrastructure improvement alternatives.
Ramp metering	This element incorporates managing access to I-526 EAST at interchange on-ramps using ramp traffic signals.	A 2018 study[18] of ramp metering and other ATM strategies on I-35 in Williamson County (TX) road network concluded that ramp metering reduces the travel time on the freeway but worsens the surface network.	• DEMAND • SAFETY • TECHNOLOGY	Will not carry forward as an improvement concept as there are potential negative impacts on the surface network and this requires system-wide evaluation.

[16] Ramadan, Ossama E; Sisiopiku, Virginia P. Modeling Highway Performance under Various Short-Term Work Zone Configurations. Journal of Transportation Engineering, Part A: Systems, Volume 144, Issue 9, 2018.

[17] Lyon, C., B. Persaud, and K. Eccles. "Safety Evaluation of Wet-Reflective Pavement Markers". Report No. FHWA-HRT-15-065. Federal Highway Administration. Washington, D.C. (October 2015).

[18] Boyles, Stephen David, C. Michael Walton, Jennifer Duthie, Ehsan Jafari, Nan Jiang, Alireza Khani, Jia Li et al. *A Planning Tool for Active Traffic Management Combining Microsimulation and Dynamic Traffic Assignment*. Center for Transportation Research at the University of Texas at Austin, 2018.

Strategy	Description	Findings from Prior Studies	Project Goals Supported	Ability to Standalone & Recommended Action
Accommodation of connected and autonomous vehicles	This element incorporates smart technology infrastructure to accommodate connected and autonomous vehicles.	A 2016 FHWA report[19] studied the impacts of the Smart Roadside Initiative (SRI) and concluded that commercial and transit vehicles would benefit most under SRI. However, larger scale studies are needed to quantify benefits. Several publications[20] provided concept of operations and studied vehicle-to-infrastructure (V2I) applications and predicted safety benefits, reduction in travel time, and improvement in capacity.	• COMPATIBILITY • DEMAND • SAFETY • MULTIMODAL • TECHNOLOGY	Will carry forward as an improvement concept and exclude from alternative comparison as it is a common concept across all proposed infrastructure improvement alternatives.
Truck platooning	This concept uses technology such as radar and vehicle-to-vehicle communication to electronically align trucks to reduce gaps between them to maintain a tight formation.	Truck platooning studies[21] indicated a potential road capacity increase but only during congested scenarios. However, platooning in simulation models showed merging issues for general traffic.	• COMPATIBILITY • DEMAND • SAFETY • MULTIMODAL • TECHNOLOGY • CONNECTIVITY	Will not carry forward as an improvement concept as there are concerns regarding impact on non-truck traffic.
Variable Speed Limits (VSL)	This technology uses information based on traffic speed, volume detection, and road weather information systems to determine the appropriate speed for optimal traffic flow.	VSL benefits have been documented as early as 1999[22]. VSL reduced crashes by 10-30 percent[22]. In addition to safety benefits, VSL combined with ramp metering reduced the travel times by 8 percent[21] and mitigated recurring and non-recurring congestion delays by 16 percent and 27 percent, respectively[23].	• DEMAND • SAFETY • TECHNOLOGY	Will carry forward as an improvement concept and exclude from alternative comparison as it is a common concept across all proposed infrastructure improvement alternatives.

[19] Mollaghasemi, Mansooreh, Sam Fayez, Ahmed El-Nashar, Fabio Zavagnini, Ken Troup, and Dan Leonard. *Impact Assessment of the Smart Roadside Initiative (SRI) Prototype*. No. FHWA-JPO-17-495. 2016.
[20] Federal Highway Administration ITS Joint Program Office. Vehicle-to-Infrastructure (V2I) Publications. <https://www.its.dot.gov/v2i/v2i_publications.htm>. Accessed March 5, 2021.
[21] Wang, Meng, Sander van Maarseveen, Riender Happee, Onno Tool, and Bart van Arem. "Benefits and risks of truck platooning on freeway operations near entrance ramp." *Transportation Research Record* 2673, no. 8 (2019): 588-602.
[22] Lyles, Richard W., and Virginia P. Sisiopiku. "An Evaluation of Speed Control Techniques in Work Zones (work Zones 2)." (1999).
[23] Boyles, Stephen D., C. Michael Walton, Jennifer Duthie, Ehsan Jafari, Nan Jiang, Alireza Khani, Jia Li et al. *A Planning Tool for Active Traffic Management Combining Microsimulation and Dynamic Traffic Assignment (FHWA 0-6859-1)*. No. FHWA/TX-17/0-6859-1. 2018.

Strategy	Description	Findings from Prior Studies	Project Goals Supported	Ability to Standalone & Recommended Action
Park-and-ride	This concept provides locations for people to park their personal vehicles and transfer to a higher occupancy mode of transportation.	A recent study[24] concluded that introduction or expansion of park-and-ride facilities affect traffic demand by i*)* directly affecting people's travel behavior, and ii*)* affecting land use development and transport systems in ways indirectly affecting people's travel behavior. Accordingly, introduction of park-and-ride facilities is expected to reduce traffic demand on I-526, especially commuter demand.	• COMPATIBILITY • DEMAND • MULTIMODAL • TECHNOLOGY • CONNECTIVITY	Will carry forward as an improvement concept. This could be incorporated into the local connections on adjacent roadways and conjunction with BCDCOG regional transit planning efforts.

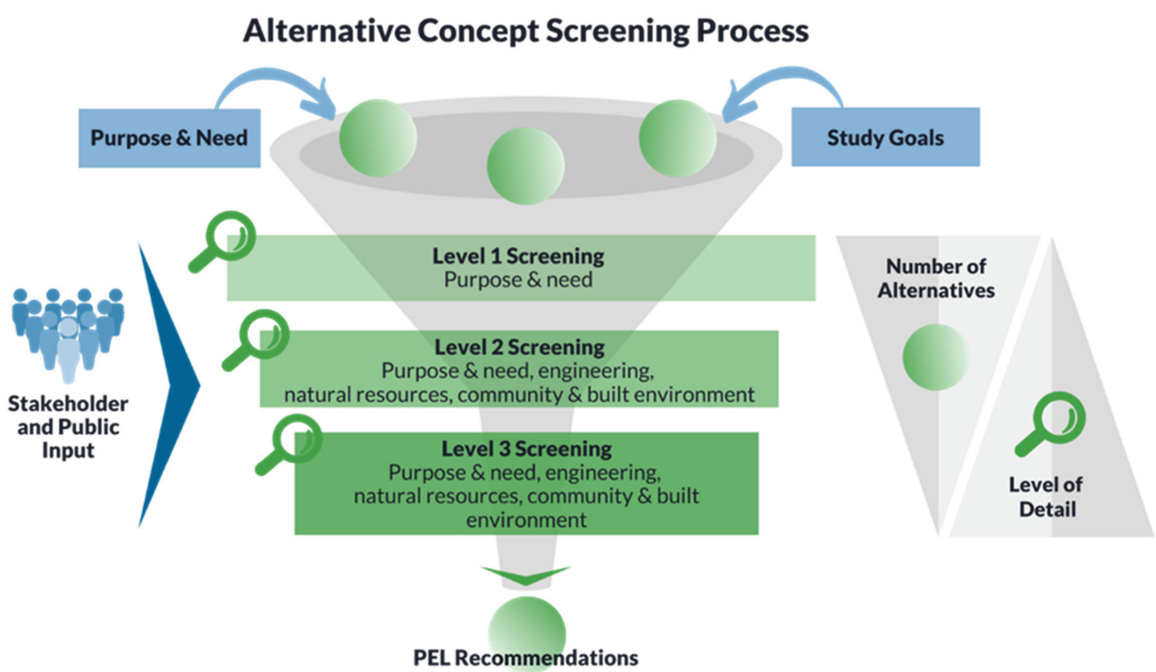
Following this analysis of TSMO strategies in the I-526 EAST corridor, none of the strategies appear to be viable as standalone alternatives. While additional capacity will be required, several of the presented TSMO strategies should be incorporated into the continued refinement, design, traffic operational design, and design criteria of the recommended preferred alternative. This would contribute to meeting project goals and potentially prolonging the performance life of the recommended preferred alternative by constructing a modern, multimodal corridor.

[24] Tennøy, Aud, Jan Usterud Hanssen, and Kjersti Visnes Øksenholt. "Developing a tool for assessing park-and-ride facilities in a sustainable mobility perspective." *Urban, Planning and Transport Research* 8, no. 1 (2020): 1-23.

7.0 LEVEL 1 SCREENING PROCESS

The three-level screening process, illustrated in **Figure 7.1,** begins with the range of concepts discussed in **Chapter 6**. Each concept is evaluated to determine if it meets the purpose and need while considering impacts to both the communities and the built and natural environment.

Figure 7.1: I-526 LCC EAST PEL Alternative Concept Screening Process



7.1 LEVEL 1 SCREENING CRITERIA

The Level 1 screening evaluation uses a qualitative and quantitative methodology to evaluate the universe of concepts against the baseline (or future No-build condition) to determine whether the concept meets the purpose and need. This includes measures of improved congestion and roadway deficiencies. Congestion was assessed using quantitative performance metric outputs from the CHATS Interim Regional TDM. Roadway deficiencies were qualitatively evaluated using professional engineering judgment.

7.1.1 Congestion Analysis

Due to current average daily traffic volumes, portions of the I-526 LCC EAST corridor approach capacity, resulting in heavy congestion. As demand increases in the future, traffic volumes will exceed the available capacity of the corridor and result in worsening congestion and poor travel time reliability.

The CHATS Interim Regional TDM was used to evaluate the performance of capacity modifications and additional new location alignments at the regional level for a design year of 2050. This modeling tool is the most appropriate to estimate traffic demand and performance at the macro-level in terms of congestion metrics and delay throughout the corridor. The outputs of the CHATS Interim Regional TDM are applicable in the Level 1 screening to identify high-level capacity needs along the I-526 LCC EAST corridor. In Level 1 screening, the infrastructure improvement concepts were evaluated with the goal of quantifying the amount of mainline capacity needed to provide mobility improvement at the corridor-wide level. The infrastructure improvement concepts evaluated included: No-build (baseline), No-build plus one additional travel lane in each direction, No-build plus two additional travel lanes in each direction, and a new location alignment route.

The performance measure outputs from the CHATS Interim Regional TDM used in the Level 1 screening include:

- **Improved Level of Service and Volume to Capacity Ratios** – A traditional measure of roadway performance is level of service (LOS). A LOS output in TDM is a rating based on the estimated V/C ratio. This represents the total volume (or demand) on a roadway against the capacity of the lane configuration under consideration. To evaluate the ability of a concept to improve congestion, it is necessary to estimate a forecast year V/C ratio and provide a relatively acceptable operation. For this Level 1 analysis, the CHATS Interim Regional TDM was used to calculate the estimated V/C ratio for annual daily traffic conditions for the design year of 2050. It was determined, based on the Transportation Research Board's Highway Capacity Manual (2000),[25] that an average daily V/C ratio over 0.88 would not provide an acceptable operation and would not have the potential to meet the purpose and need of this project.
- **Reduced Delay and Improve Travel Speed in the Corridor** – Delay is calculated as the difference in travel speeds between posted speed, or free-flow speed, and congested speed. For drivers, this is the additional time it takes to travel a roadway under congested conditions compared to uncongested conditions. For the Level 1 screening, the CHATS Interim Regional TDM was used to estimate the corridor-wide delay for each concept presented. The average speed of the I-526 corridor provides insight into the congestion, as speed is directly related to congestion that is being experienced based on the CHATS Interim Regional TDM. The I-526 posted speed limits within the study area are 55, 60, and 65 mph. For this corridor, daily average speeds less than 45 mph were considered undesirable.

To provide a quantifiable "yes" or "no" scoring for congestion in the Level 1 screening, the performance of these concepts was compared with the No-build performance using the CHATS Interim Regional TDM results presented in **Table 7.1.**

All Level 1 concepts were compared with the No-build concept using the results in **Table 7.1**. The CHATS Interim Regional TDM analysis also guided the refinement of concepts carried forward into Level 2 screening to accommodate capacity needs based upon the estimated travel demand. The results of the CHATS Interim Regional TDM analysis determined that a minimum of eight lanes, or four through lanes in each direction, would be required to achieve a V/C ratio below the 0.88 threshold outlined in the

[25] The Highway Capacity Manual (HCM) is a publication of the Transportation Research Board of the National Academies of Science in the U.S. It serves as the principal resource for the analysis for capacity and level of service of U.S. streets and highways.

Transportation Research Board's Highway Capacity Manual (2000)[26] for an acceptable level of congestion and has guided the further development of the infrastructure improvement concepts.

Table 7.1: Summary of Level 1 Concepts TDM Results

Infrastructure Improvement Concept	Model Year	Daily Volume to Capacity (V/C ≤ 0.88)	Daily Vehicle Hours of Delay (vehicle-hours)[1]	Average Speed (mph)	Total Two-Way Vehicle Miles Traveled Average Daily[1]
No-build	2050	1.20	10,400	37	1,026,200
No-build + one lane each way	2050	0.91	6,300	45	1,181,000
No-build + two lanes each way	2050	0.73	3,300	55	1,246,000
New location alignment route (new alignment from Bushy Park Road to SC 41)	2050	1.18	9,200	38	997,600

Source: CHATS Interim Regional TDM
Notes: For planning purposes only. Outputs are for the I-526 mainline. [1] Rounded to the hundreds.
Red text indicates V/C ratios that are greater than 0.88.

7.1.2 Roadway Deficiency Analysis

The existing roadway, bridges, and interchange ramps in the corridor have geometric deficiencies that do not accommodate existing and future traffic volumes and contribute to inadequate mobility and travel times. To evaluate roadway deficiency, concepts were evaluated on their ability to satisfy the question, "Does the concept have the potential to meet SCDOT roadway design standards on I-526 mainline and/or the interchanges?" The following criteria were considered when answering the question:

- Shoulder width
- Acceleration and deceleration ramps
- Tight ramp curves (existing loop ramp radius is less than the minimum required for the design speed)

7.2 Level 1 Screening Results

Following the Level 1 screening evaluation, scores of the three evaluation criteria questions were summarized, and each concept yielded one of the following results:

- **Carried Forward** – Concepts that receive a "yes" for each of the evaluation questions are carried forward to the Level 2 screening.
- **Carried Forward as a Supplemental Option** – Concept removed from consideration as a standalone option due to failure to fully satisfy the purpose and need; however, it will be carried forward as a supplemental option to be evaluated in conjunction with other concepts.

[26] Transportation Research Board. *Highway Capacity Manual: U.S. Customary Units*. 2000. 23-4.

- **Eliminated** – The concept failed to meet the purpose and need of the study or was considered non-feasible. Concepts were eliminated if they received a "no" for any of the evaluation questions and could not be used in conjunction with other concepts.

Table 7.2 summarizes the results and recommendations for each of the concepts in the Level 1 screening.

Table 7.2: No-build and Infrastructure Concepts Level 1 Screening Results

Infrastructure Improvement Concept	Congestion	Roadway Deficiencies	Summary of Results	Evaluation Data Source/ Notes
No-build	n/a	n/a	Carried forward	The No-build is the baseline condition and will be carried forward into the Level 2 and Level 3 screenings to compare benefits and impacts with other concepts.
Infrastructure Concepts				
Alternative Alignment				
New alignment alternative route	No	No	Eliminated	The addition of a new alignment would reduce the total demand on I-526 LCC EAST, but it would provide minimal improvement for delay and travel speed on the I-526 mainline. This concept will not result in an acceptable operational improvement of V/C and fails to improve roadway deficiencies on the I-526 mainline.
Mainline Improvements				
No-build + one lane each way	No	Yes	Eliminated	Adding two general-purpose lanes will not provide an acceptable operational improvement in the V/C, delay, and travel speed. Roadway deficiencies would be addressed with the addition of new lanes.
No-build + two lanes each way	Yes	Yes	Carried forward	Adding four general-purpose lanes will have operational improvement of congestion and improve roadway deficiencies on the I-526 mainline.
Interchange /Ramp Improvements				
Interchange Improvements	No	No	Carried forward as a supplemental option	Interchange improvements cannot provide an acceptable operational improvement on their own; however, if improvements are made to the I-526 mainline, subsequent changes to the interchanges will be required to accommodate the mainline improvements and the geometric deficiencies.
Dedicated truck ramp to port (additional facility)	No	No	Carried forward as a supplemental option	Adding a dedicated truck ramp would not improve congestion or address roadway deficiencies as a standalone option; however, this truck ramp could be added to any of the infrastructure improvements and potentially improve flow and connections to the Wando Welch Terminal, helping to achieve the project goal of improving access to port facilities.

7.2.1 Level 1 Screening Concepts Carried Forward

Concepts carried forward based on the CHATS Interim Regional TDM analysis include the No-build and the No-build plus two additional lanes in each direction. The addition of two lanes in each direction passed the 0.88 V/C ratio deemed necessary for achieving a desirable average daily operation for the corridor. This assumption of total capacity will be carried forward and design refined through subsequent levels of analysis.

Supplemental Options Carried Forward

Concepts that were moved forward as supplemental options cannot satisfy the project's purpose and need on their own and were eliminated as standalone concepts. Although eliminated as standalone concepts, these options may increase the effectiveness of other concepts if combined to create a more implementable solution. The discussion below highlights why these concepts were eliminated as a standalone concept but retained as supplemental options.

Interchange Improvements Concepts /Dedicated Truck Ramp to Port

Improvements to interchanges ramps would help to address geometric deficiencies on-ramps within the project study area. However, interchange improvements will not satisfy the purpose and need of improving I-526 mainline congestion and will be eliminated as standalone options. If improvements are made to the I-526 mainline, subsequent changes to the interchanges will be required. Thus, interchange improvement concepts will be moved forward to Level 3 as supplemental options.

7.2.2 Level 1 Screening Concepts Eliminated

During the Level 1 screening, concepts were evaluated on whether they met the project's purpose and need by considering improvements to congestion, travel time, and roadway deficiencies. The new alignment alternative route concept and the addition of a single travel lane in each direction did not provide enough capacity to improve congestion above a 0.88 V/C ratio at the corridor-wide level.

Two concepts were eliminated in the Level 1 screening:

- New location alignment route
- One additional general-purpose lane for each direction

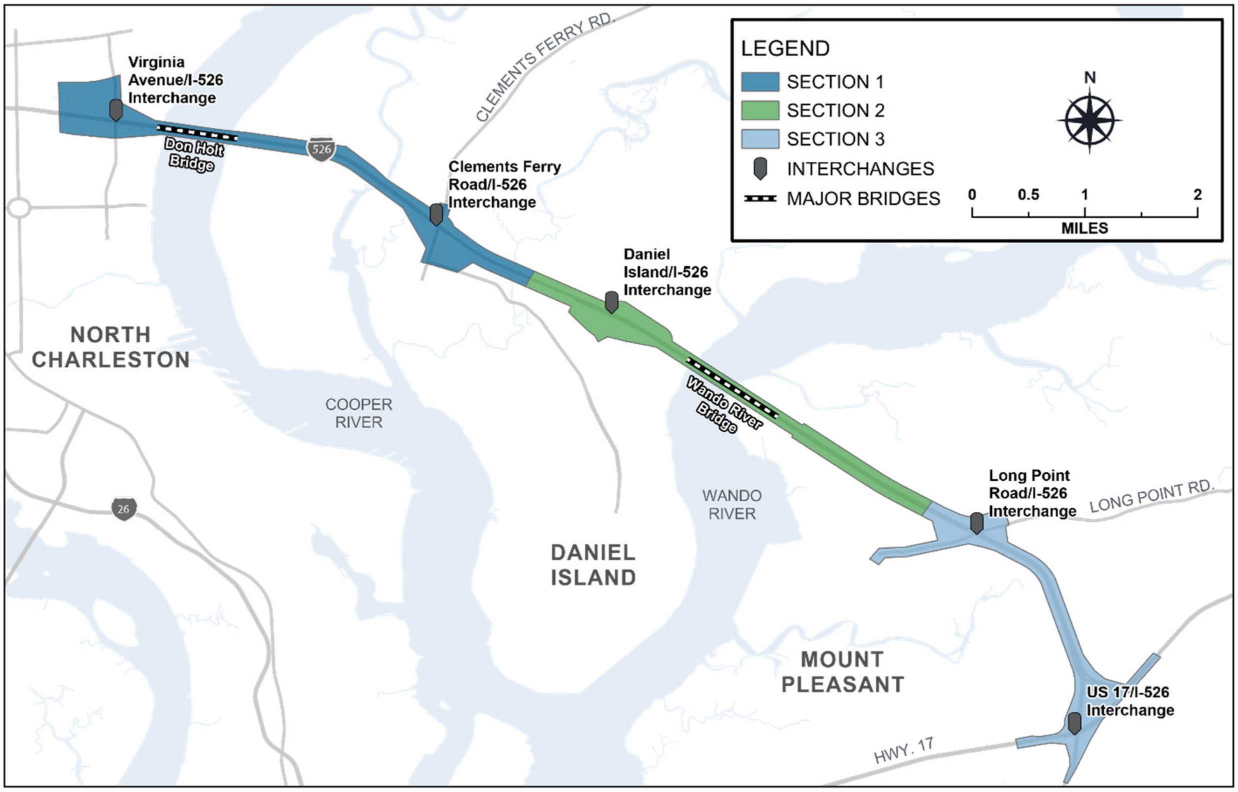
8.0 Development of Conceptual Design Options

Following the Level 1 screening, the mainline infrastructure improvement concepts carried forward were developed into conceptual design options to undergo the Level 2 screening. During the Level 1 screening, the CHATS Interim Regional TDM analysis indicated that a minimum of eight lanes would be required to achieve an acceptable level of congestion. Based on these results, the project team determined that all conceptual design options were to include two additional lanes in each direction (totaling eight through lanes). The existing interchanges retained their current configuration; however, ramps were modified to tie into the mainline options and meet current geometric design standards. The following describes how these design concepts were developed and analyzed.

8.1 Evaluations of the Study Corridor

The project team evaluated the corridor in three sections based on engineering and environmental constraints which are largely driven by the approaches to the Don Holt and Wando bridges. The three sections of the corridor do not represent standalone projects and were only used to streamline analysis of engineering and environmental screening criteria. Reducing the relative scale of the corridor into smaller sections allowed engineering experts to evaluate potential design and construction constraints more efficiently and at a localized level. The sections are shown in **Figure 8.1** and summarized below.

Figure 8.1: I-526 LCC EAST Corridor Sections



Section 1: Section 1 extends from Virginia Avenue in North Charleston, crosses the Don Holt bridge over the Cooper River, and ends at mile marker 23 near Nowell Creek on Daniel Island spanning approximately 3.9 miles. In addition to the I-526 mainline, features of this section include:

- The Don Holt bridge over the Cooper River
- Virginia Avenue/I-526 interchange
- Clements Ferry Road/I-526 interchange

Section 2: Section 2 extends from Nowell Creek at mile marker 23 on Daniel Island, crosses the Wando River, and terminates at mile marker 27 near Shoals Drive in Mount Pleasant spanning approximately 3.6 miles. In addition to the I-526 mainline, features of this section include:

- Wando bridges over the Wando River
- Daniel Island Interchange at Seven Farms Drive/River Landing Drive/I-526

Section 3: Section 3 extends from west of Long Point Road near Shoals Drive (mile marker 27) in Mount Pleasant and terminates at U.S. 17/Johnnie Dodds Boulevard spanning approximately 2.8 miles. In addition to the I-526 mainline, features of this section include:

- Long Point Road/I-526 interchange
- U.S. 17/I-526 interchange

8.2 Conceptual Design Options (Infrastructure Improvements)

The governing factors for developing the design concepts include additional mainline capacity and two major bridge structures—the Don Holt and Wando bridges. A concept to evaluate a higher bridge structure for the Don Holt bridge was also included as an option to improve freight connectivity to the North Charleston Port Terminal. A total of 21 infrastructure improvement concepts were developed for the three sections of the corridor. Adding mainline capacity to the I-526 corridor was evaluated using the following scenarios:

- Symmetrical – Adding capacity symmetrically to each side of the existing alignment
- North – Adding capacity to the north of the existing alignment
- South – Adding capacity to the south of the existing alignment
- Retain – Retaining the current bridge structure
- Replace – Replacing the current bridge structure

There are nine concept options for **Section 1**, including four that retain the Don Holt bridge (Options 1-A through 1-D) and five that replace the Don Holt bridge (Options 1-E through 1-I). **Section 2** consists of 10 concept options, including four that retain the Wando bridges (Options 2-A through 2-D) and six that replace the Wando bridges (Options 2-E through 2-J). **Section 3** consists of two options for widening (Options 3-A and 3-B). Section 3 consists primarily of roadway embankments with shorter, more traditional bridge structures that are more easily replaced or widened. ROW footprints were developed for each option, and those footprints were used to quantify potential environmental impacts associated with each. Design criteria for each alternative was developed according to the SCDOT *Roadway Design Manual*[27]. Each option is summarized in **Table 8.1** and is described in greater detail below, and a mapbook of each of the options can be found in Appendix A.

[27] https://www.scdot.org/business/pdf/roadway/2017_SCDOT_Roadway_Design_Manual.pdf

Table 8.1: Design Concept Options 1, 2, and 3

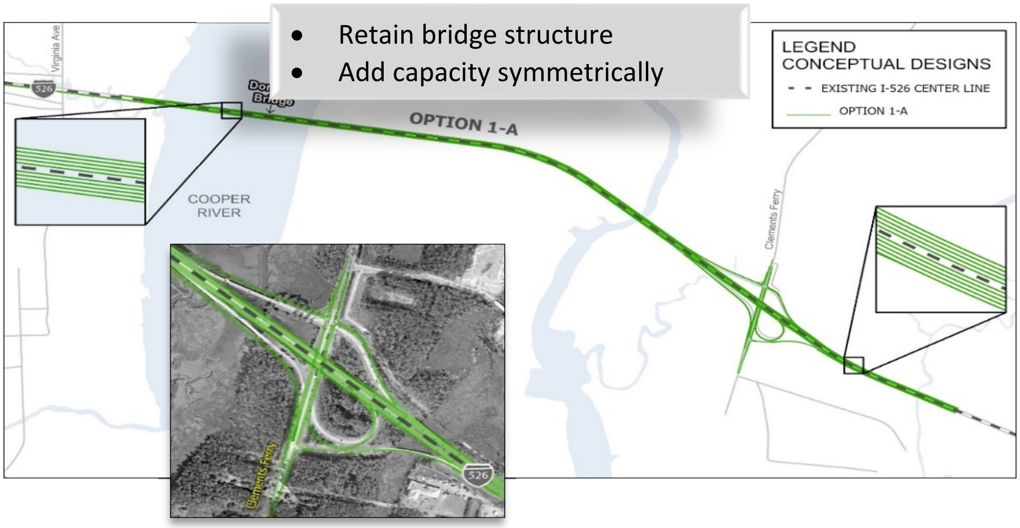
Design Option	Concept Details	Added Capacity Options
Section 1		
Option 1-A	Retain the Don Holt bridge and widen symmetrically for a total of eight lanes.	Retain/Symmetrical
Option 1-B	Retain Don Holt bridge and add two lanes in each direction by adding parallel bridge structures on each side, for a total of eight lanes.	Retain/Symmetrical
Option 1-C	Retain the Don Holt bridge and add a new four-lane bridge north of the existing bridge to carry westbound traffic. Existing Don Holt bridge retained to carry eastbound traffic, for a total of eight lanes.	Retain/North
Option 1-D	Retain the Don Holt bridge and add a new four-lane bridge south of the existing bridge to carry eastbound traffic. Existing Don Holt bridge retained to carry westbound traffic, for a total of eight lanes.	Retain/South
Option 1-E	Replace the Don Holt bridge (**increase navigational clearance by 31 feet**) by constructing two new four-lane bridges on each side, for a total of eight lanes.	Replace/Symmetrical
Option 1-F	Replace the Don Holt bridge (**increase navigation clearance by 31 feet**) by constructing a new eight-lane bridge north of the existing.	Replace/North
Option 1-G	Replace the Don Holt bridge (**increase navigation clearance by 31 feet**) by constructing a new eight-lane bridge south of the existing bridge.	Replace/South
Option 1-H	Construct a new, higher four-lane bridge north of existing and replace the Don Holt bridge (**increase navigation clearance by 31 feet**) in place, for a total of eight lanes.	Replace/North
Option 1-I	Construct a new/higher four-lane bridge south of the existing bridge and replace the Don Holt bridge (**increase navigation clearance by 31 feet**) in place, for a total of eight lanes.	Replace/South
Section 2		
Option 2-A	Retain the Wando bridge and add two lanes in each direction by adding parallel bridge structures on each side (outside), for a total of eight lanes.	Retain/Symmetrical
Option 2-B	Retain the Wando bridge and add two lanes in each direction by adding parallel bridge structures on each side (outside), for a total of eight lanes.	Retain/Symmetrical
Option 2-C	Retain the Wando bridge and add a new four-lane bridge north of the existing bridge to carry westbound traffic. The existing Wando bridge would be retained to carry eastbound traffic, for a total of eight lanes.	Retain/North
Option 2-D	Retain the Wando bridge and add a new four-lane bridge south of the existing bridge to carry westbound traffic. The existing Wando bridge would be retained to carry eastbound traffic, for a total of eight lanes.	Retain/South
Option 2-E	Replace the Wando bridge by constructing two new four-lane bridges on each side of the existing structures, for a total of eight lanes (single-stage with larger footprint).	Replace/Symmetrical
Option 2-F	Replace the Wando bridge by constructing a new eight-lane bridge north of the existing structures (single-stage construction).	Replace/North
Option 2-G	Replace the Wando bridge by constructing a new eight-lane bridge south of the existing structures (single-stage construction).	Replace/South
Option 2-H	Replace the Wando bridge and construct a new four-lane bridge to the north. The existing Wando bridge would be removed and a new four-lane bridge would be built within the footprint of the existing structure, for a total of eight lanes.	Replace/North
Option 2-I	Replace the Wando bridge and construct a new four-lane bridge to the south. The existing Wando bridge would be removed and a new four-lane bridge would be built within the footprint of the existing structure, for a total of eight lanes.	Replace/South
Option 2-J	Replace the Wando bridge by adding two-lane parallel bridge structures on each side of the existing structures. Remove the existing Wando bridge and widen the newly constructed bridges to four lanes each way, for a total of eight lanes (staged construction, but smaller footprint).	Replace/Symmetrical (Staged Construction)
Section 3		
Option 3-A	Widen both to the inside and outside using the existing median, for a total of eight lanes (smaller footprint).	Symmetrical
Option 3-B	Widen to the outside and retain existing median, for a total of eight lanes (larger footprint).	Symmetrical

8.2.1 Section 1 Preliminary Design Concepts

Concept Option 1-A

This concept would retain the Don Holt bridge and widen symmetrically to eight lanes. The existing structures west of Clements Ferry Road would be widened symmetrically to eight lanes. East of Clements Ferry Road, the widening would include a lane in each direction inside the median and a lane in each direction outside the existing facility.

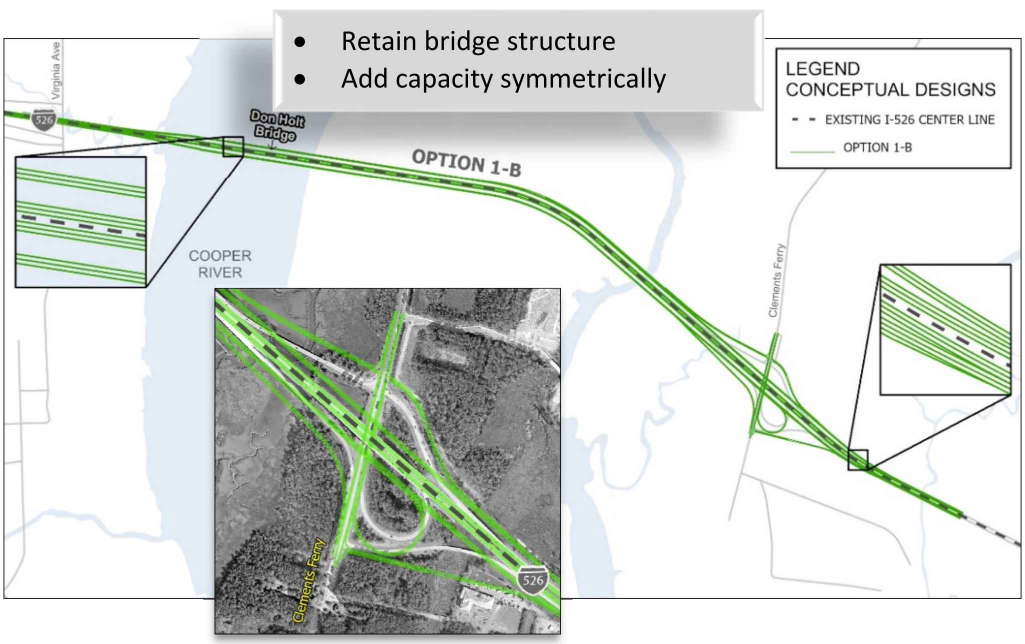
Figure 8.2: Conceptual Designs, Option 1-A



Concept Option 1-B

This concept would retain the Don Holt bridge and add two lanes in each direction by adding parallel bridge structures on each side. East of Clements Ferry Road, the widening would include two lanes in each direction outside of the existing facility, maintaining the existing median.

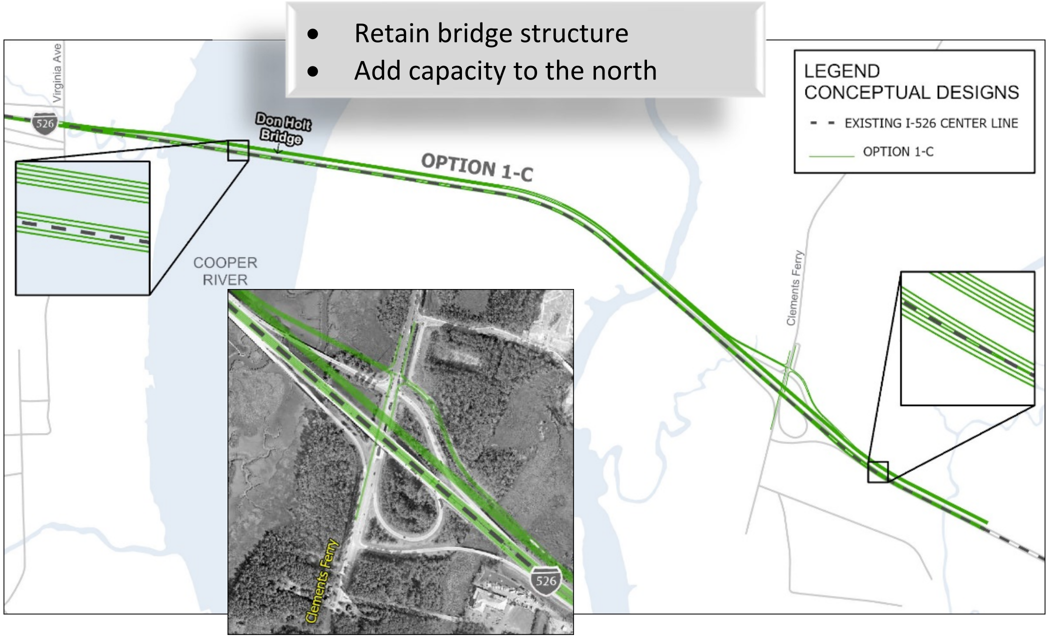
Figure 8.3: Conceptual Designs, Option 1-B



Concept Option 1-C

This concept would retain the Don Holt bridge and add a new four-lane bridge north of the existing bridge to carry westbound traffic. The existing Don Holt bridge would be retained to carry eastbound traffic. The four-lane section would be carried through the Clements Ferry interchange. The existing roadway facility would carry all eastbound traffic.

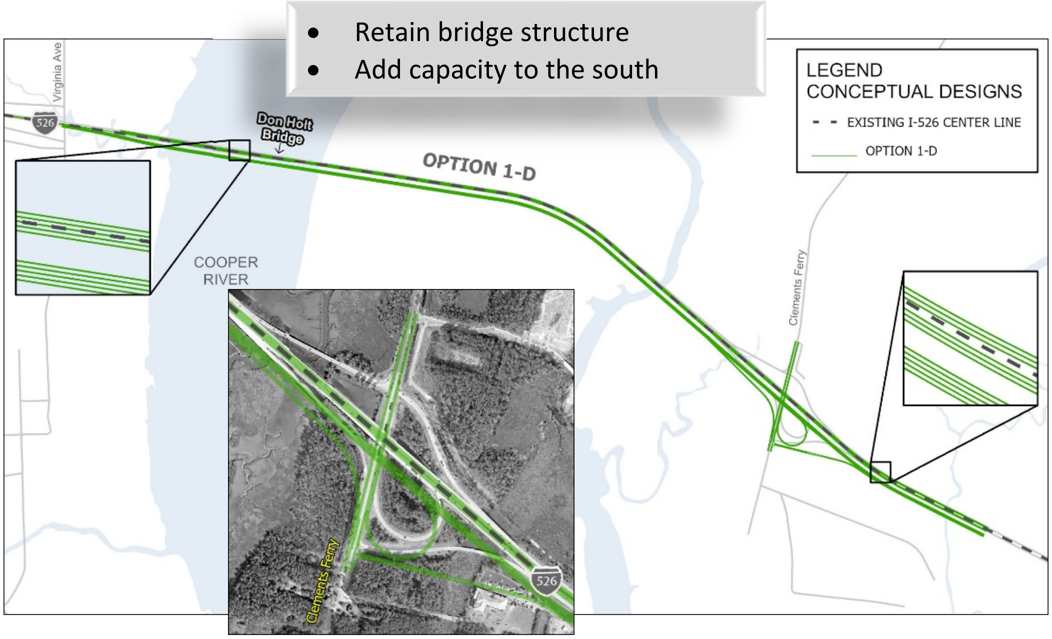
Figure 8.4: Conceptual Designs, Option 1-C



Concept Option 1-D

This concept would retain the Don Holt bridge and add a new four-lane bridge south of the existing bridge to carry eastbound traffic. The existing Don Holt bridge would be retained to carry westbound traffic. The four-lane section would be carried through the Clements Ferry interchange. The existing roadway facility would carry all westbound traffic.

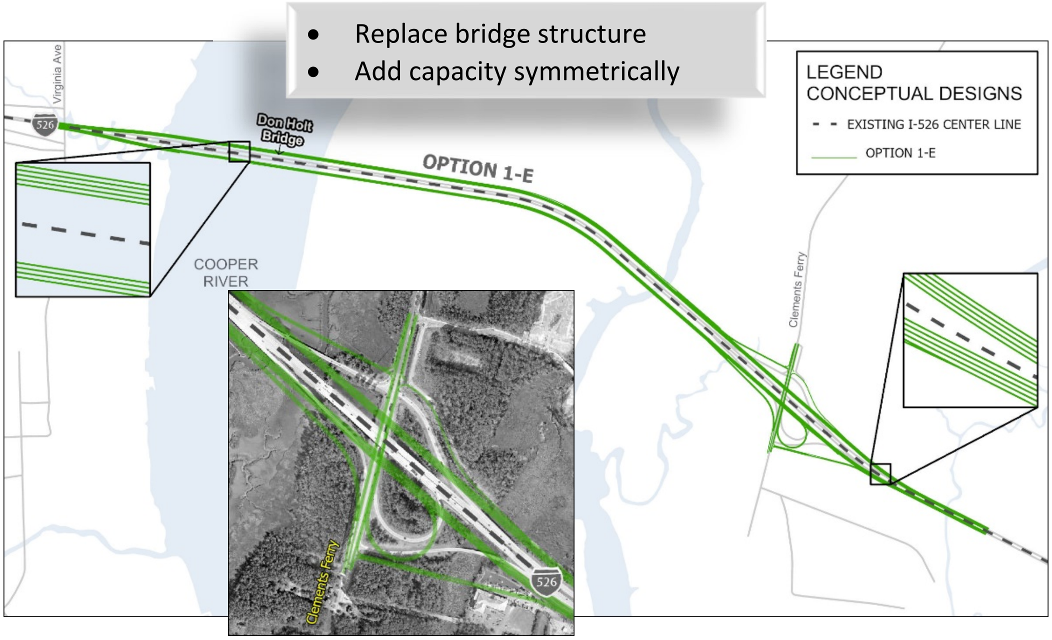
Figure 8.5: Conceptual Designs, Option 1-D



Concept Option 1-E

This concept would replace the Don Holt bridge by constructing two new four-lane bridges on each side. The new bridge structure would be set so that it would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge, making passage of the same sized vessel possible. The existing roadway would be widened to include two new travel lanes along the outside while maintaining the current median.

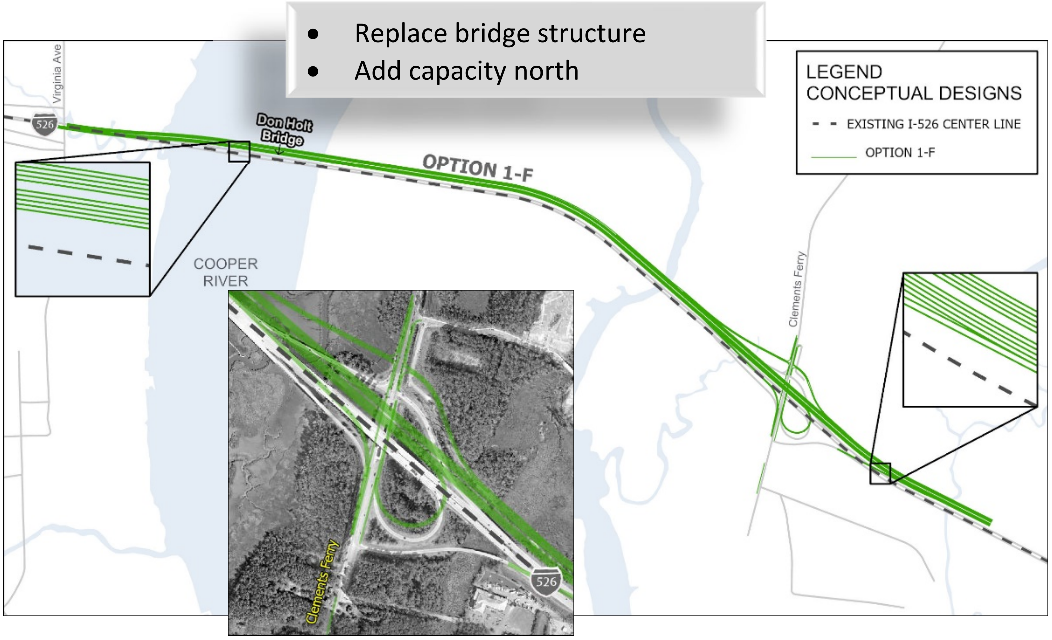
Figure 8.6: Conceptual Designs, Option 1-E



Concept Option 1-F

This concept would replace the Don Holt bridge by constructing a new eight-lane bridge north of the existing bridge. The new bridge structure would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge, making passage of the same size vessel possible. The new eight-lane section would continue along the north of the existing facility to the east of Clements Ferry Road interchange.

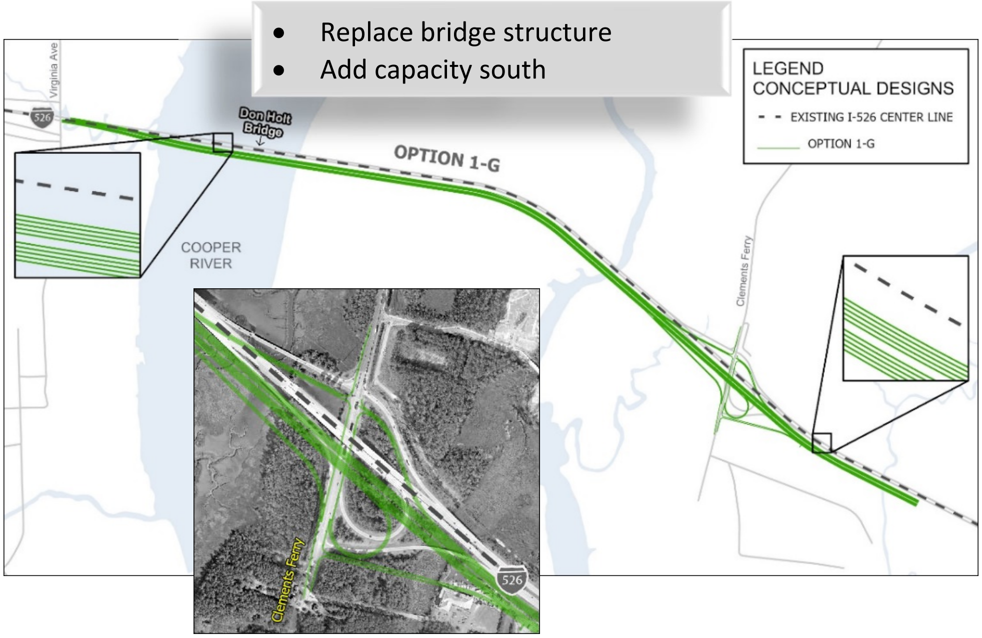
Figure 8.7: Conceptual Designs, Option 1-F



Concept Option 1-G

This concept would replace the Don Holt bridge by constructing a new eight-lane bridge south of the existing bridge. The new bridge structure would be set so that it would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge, making passage of the same size vessel possible. The new eight-lane section would continue along the south of the existing facility to the east of Clements Ferry Road interchange.

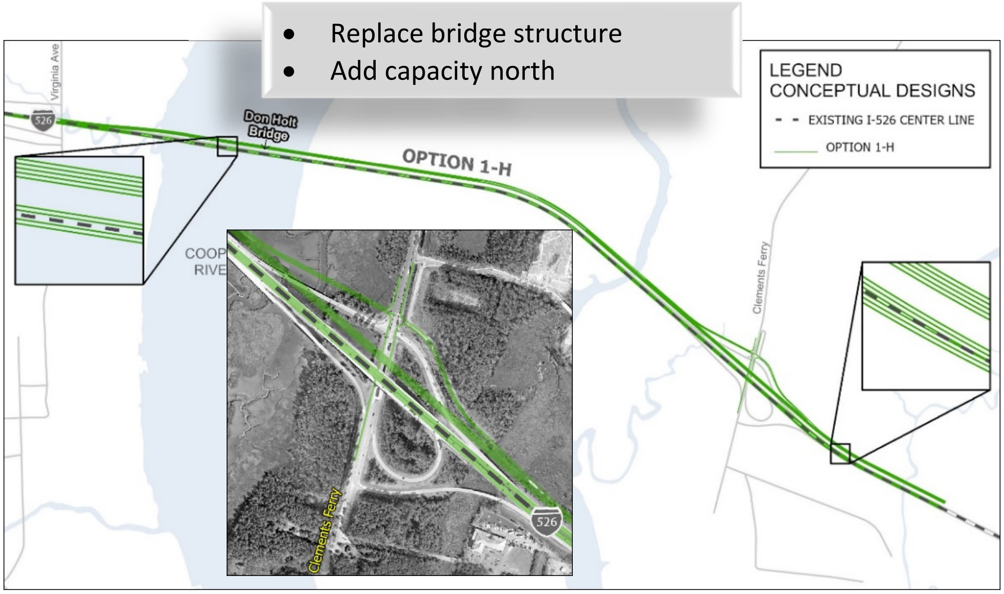
Figure 8.8: Conceptual Designs, Option 1-G



Concept Option 1-H

This concept would construct a new, higher four-lane bridge north of the existing one and replace the Don Holt bridge. The new bridge structure would be set so that it would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge, making passage of the same size vessel possible. Traffic would be moved to the new facility, the existing Don Holt bridge would be removed, and a new four-lane structure would be constructed where the current alignment is located. East of Clements Ferry Interchange, a new four-lane section would be constructed north of the existing facility and the existing westbound roadway would be widened to include two additional travel lanes for westbound traffic.

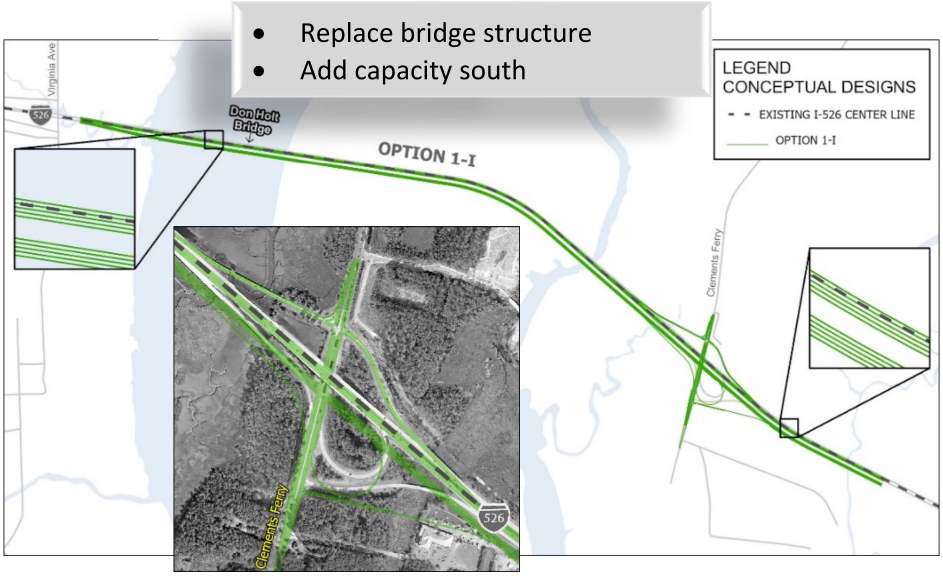
Figure 8.9: Conceptual Designs, Option 1-H



Concept Option 1-I

This concept would construct a new, higher four-lane bridge south of the existing bridge and replace the Don Holt bridge. The new bridge structure would be set so that it would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge, making passage of the same size vessel possible. Traffic would be moved to the new facility, the existing Don Holt bridge would be removed, and a new four-lane structure would be constructed where the current alignment is located. East of Clements Ferry Interchange, a new four-lane section would be constructed to the south of the existing facility and the existing eastbound roadway would be widened to include two additional travel lanes for eastbound traffic.

Figure 8.10: Conceptual Designs, Option 1-I

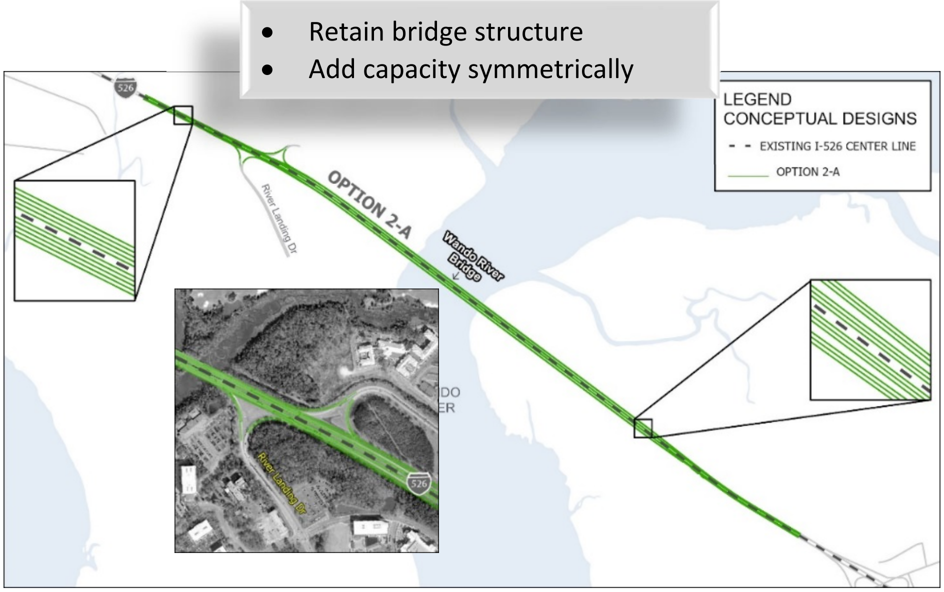


8.2.2 Section 2 Preliminary Design Concepts

Concept Option 2-A

This concept would retain the Wando bridge and add two lanes in each direction by adding parallel bridge structures on each side (outside) to maintain current navigational clearance. It would provide ROW to allow for future widenings. The new structures would be constructed at the same elevation of the Wando bridge.

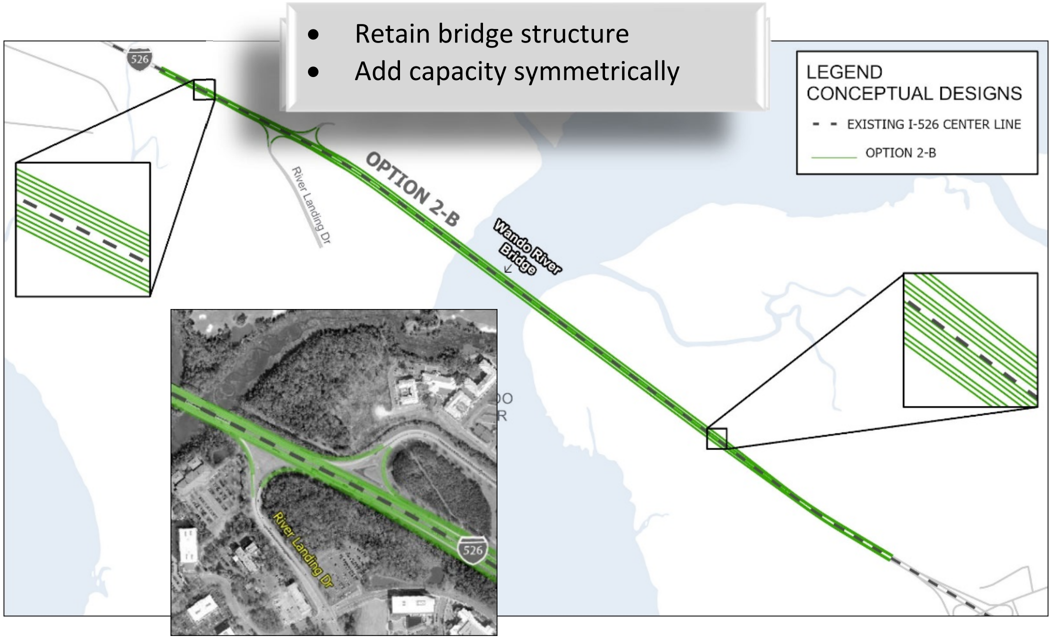
Figure 8.11: Conceptual Designs, Option 2-A



Concept Option 2-B

This concept would retain the Wando bridge and add two lanes in each direction by adding parallel bridge structures on each side (outside). It would provide ROW to allow for future widenings.

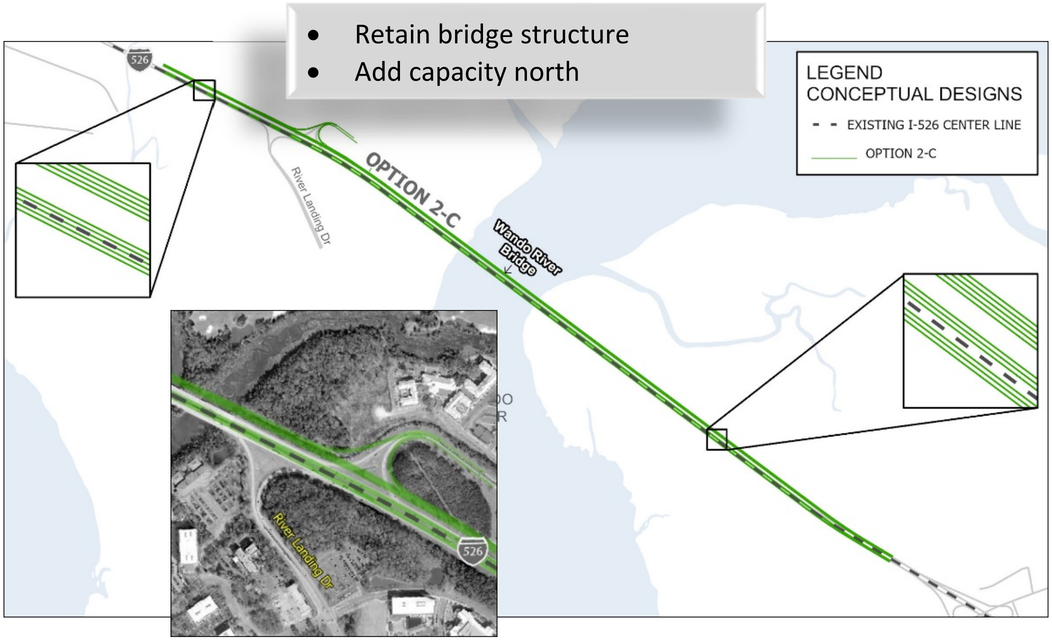
Figure 8.12: Conceptual Designs, Option 2-B



Concept Option 2-C

This concept would retain the Wando bridge and add a new four-lane bridge north of the existing bridge to carry westbound traffic. The existing Wando bridge would be retained to carry eastbound traffic. The existing facility would be used for the eastbound traffic.

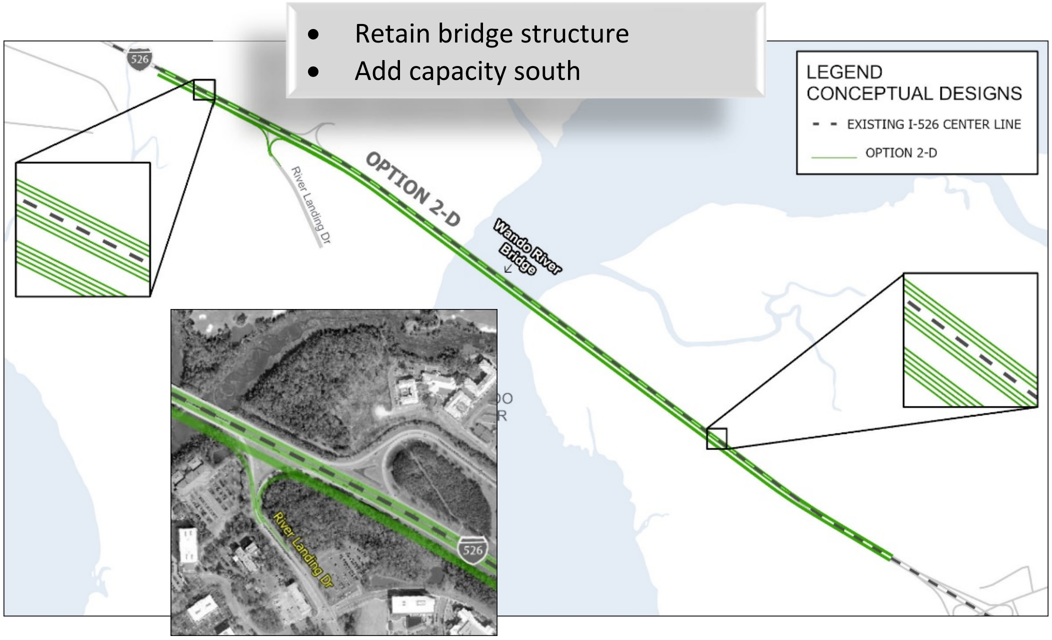
Figure 8.13: Conceptual Designs, Option 2-C



Concept Option 2-D

This concept would retain the Wando bridge and add a new four-lane bridge south of the existing bridge to carry westbound traffic. The existing Wando bridge would be retained to carry eastbound traffic.

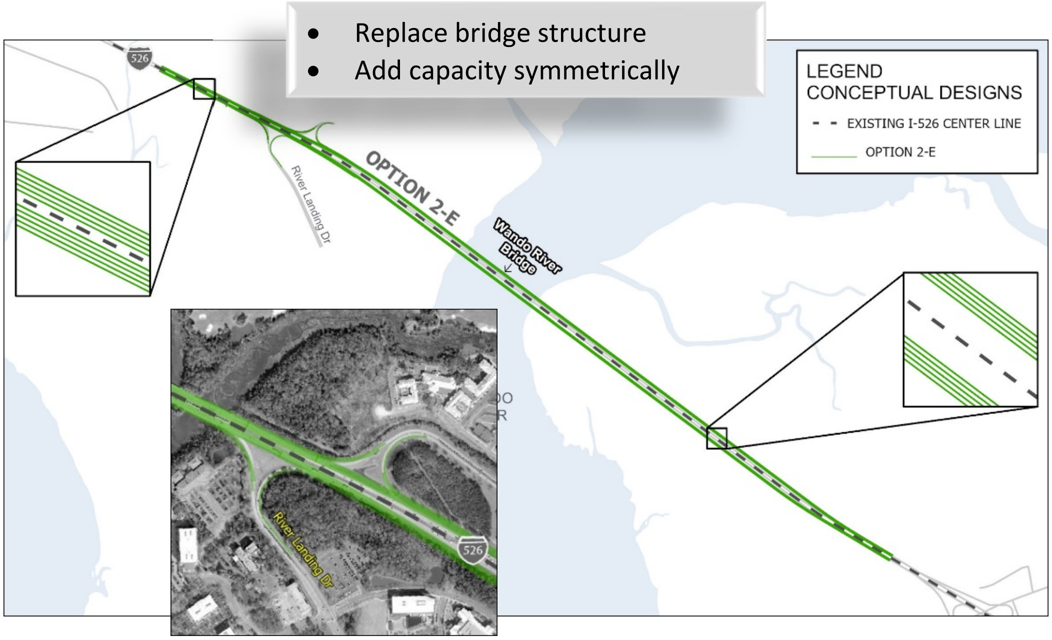
Figure 8.14: Conceptual Designs, Option 2-D



Concept Option 2-E

This concept would replace the Wando bridge by constructing two new four-lane bridges on each side of the existing structures (single-stage with larger footprint). The existing Wando bridge would then be removed.

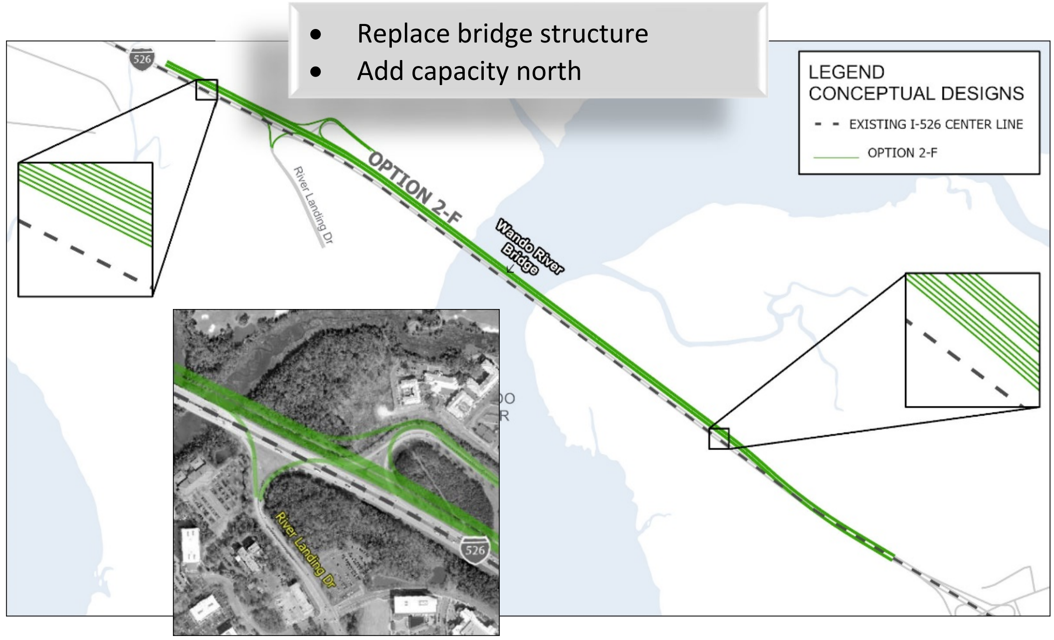
Figure 8.15: Conceptual Designs, Option 2-E



Concept Option 2-F

This concept would replace the Wando bridge by constructing a new eight-lane bridge north of the existing structures (single-stage construction). The existing Wando bridge would then be removed.

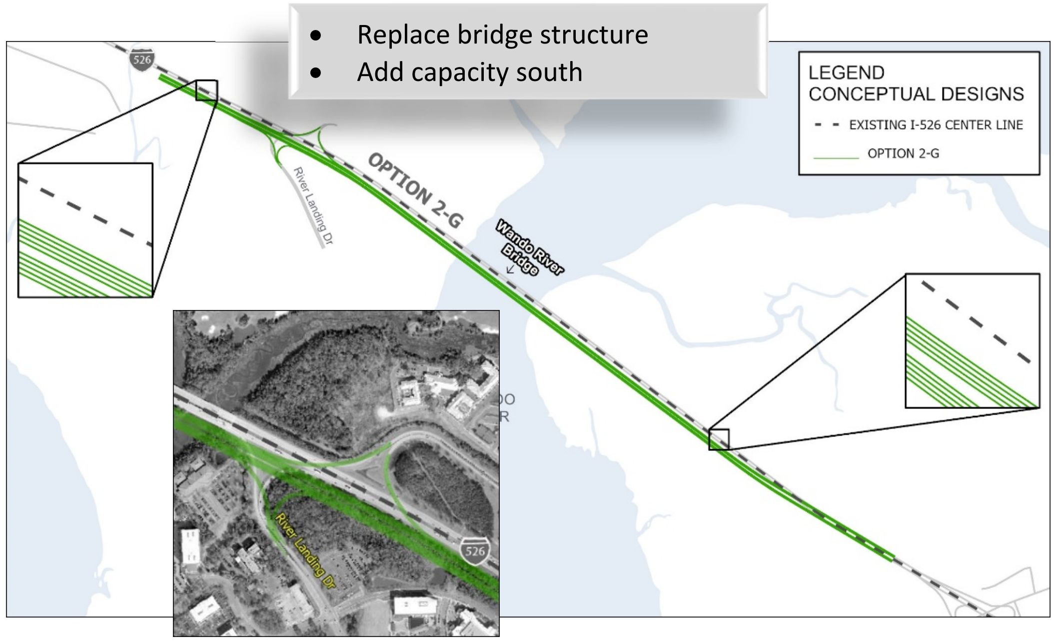
Figure 8.16: Conceptual Designs, Option 2-F



Concept Option 2-G

This concept would replace the Wando bridge by constructing a new eight-lane bridge south of the existing structures (single-stage construction). The existing Wando bridge would then be removed.

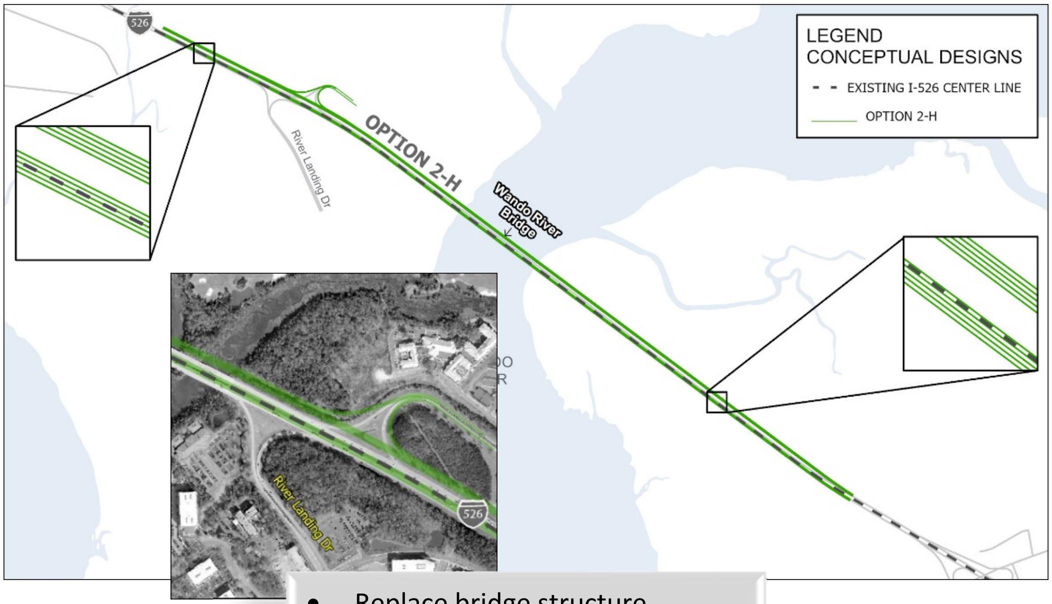
Figure 8.17: Conceptual Designs, Option 2-G



Concept Option 2-H

This concept would replace the Wando bridge and construct a new four-lane bridge to the north. The existing Wando bridge would be removed and a new four-lane bridge would be built within the footprint of the existing structure.

Figure 8.18: Conceptual Designs, Option 2-H



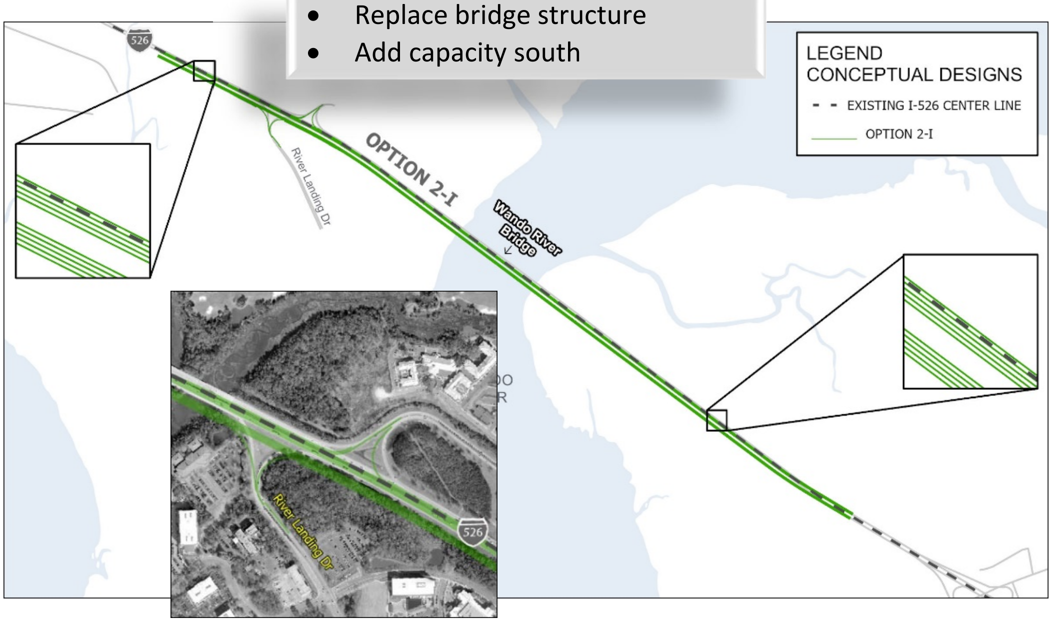
- Replace bridge structure
- Add capacity north

Concept Option 2-I

This concept would replace the Wando bridge and construct a new four-lane bridge to the south. The existing Wando bridge would be removed and a new four-lane bridge would be built within the footprint of the existing structure.

Figure 8.19: Conceptual Designs, Option 2-I

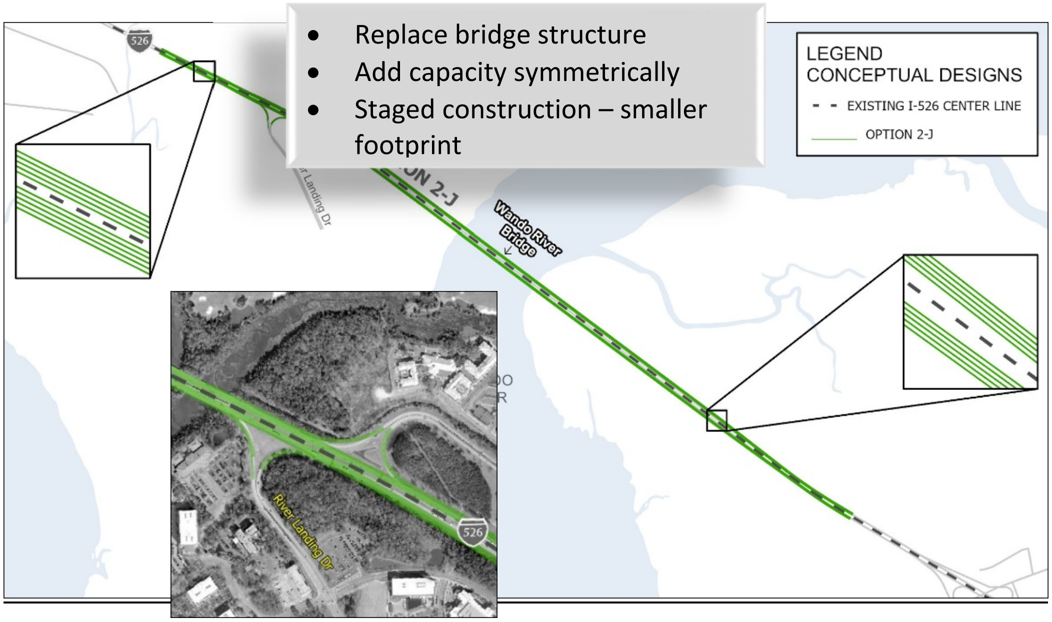
- Replace bridge structure
- Add capacity south



Concept Option 2-J

This concept would replace the Wando bridge by adding two-lane parallel bridge structures on each side of the existing structures. It would remove the existing Wando bridge and widen the newly constructed bridges to four lanes each way (staged construction but smaller footprint).

Figure 8.20: Conceptual Designs, Option 2-J

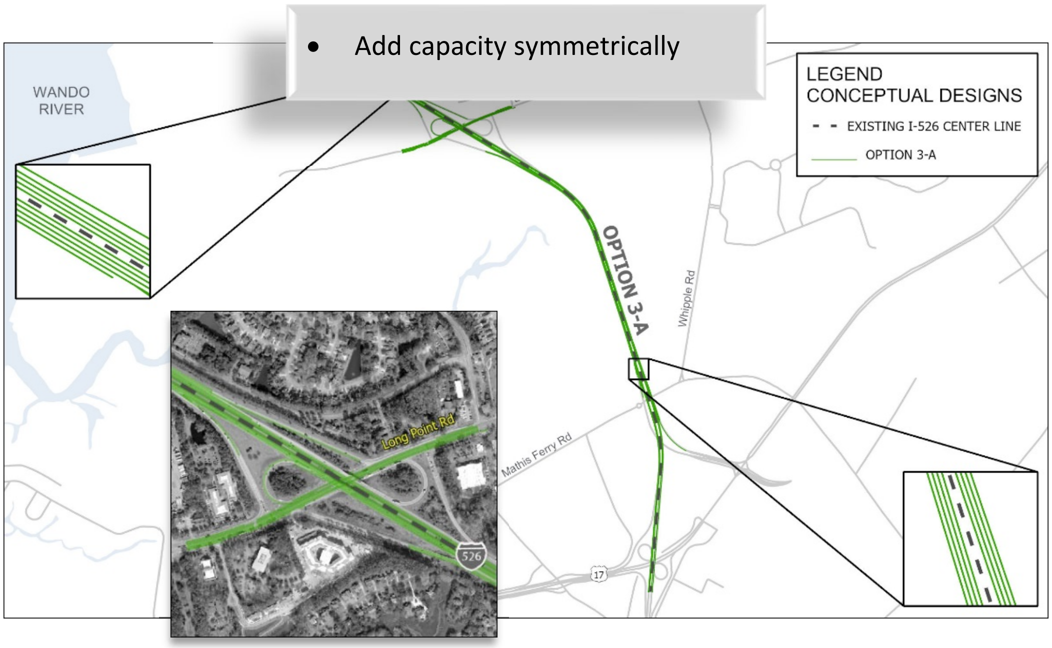


8.2.3 Section 3 Preliminary Design Concepts

Concept Option 3-A

This concept would widen both to the inside and outside using the existing median (smaller footprint).

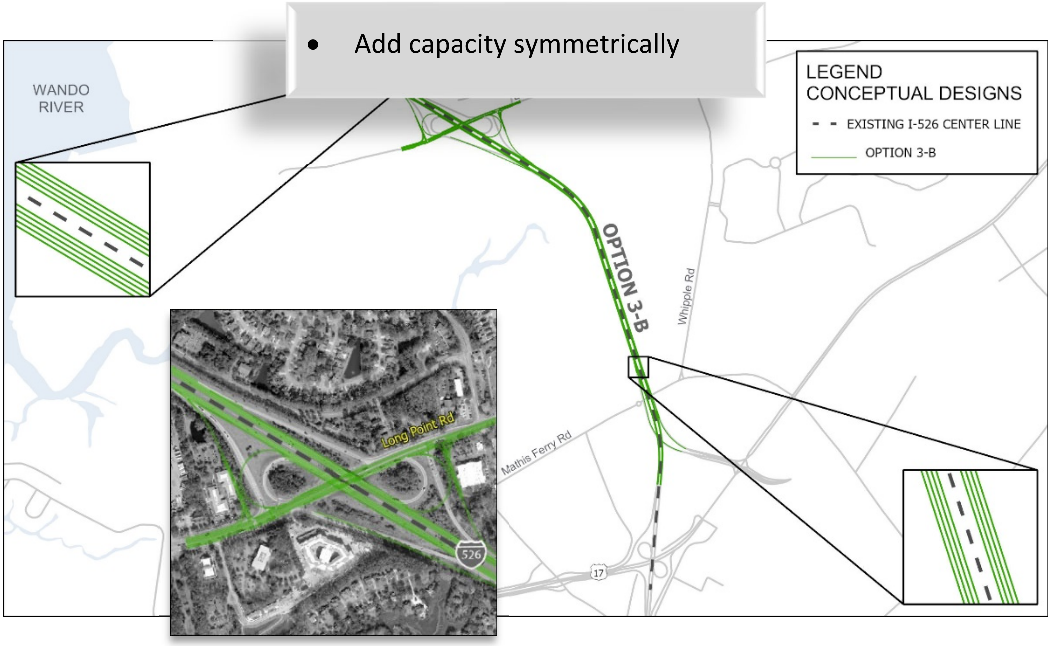
Figure 8.21: Conceptual Designs, Option 3-A



Concept Option 3-B

This concept would widen to the outside and retain the existing lanes (larger footprint).

Figure 8.22: Conceptual Designs, Option 3-B



9.0 LEVEL 2 SCREENING PROCESS

9.1 LEVEL 2 SCREENING CRITERIA

The Level 2 screening of the conceptual design options determines which options have the highest potential to meet the purpose and need of the project. In addition, the Level 2 screening also evaluates engineering and the environmental impacts associated with each of the conceptual design options. The screening criteria for Level 2 is divided into four major categories:

- **Purpose and Need** (quantitative based on additional traffic analysis)
- **Engineering** (qualitative based on engineering evaluation)
- **Natural Resources** (quantitative based on potential impacts to resources)
- **Community and the Built Environment** (quantitative based on potential impacts)

The Level 2 evaluation results are based on the LOS grade for the purpose and need while the remaining categories are scored on a scale with a minimum score of 1 to a maximum of 5 for each category. The lowest score identified concepts with the highest potential to meet the project's purpose and need, considering natural and human environment impacts.

Within this section is the detailed methodology for the screening within these categories and the recommendations based on the results of the analysis. The criteria are used both for the elimination of concepts and to inform decision-makers of relative impacts to guide further refinement of concepts to progress into additional phases of analysis.

Because reducing congestion and improving travel time reliability are part of the purpose of the project, traffic performance was the principal eliminating factor in the Level 2 screening. Options that were identified as having a LOS F were removed from further consideration. The three remaining major categories were divided into five sub-categories. Each of the sub-categories was taken into equal consideration (scoring was not weighted), because of their importance to the project. **Table 9.1** describes each of the four categories, the screening criteria, key measures, and scoring parameters.

Table 9.1: Level 2 Four Screening Categories and Methods

Category	Criteria	Key Measures	Quantification for Screening
Purpose and Need	Highway Capacity Software (HCS) analysis	Traffic performance (LOS)	LOS
Engineering (Design and Constructability)	**Design**		
	Compatible with local plans and projects	Connections to existing roadway improvement projects	Scored (1 to 5)
	Improve seismic resiliency	Bridge replacement/new bridge structures/modification to existing bridges	Scored (1 to 5)
	Ports & transit access	Improves access to ports and transit facilities	Scored (1 to 5)
	Constructability		
	Constructability	Potential construction & staging issues, traffic disruption, construction complexity	Scored (1 to 5)
Natural Resources	Aquatic Resources	Acreage of impact	Scored (1 to 5)
Community and Built Environment (Relocation and Parks)	Residential/business and recreational facilities	Residential/business and recreational facilities impacted by the ROW footprint	Scored (1 to 5)
	Parks (4f)	Impacts on park facilities	Scored (Parks Impacted)

9.1.1 Purpose and Need Screening

Each of the conceptual design options was evaluated using the Highway Capacity Software (HCS) by segment. HCS is the tool used in applying the HCM analysis methods. This provides a more sophisticated analysis of the refined roadway configurations under peak time conditions, building upon the average daily, corridor-wide analysis conducted during Level 1 screening.

HCM enables the analyst to assess the existing conditions of a given location quickly, confirm "hot spot" locations, and realize the cause and effects of modified geometry and operational schemes.

Each of the conceptual design options was evaluated using HCS. The mainline LOS was determined for each conceptual design option and a grade was assigned. The LOS specifies traffic flow and is graded A through F (**Table 9.2**). A LOS of A represents free flow, whereas a LOS of F equates to sitting in traffic with little movement through the corridor.

Table 9.2: Traffic Congestion Grade Matrix for Purpose and Need

Key Measures (2050 Peak Hour Performance)
LOS A
LOS B
LOS C
LOS D
LOS E
LOS F

9.1.2 Engineering Evaluation Criteria

Engineering Design

The ability of a conceptual design option to improve the roadway infrastructure to accommodate increased traffic volumes, reduce congestion-related incidents, and enhance mobility for people and goods is accounted for in the purpose and need criteria. All infrastructure improvement options will accommodate future transportation technologies. However, there are additional engineering design components that align with the project goals and were deemed appropriate for the Level 2 screening. The additional engineering design components are identified below:

- **Consistent with local plans and projects –** Is the conceptual design consistent with local land use plans as well as existing and committed infrastructure improvement projects?
- **Improve seismic resiliency –** Does the conceptual design increase seismic resiliency of the corridor?
- **Improve connections with area ports and transit –** Does the conceptual design improve highway and waterway access to ports and transit facilities?

Each of the conceptual design options was evaluated by the project team using the criteria below, and each option was scored on a scale of 1 (most desirable) to 5 (least desirable). Each member of the project team provided a score for each of the sub-categories outlined above, these scores were then averaged for a combined overall engineering design score.

Constructability

The conceptual designs have been developed using the SCDOT *Roadway Design Manual 2017*. Each option has been designed to improve the roadway infrastructure, correct roadway geometric deficiencies, and increase the number of lanes (eight lanes total). The project team, which included roadway, traffic, construction, and bridge engineers, evaluated each conceptual design option based on the constructability criteria outlined below:

- **Constructability –** Issues with staging and construction, along with disruption to traffic flow and complexity (high, medium, low).

Areas included in the engineering evaluation also overlapped with some of the project goals outlined in the purpose and need. Each of the conceptual design options was evaluated by the project team using the criteria below, and each option was scored on a scale of 1 (most desirable) to 5 (least desirable). Level 2 Scoring details are outlined in **Appendix C**.

Table 9.3: Key Measures and Scoring Matrix for Engineering

Key Measures	Score	Comments
Design		
Consistency with local plans and projects		
High	1	Ties into existing and proposed projects along the corridor
Medium	3	Potential issues tying into existing and proposed corridor projects
Low	5	Significant impacts to existing and proposed corridor projects
Improves seismic resiliency		
High	1	Replaces all bridge structures
Medium	3	Retains the existing bridges and builds additional bridges for additional capacity
Low	5	No improvements to resiliency
Improves connections with area ports and transit system		
High	1	Improves connections
Medium	3	Provides some improvements
Low	5	Does not improve connection with areas ports and transit facilities
Constructability		
Low	1	Minor issues with staging, construction, traffic disruption, and complexity
Medium	3	Moderate issues with staging construction, traffic disruption, and complexity
High	5	Complex issues with staging construction, traffic disruption, and complexity

9.1.3 Natural Resources Screening

A desktop environmental review and preliminary field studies identified key issues, natural resource concerns, and potential constraints to assist with the PEL study decision-making. **Table 9.4** shows the natural resources identified within the study area. The table also identifies whether the resource was used as an elimination criterion.

Table 9.4: Natural Resources Screening

Resource	Screening Criterion	Comments
Air Quality – South Carolina Department of Health and Environmental Control	No	The study area is within attainment of air quality standards.
Water resources	No	All infrastructure improvement options would impact resources similarly.
Floodplains	No	All infrastructure improvement options would impact resources similarly.
Aquatic Habitats/Wetlands – U.S. Army Corps of Engineers	**Yes**	**Data was quantifiable.** The total acreage of aquatic resources identified within the conceptual design ROW footprint, including but not limited to wetlands, streams, tidal creeks, ponds, and marshes. Open water that would be bridged was not included in the quantification.

Resource	Screening Criterion	Comments
Protected species/critical habitat – United States Fish and Wildlife Service	No	All infrastructure improvement options would impact resources similarly
Coastal Zone – South Carolina Department of Health and Environmental Control Ocean and Coastal Resource Management	No	All infrastructure improvement options would impact resources similarly

The difference between the highest and lowest values was identified and a scoring range was developed. A score of 1 would have the lower impact on the resource, and a score of 5 would have the higher impact. The total score for each option was used in the screening process.

9.1.4 Community and Built Environment Screening

Desktop surveys were also completed to obtain residential, business, parks, and cultural and historic resources. **Table 9.5** shows the human and environmental resources identified within the study area. The table also determines if the resource was used in the elimination screening.

Table 9.5: Community and Built Environment Resources

Resource	Screening Criterion	Comments
Environmental Justice	No	All infrastructure improvement options would impact resources similarly
Relocations (Residential/Businesses)	**Yes**	**Data was quantifiable. Inventory of residential and business structures were identified and quantified to the number of units impacted for each design options.**
Hazardous Materials – South Carolina Department of Health and Environmental Control	No	All infrastructure improvement options would impact resources similarly
Farmland – U.S. Department of Agriculture	No	All infrastructure improvement options would impact resources similarly
Cultural and Historic Resources	**Yes**	**There is one eligible resource (Long Point Schoolhouse) and two cemeteries identified within the project study area**
Parks (4f)	**Yes**	**Data was quantifiable.** The number of impacted properties was quantified for each conceptual design option.

Resources that would provide quantifiable data for the screening include:

- **Relocations –**The number of units impacted for each design option was quantified during an inventory of residential and business structures.

- **Parks –** Because of the proximity to these facilities, shifts in the current alignment can impact these properties differently. The number of impacted properties was quantified for each conceptual design option.

- **Cultural Resources –** There is one historic resource, the Long Point Schoolhouse, located on Long Point Road north of I-526. There are also two cemeteries, New Hope Church Cemetery and an African American cemetery. These cemeteries are not historic but are protected. All the infrastructure improvement concepts would avoid the New Hope Church Cemetery. Because of its proximity to I-526, the African American cemetery was evaluated for each of the design concept options. If the roadway facility did not impact the site, the option moved forward. Options that slightly touched the site were reviewed with design engineers to determine if the site could be avoided. If the site could be avoided, it was noted for that option and moved forward. If the roadway facility impacted the majority of the site, it was eliminated from further consideration.

Impacts associated with relocations were counted. The difference between the highest and lowest values was identified, and a scoring range was developed. A score of 1 would have a lower number of relocations, and a score of 5 would have a higher number of relocations. The total score for each option was used in the screening process. Parks impacted by the ROW of conceptual design options were also counted; however, these ranged between 0 to 2. Since no option had more than 2 park impacts, the impact number was used for the score rather than a 1 to 5 range. Scores for each option can be found in **Appendix C**.

9.2 Level 2 Screening Results

A multi-disciplinary team comprised of engineers (roadway design, bridge, construction, and traffic) and planners (transportation and environmental), generated and evaluated the scores for each option. This team approach determined the least favorable options to move forward, and those conceptual design options were removed from further consideration. The following provides the analysis and detailed explanations to support why conceptual design options would or would not be carried forward for further analysis.

9.2.1 Purpose and Need Screening Results

All 21 design options were screened and scored on how well they performed from a traffic perspective. The critical evaluation criteria for the I-526 mainline conceptual design options was traffic performance with LOS as the performance measure. A result of LOS E was considered acceptable because the output reflects the performance of an individual segment and not the operation of the entire corridor. A result of LOS F was considered unacceptable because the breakdown of that individual segment would cause a breakdown of traffic flow in other adjacent segments of the mainline. Six design options performed at LOS F and are eliminated in Level 2.

The poor performance of these six design options is the result of the design and lane configurations of the infrastructure improvement concepts. Four options (Options 1-A, 1-B, 2-A, and 2-B) retain the existing bridge structure and construct two-lane parallel bridges on either side. This configuration would cause a split in the traffic, reducing the potential effectiveness of additional capacity. Similarly, Options 2-C and 2-D also retain the existing bridge and widen to the north or the south. This configuration would improve the new structure's operation but would split traffic on the existing facility.

The traffic performance results for each conceptual design option are shown in **Table 9.6**.

Table 9.6: HCM Scoring Results for Purpose and Need Analysis

Design Option	Capacity Option	Performance (2050 Peak Hour Performance)
Section - 1		
1-A	Retain/Symmetrical	LOS F
1-B	Retain/Symmetrical	LOS F
1-C	Retain/North	LOS E
1-D	Retain/South	LOS E
1-E	Replace/Symmetrical	LOS E
1-F	Replace/North	LOS E
1-G	Replace/South	LOS E
1-H	Replace/North	LOS E
1-I	Replace/South	LOS E
Section - 2		
2-A	Retain/Symmetrical	LOS F
2-B	Retain/Symmetrical	LOS F
2-C	Retain/North	LOS F
2-D	Retain/South	LOS F
2-E	Replace/Symmetrical	LOS E
2-F	Replace/North	LOS E
2-G	Replace/South	LOS E
2-H	Replace/North	LOS E
2-I	Replace/South	LOS E
2-J+	Replace/Symmetrical	LOS E
Section - 3		
3-A	Symmetrical	LOS D
3-B	Symmetrical	LOS D
+ Staged construction		

A review of the results, specifically for the purpose and need, determined that those options with a grade of F would be removed from further consideration. Because reducing congestion and improving travel time reliability is the project's purpose, design options with a failing LOS would not be reasonable. These design options will be removed from further analysis and are shown in **Table 9.7** and discussed in further detail below.

Table 9.7: Removed Design Options

Design Option	Capacity Option	Comments
1-A	Retain/Symmetrical	LOS F
1-B	Retain/Symmetrical	LOS F
2-A	Retain/Symmetrical	LOS F
2-B	Retain/Symmetrical	LOS F
2-C	Retain/North	LOS F
2-D	Retain/South	LOS F

9.2.2 Engineering, Natural Resource, and Community and Built Environment Resources Screening Results

The next step evaluates the infrastructure improvement concepts for engineering, natural resource, and the community and built environment considerations. The results of this analysis are provided in **Table 9.8**.

Table 9.8: Level 2 Project Goals, Engineering, and Impacts Scoring Results

Design Option	Capacity Option	Engineering		Natural Resource	Community and Built Environment		Total Score
		Constructability	Design		Relocations	Park (4f)	
Section 1							
1-A	Retain Symmetrical	3.8	3.3	1.0	3.0	1.0	12.1
1-B	Retain Symmetrical	1.4	2.9	4.0	4.0	1.0	13.3
1-C	Retain North	3.0	3.5	3.0	1.0	1.0	11.5
1-D	Retain South	3.0	3.5	2.0	4.0	1.0	13.5
1-E	Replace Symmetrical	3.4	2.1	5.0	4.0	1.0	15.5
1-F	Replace North	5.0	2.6	2.0	1.0	1.0	11.6
1-G	Replace South	5.0	2.6	1.0	5.0	1.0	14.6
1-H	Replace North	3.0	3.5	3.0	1.0	1.0	11.5
1-I	Replace South	3.0	2.9	2.0	4.0	1.0	12.9
Section 2							
2-A	Retain Symmetrical	1.8	2.9	4.0	1.0	2.0	11.7
2-B	Retain Symmetrical	1.8	2.9	4.0	1.0	2.0	11.7
2-C	Retain North	3.0	3.0	5.0	1.0	2.0	14.0
2-D	Retain South	3.0	3.0	4.0	2.0	2.0	14.0
2-E	Replace Symmetrical	2.2	1.5	5.0	4.0	2.0	14.7
2-F	Replace North	1.8	2.7	3.0	4.0	1.0	12.5
2-G	Replace South	1.8	2.7	1.0	5.0	1.0	11.5
2-H	Replace North	3.0	3.0	5.0	1.0	2.0	14.0
2-I	Replace South	3.0	2.3	4.0	2.0	2.0	13.3
2-J+	Replace Symmetrical	3.0	1.7	4.0	1.0	2.0	11.7
Section 3							
3-A	Symmetrical	3.0	2.3	1.0	1.0	0.0	7.3
3-B	Symmetrical	1.8	2.7	2.0	5.0	0.0	11.5

+ Staged construction

As discussed previously, the criteria and scoring metrics used for screening the conceptual design options are not the final factors in determining if an option is to be eliminated or moved forward. The goal of the Level 2 screening is to ensure that higher-performing conceptual design options are moved forward; however, to also identify those options that would have higher impacts on the natural and human environment. Options 1-E and 2-E have the highest number of impacts on natural resources; however, these options performed well from an engineering design and constructability perspective. While the number of impacts to natural resources are higher compared to other options, the differences were minimal and are not significant enough to eliminate these options solely on natural resource impacts. Therefore, the project team moved Options 1-E and 2-E forward to Level 3 for further analysis.

Option 2-G meets the purpose and need from an operational perspective and had a low overall score in the other evaluation criteria; however, Option 2-G impacts a cultural resource site (African-American cemetery) along the corridor. Therefore, Option 2-G was eliminated from further evaluation.

Options 3-A and 3-B were evaluated to determine which option would move forward. This analysis was based on the five sub-categories (excluding the purpose and need criteria). Option 3-B has the largest footprint when compared to Option 3-A. Option 3-B scored well for constructability; however, it has higher potential impacts on natural resources and the community and built environment. Option 3-B was removed from further consideration because of these factors. A detailed discussion of why this option has been removed is included later in this document.

9.2.3 Remaining Design Options Further Evaluated

Four conceptual design options in Section 1 have an equivalent option in Section 2 (Options 1-E and 2-E, 1-F and 2-F, 1-H and 2-H, and 1-I and 2-I) to pair with. The four remaining options (Options 1-C, 1-D, 1-G, and 2-J) do not have an equivalent conceptual design option in the adjacent section.

From a constructability standpoint, pairing options with their equivalent counterpart between sections 1 and 2 is ideal because it would require fewer transitions between sections. Of the remaining options without an equivalent counterpart, Option 1-C, Option 1-D, and 2-J can be paired with some of the remaining options. These options will be carried forward.

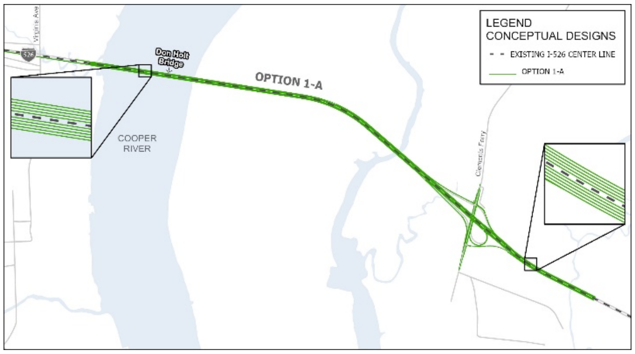
Option 1-G completely shifts the alignment south with a new 8-lane facility. This option does not pair well with the remaining options in Section 2 due to the length of transition required to shift the alignment across the existing facility and tie in to the remaining options. Crossing the existing alignment would also create constructability issues with staging traffic during construction and accomplishing the cross tie-in. All options that have been removed are discussed in further detail in Section 10.4 (Level 2 Conceptual design Options Eliminated).

For Section 3, Option 3-A will move forward.

9.3 LEVEL 2 SCREENING – CONCEPTUAL DESIGN OPTIONS ELIMINATED

Concept Option 1-A

Figure 9.1: Conceptual Designs Removed, Option 1-A



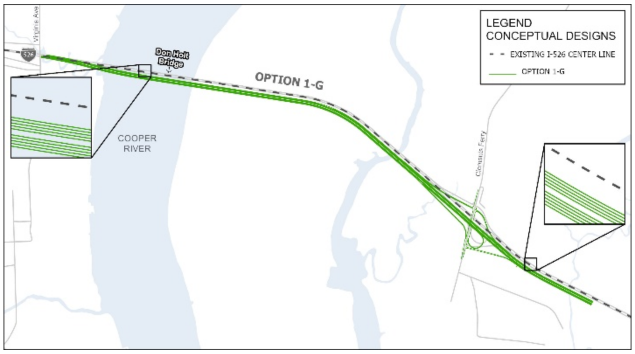
Option 1-A was removed from further consideration because of low traffic performance (LOS F). This failing level of service can be attributed to the need to use two-lane parallel bridge superstructures to widen the existing truss. The concept was developed to retain the Don Holt bridge and split both the eastbound and westbound traffic across the truss, resulting in poor traffic performance. This split of traffic created new weaves in both travel directions closely located to adjacent ramps. The weaves in the westbound travel direction fail operationally based on traffic demand and close vicinity to ramps. The threshold of capacity is exceeded on the existing Don Holt bridge (inner freeway segment of the westbound split). The excess demand along with the existing grade causes operational failure.

Concept Option 1-B

Option 1-B was removed from further consideration because of low traffic performance (LOS F). This failing LOS can be attributed to the use of two-lane parallel bridge structures. The concept was developed to retain the Don Holt bridge and split both the eastbound and westbound traffic across the bridge structure. This split of traffic creates new weaves closely located to adjacent ramps. One weave for this alternative is located to the east of Clements Ferry Road. This location requires all westbound Clements Ferry Road traffic to use the new bridge (outside freeway segment of the westbound split). The capacity threshold is exceeded once the Clements Ferry Road westbound on-ramp volume accesses the outside split and experiences operational failure through to Virginia Avenue on freeway segments and in weave locations.

Concept Option 1-G

Figure 9.2: Conceptual Designs Removed, Option 1-G

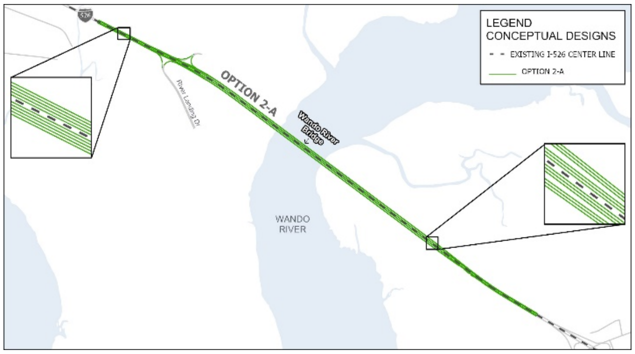


Option 1-G had one of the highest overall scores. It did not score well on constructability and community impacts. This option had a higher number of relocations than the other options in Section 1. This option would tie into Option 2-G, which impacts an African American Cemetery and was subsequently eliminated. This left Option 1-G without an equivalent alignment as this option does not pair well with the remaining options in Section 2 due to the length of transition required to shift the alignment across the existing facility and tie in to the remaining options.

Concept Option 2-A

Option 2-A was removed from further consideration because of low traffic performance (LOS F). This failing LOS can be attributed to two-lane parallel bridge structures. This split of traffic creates new weaves closely located to adjacent ramps. Weaves on the mainline can cause disruption in the traffic flow and creates additional decision points for drivers. This alternative experienced operational failure of the eastbound weave between River Landing Drive and the Wando River bridge deck. The short distance along with high traffic demands contribute to the operational failure.

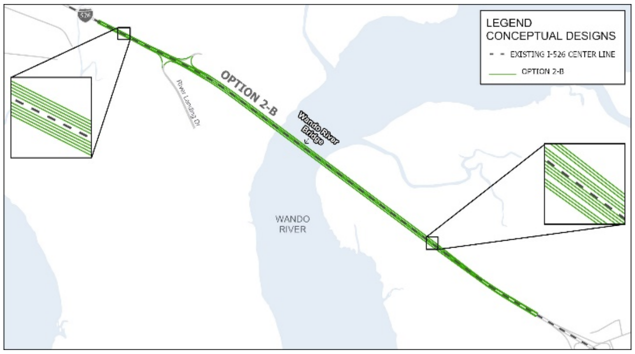
Figure 9.3: Conceptual Designs Removed, Option 2-A



Concept Option 2-B

Option 2-B was removed from further consideration because of low traffic performance (LOS F). This failing LOS can be attributed to the use of two-lane parallel bridge structures. This split of traffic creates new weaves closely located to adjacent ramps. The weave on the mainline can cause disruption in the traffic flow and creates additional decision points for drivers. The eastbound weave between the Wando River bridge and Long Point Road experiences operational failure from traffic demand.

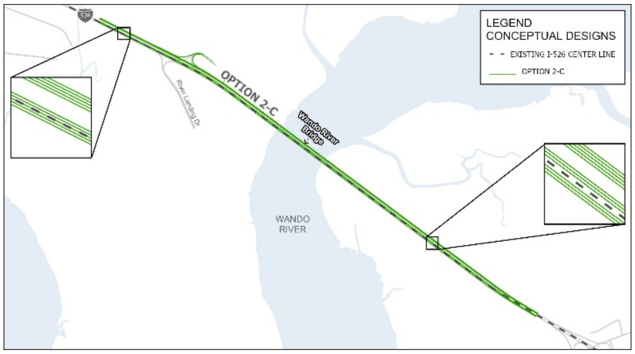
Figure 9.4: Conceptual Designs Removed, Option 2-B



Concept Option 2-C

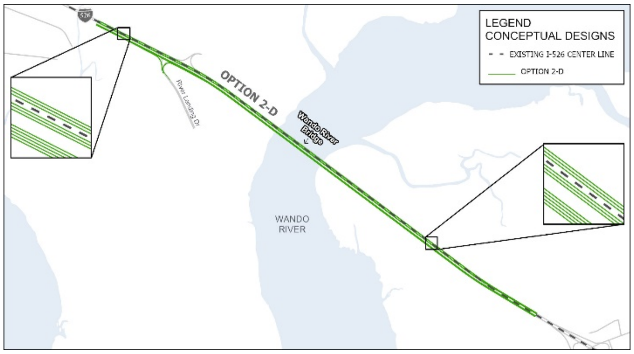
Option 2-C was removed from further consideration because of low traffic performance (LOS F). This failing LOS can be attributed to maintaining the existing bridge structures to carry eastbound traffic, thus splitting the traffic. This split of eastbound traffic creates a new weave closely located to adjacent ramps. The weave on the mainline can cause disruption in the eastbound traffic flow and creates an additional decision point for eastbound drivers. This alternative splits traffic west of River Landing Drive and forces on-ramp traffic from River Landing Drive to utilize the new bridge (outside freeway segment of the split). The high demand from River Landing Drive causes operational failure on the new bridge freeway segment.

Figure 9.5: Conceptual Designs Removed, Option 2-C



Concept Option 2-D

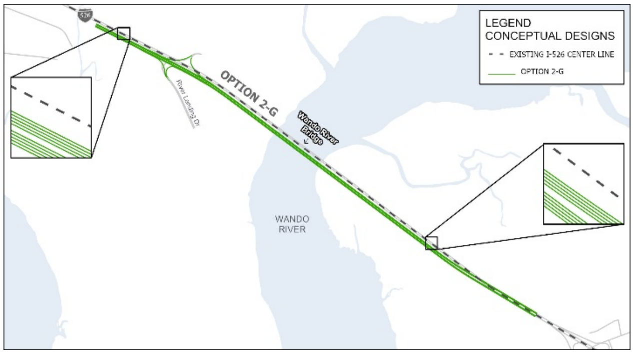
Figure 9.6: Conceptual Designs Removed, Option 2-D



Option 2-D was removed from further consideration because of low traffic performance (LOS F). This failing LOS can be attributed to maintaining the existing bridge structures to carry westbound traffic, thus splitting the traffic. This split of westbound traffic creates a new weave closely located to adjacent ramps. The weave on the mainline can cause disruption in the westbound traffic flow and creates an additional decision point for westbound drivers. This alternative splits traffic west of Long Point Road. This requires westbound traffic destined for Seven Farms Drive to make an advanced decision near Long Point Road while also navigating high demand on-ramp traffic from Long Point Road. The demand causes operational failure in the weaving movement.

Concept Option 2-G

Figure 9.7: Conceptual Designs Removed, Option 2-G



Option 2-G would impact an early to mid-twentieth century African American cemetery. The cemetery is located north of Long Point Road. Option 2-G also had the most relocations (74 units) in Section 2. This option would also have a significant impact on the Medical University of South Carolina (MUSC) Health Stadium and the Live To Play (LTP) Daniel Island (tennis complex). Option 2-G would also impact the African American cemetery. The primary reason for the removal of this option is because of its direct impact to the cemetery.

Concept Option 3-B

Figure 9.8: Conceptual Designs Removed, Option 3-B

Option 3-B would have the largest footprint compared to Option 3-A. Option 3-B scores well for constructability; but has a higher number of potential impacts on natural resources and the community and built environment. Comparing Option 3-B to 3-A, it was determined that 3-A was the better option to move forward.

9.4 Summary of the Level 2 Screening

After screening 21 conceptual design options, it was determined that 9 options would be removed from further analysis, and 12 options would move forward. The conceptual design options removed include six options (Options 1-A, 1-B, 2-A, 2-B, 2-C, and 2-D) because they had a LOS F and would not fully meet the purpose and need. Option 2-G had a higher number of relocations and impacts a cemetery, leaving Options 1-G without a pairing alignment in Section 2 as this option does not pair well with the remaining options. The remaining option removed was Option 3-B because it had a higher number of potential impacts to natural resources and the built environment because of its larger footprint.

The 12 options carried forward for further analysis include four options (Options 1-F, 1-H, 2-F, and 2-H) that replace the bridge structures and add capacity to the north. An additional three options (Options 1-I, 2-I, and 2-J) will replace the bridge structures and add capacity to the south. Two options (Options 1-C and 1-D) will retain the Don Holt bridge and add capacity to the north or south, respectively. Two options will replace the bridge structures and add capacity symmetrically (Options 1-E and 2-E). Option 3-A will move forward because it widens the existing facility both inside and outside the median and has the smallest footprint.

Twelve conceptual design options were carried forward as a result of the Level 2 screening. The 12 options (Options 1-C, 1-D, 1-E, 1-F, 1-H, 1-I, 2-E, 2-F, 2-H, 2-I, 2-J, and 3-A) to be combined into conceptual design, corridor-wide, end-to-end alternatives are summarized in **Table 9.9**.

Table 9.9: Conceptual design Options Moved Forward

Design Option	Capacity Option	Descriptions
1-C	Retain North	Retain the Don Holt bridge and add a new four-lane bridge north of the existing bridge to carry westbound traffic. The existing Don Holt bridge will be retained to carry eastbound traffic, for a total of eight lanes.
1-D	Retain South	Retain the Don Holt bridge and add a new four-lane bridge south of the existing bridge to carry eastbound traffic. The existing Don Holt bridge will be retained to carry westbound traffic, for a total of eight lanes.
1-E	Replace Symmetrical	Replace the Don Holt bridge (**increase navigational clearance by 31 feet**) by constructing two new four-lane bridges on each side, for a total of eight lanes.
1-F	Replace North	Replace the Don Holt bridge (**increase navigational clearance by 31 feet**) by constructing a new eight-lane bridge north of the existing bridge.
1-H	Replace North	Construct a new, higher four-lane bridge north of the existing bridge and replace the Don Holt bridge (**increase navigation clearance by 31 feet**) in place, for a total of eight lanes
1-I	Replace South	Construct a new, higher four-lane bridge south of the existing bridge and replace the Don Holt bridge (**increase navigation clearance by 31 feet**) in place, for a total of eight lanes.
2-E	Replace Symmetrical	Replace the Wando bridge by constructing two new four-lane bridges on each side of the existing structures, for a total of eight lanes (single-stage with larger footprint).
2-F	Replace North	Replace the Wando bridge by constructing a new eight-lane bridge north of the existing structures (single-stage construction).
2-H	Replace North	Replace the Wando bridge and construct a new four-lane bridge to the north. The existing Wando bridge would be removed and a new four-lane bridge would be built within the footprint of the existing structure, for a total of eight lanes.
2-I	Replace South	Replace the Wando bridge and construct a new four-lane bridge to the south. The existing Wando bridge would be removed and a new four-lane bridge would be built within the footprint of the existing structure, for a total of eight lanes.
2-J+	Replace Symmetrical	Replace the Wando bridge by adding two-lane parallel bridge structures on each side of the existing structures. Remove the existing Wando bridge and widen the newly constructed bridges to four lanes each way, for a total of eight.
3-A	Symmetrical	Widen the current facility to both to the inside and outside using the existing median for a total of eight lanes.

+ Staged Construction

10.0 Development of Conceptual Design Alternatives

The project team evaluated each of the 12 conceptual design options from Sections 1 (Options 1-C, 1-D, 1-E, 1-F, 1-H, 1-I), 2 (Options 2-E, 2-F, 2-H, 2-I, 2-J), and 3 (Option 3-A) to determine from a design perspective how each of the options could be connected to create the conceptual end-to-end alternatives that will be evaluated in the Level 3 screening.

The design team started by connecting each conceptual design option's counterpart in Sections 1 and 2. These combinations include Options 1-E and 2-E; 1-F and 2-F; 1-H and 2-H; and 1-I and 2-I. After creating those combinations, the remaining options, Options 1-C, 1-D, and 2-J, were evaluated to determine if they could be combined with any of the options that were moved forward from the Level 2 screening.

Options 1-C and 1-D were determined to be compatible with Options 2-E, 2-F, 2-H, 2-I, and 2-J (**Table 10.1**). After the evaluation of the engineering review and the Level 2 screening, the best pairing for Option 1-C and 1-D is 2-J. Option 2-J has a better constructability score and ranked first in overall scoring.

Table 10.1: Option 1-C and 1-D Compatible Options

Design Option	Capacity Option	Engineering		Natural Resource	Community and Built Environment		Total Score
		Constructability	Design		Relocations	Park (4f)	
2-E	Replace Symmetrical	2.2	1.5	5.0	4.0	2.0	14.7
2-F	Replace North	1.8	2.7	3.0	4.0	1.0	12.5
2-H	Replace North	3.0	3.0	5.0	1.0	2.0	14.0
2-I	Replace South	3.0	2.3	4.0	2.0	2.0	13.3
2-J	**Replace Symmetrical**	**3.0**	**1.7**	**4.0**	**1.0**	**2.0**	**11.7**

The bold option is the option moved forward.

Option 2-J was determined to be compatible with Options 1-H and 1-I (**Table 10.2**). After an engineering review and the Level 2 screening, the best pairing for Option 2-J is 1-H. Option 1-H has a better score from an engineering and impact perspective.

Table 10.2: Option 2-J Compatible Options

Design Option	Capacity Option	Engineering		Natural Resource	Community and Built Environment		Total Score
		Constructability	Design		Relocations	Park (4f)	
1-H	**Replace North**	**3.0**	**3.5**	**3.0**	**1.0**	**1.0**	**11.5**
1-I	Replace South	3.0	2.9	2.0	4.0	1.0	12.9

The bold option is the option moved forward.

10.1 Preliminary Conceptual Alternatives for Level 3 Screening

Seven preliminary conceptual alternatives have been developed following the Level 1 and Level 2 screening process. Two of the conceptual alternatives would retain the Don Holt bridge and add capacity to either the north or south and replace the Wando River bridge and add capacity symmetrically. Two preliminary conceptual alternatives would replace both the Don Holt and Wando bridges and add capacity to the north. One preliminary conceptual alternative would replace both bridges and add capacity to the south. One preliminary conceptual alternative would replace both bridges and add capacity to the north and south symmetrically. The remaining preliminary conceptual alternative would replace both bridges and add capacity to the north in Section 1 and add capacity symmetrically in Section 2. **Table 10.3** shows all seven preliminary conceptual alternatives with the conceptual design options used to make up the alternative.

Table 10.3: Conceptual design Alternatives for Level 3 Screening

Preliminary Design Alternative	Section 1	Section 2	Section 3
Alternative 1	Option 1-C	Option 2-J	Option 3-A
Alternative 2	Option 1-D	Option 2-J	Option 3-A
Alternative 3	Option 1-E	Option 2-E	Option 3-A
Alternative 4	Option 1-F	Option 2-F	Option 3-A
Alternative 5	Option 1-H	Option 2-H	Option 3-A
Alternative 6	Option 1-I	Option 2-I	Option 3-A
Alternative 7	Option 1-H	Option 2-J	Option 3-A

10.2 Interchange Improvement Concepts

At this phase of screening and project refinement, the interchanges are evaluated for performance in support of the additional mainline capacity. The interchange improvement concepts do not satisfy the project's purpose and need independently. However, improvements to the interchanges do have the potential to increase the mainline improvement conceptual alternatives' performance. There are five existing interchanges within the I-526 LCC EAST corridor located at Virginia Avenue, Clements Ferry Road, River Landing Drive/Seven Farms Drive (Daniel Island), Long Point Road, and U.S. 17. Each of the seven conceptual alternatives adds capacity to the I-526 mainline which may require modifications to either the capacity of the existing interchange or the configuration itself. The project team utilized HCS and FHWA's Capacity Analysis for Planning of Junctions (Cap-X) Tool to determine whether modifications are needed.

Results of the HCS evaluation identify the operation of merge and diverge locations for each interchange along the study corridor. The HCS results also indicate when there is a need for additional lanes on the ramps. The Cap-X Tool considers the need for interchange configuration modifications as well as the need for additional lanes on ramps by evaluating the traffic movements at the intersection of ramp termini and secondary roads.

The results of the HCS and Cap-X evaluation do not identify deficiencies in the existing configurations; however, they do identify where additional lane capacity is needed for existing interchanges to accommodate the projected growth in traffic demand. Improvements to these interchanges would also correct the roadway deficiencies identified in the purpose and need for the project. The roadway deficiencies include insufficient acceleration/deceleration ramp lengths contributing to merge and diverge conflicts; and tightly curved ramps (existing loop ramp radius is less than the minimum required for the design speed).

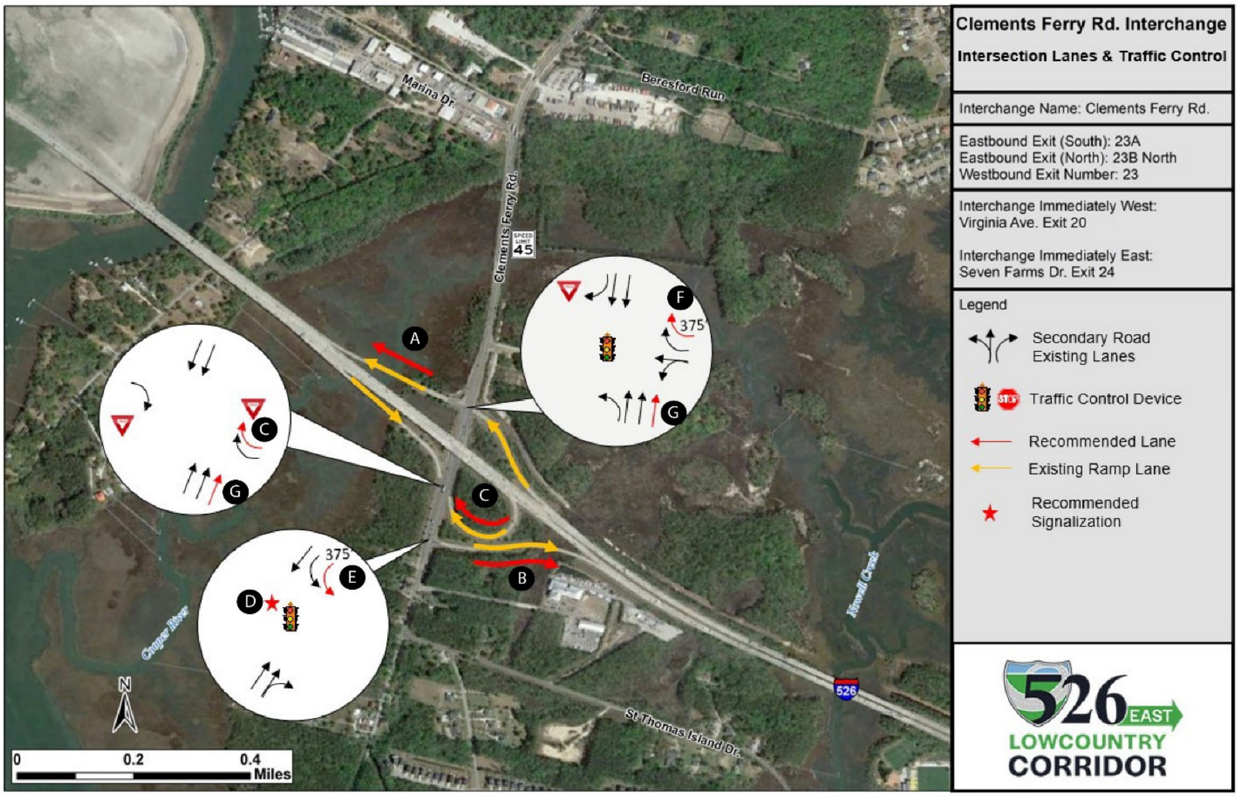
Based on this analysis, no improvements are recommended for the Virginia Avenue interchange, however, improvements are recommended at the remaining four interchanges in the corridor to accommodate the added capacity associated with the widening of the mainline. These interchange improvements are considered to be consistent for each of the preliminary mainline improvement alternatives. A summary of the recommended modifications to four of the five interchanges is discussed below.

10.2.1 Clements Ferry Road Interchange

Based on traffic projections and directional movement estimates, the overall interchange traffic demand increases 120 percent by the year 2050 at Clements Ferry Road. Recommended modifications to the Clements Ferry Road interchange include:

- An additional lane along the I-526 westbound on-ramp from Clements Ferry Road (A).
- An additional lane along the I-526 eastbound on-ramp from Clements Ferry Road (B).
- An additional lane along the I-526 eastbound loop off-ramp to Clements Ferry Road (C).
- Signalization of the Clements Ferry Road & I-526 eastbound on-ramp intersection (D).
- An additional 375’ left-turn lane along the southbound Clements Ferry Road approach to the intersection of Clements Ferry Road & I-526 eastbound on-ramp (E).
- An additional 375’ right-turn lane along the I-526 westbound off-ramp approach to the intersection of Clements Ferry Road & I-526 westbound off-ramp (F).
- An additional northbound through lane along Clements Ferry Road beginning at the I-526 eastbound ramps and continuing towards Forrest Drive (G).

Figure 10.1: Clements Ferry Road Interchange

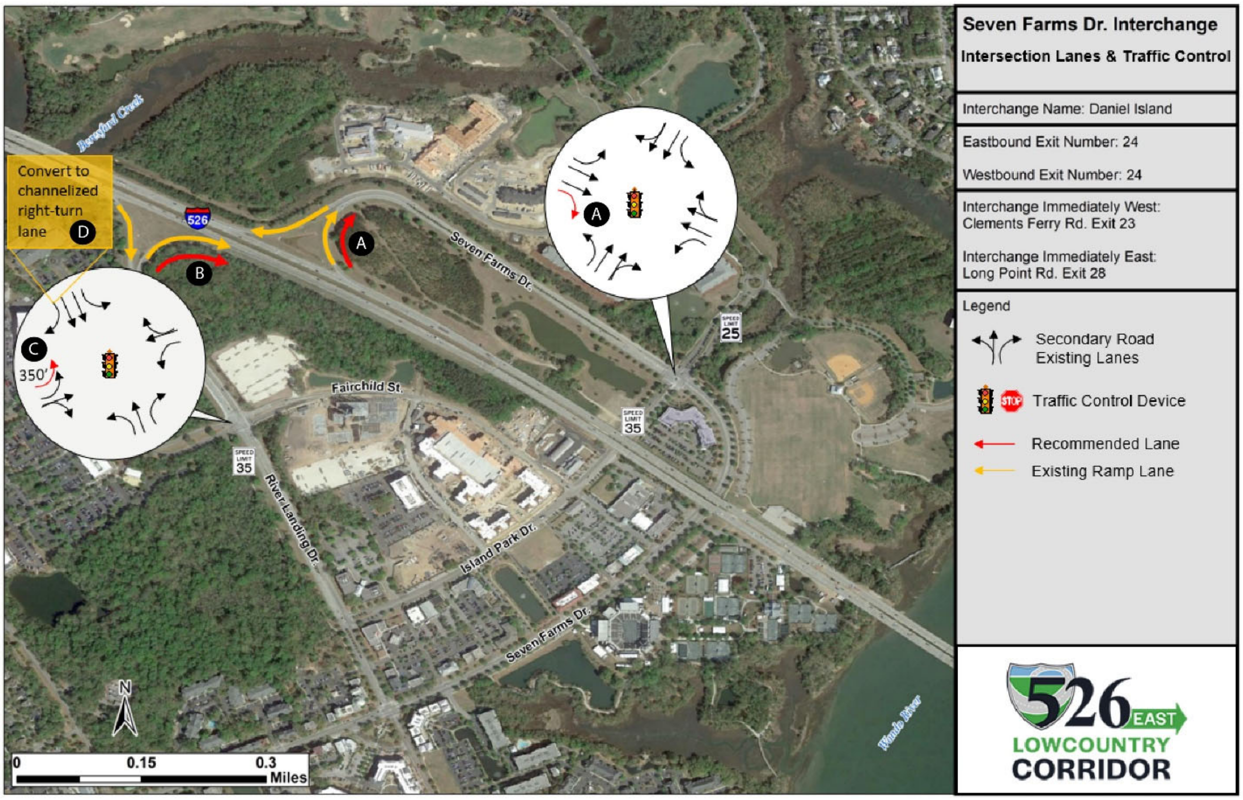


10.2.2 River Landing Drive/Seven Farms Drive (Daniel Island Interchange)

Based on traffic projections and directional movement estimates, the overall interchange traffic demand increases 66 percent by the year 2050 at River Landing Drive and Seven Farms Drive. Recommended modifications to the River Landing Drive/Seven Farms Drive interchange on Daniel Island include:

- An additional lane along the I-526 westbound off-ramp to Seven Farms Drive that terminates as an exclusive right-turn lane at the intersection with Island Park Drive (A).
- An additional lane along the I-526 eastbound on-ramp from River Landing Drive (B).
- An additional 350' left-turn lane along the northeast approach of the Fairchild Street & River Landing Drive/I-526 eastbound off-ramp intersection (C).
- Convert the existing exclusive right-turn lane along the I-526 eastbound off-ramp approach to the intersection of Fairchild Street & River Landing Drive/I-526 eastbound off-ramp to a channelized right-turn lane (D).

Figure 10.2: River Landing Drive/Seven Farms Drive (Daniel Island Interchange)

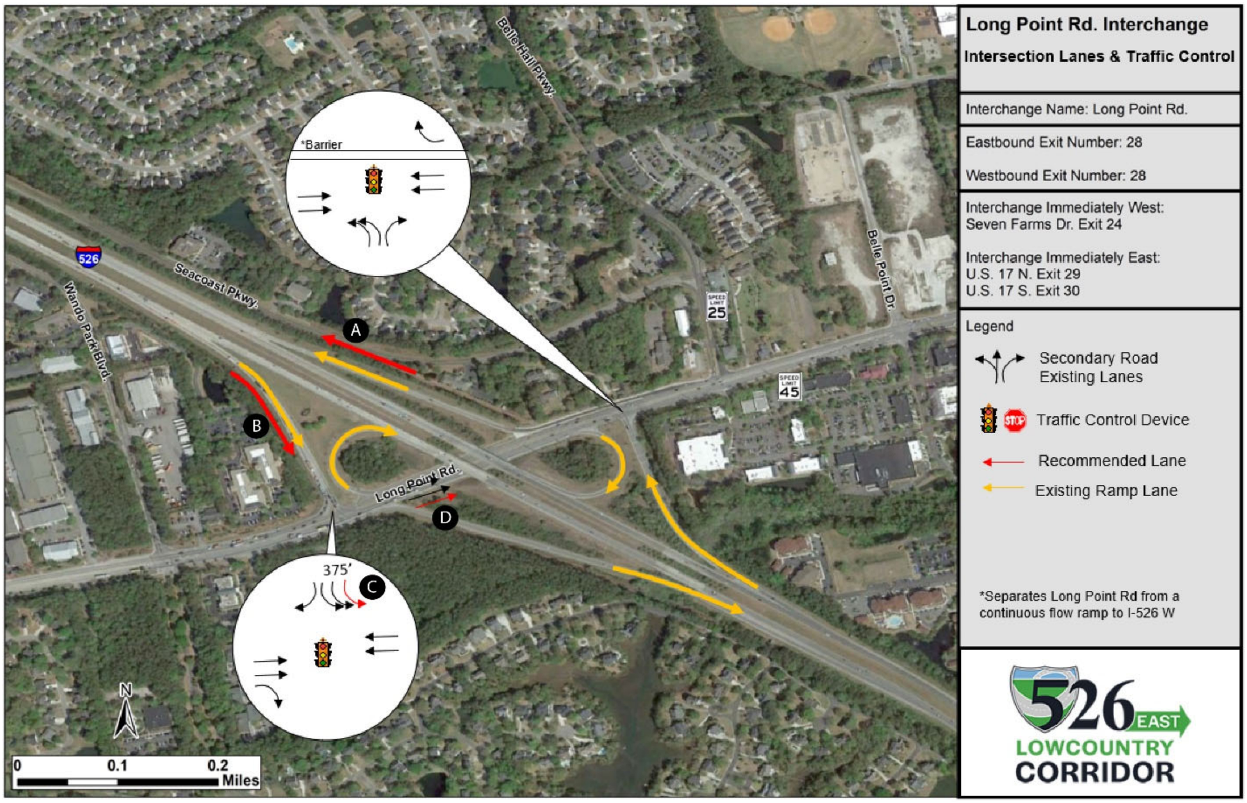


10.2.3 Long Point Road (S-97) Interchange

Based on traffic projections and directional movement estimates, the overall interchange traffic demand increases 59 percent by the year 2050 at Long Point Road. Recommended modifications to the Long Point Road interchange in the Town of Mount Pleasant include:

- An additional lane along the I-526 westbound on-ramp from Long Point Road (A).
- An additional lane along the I-526 eastbound off-ramp to Long Point Road (B).
- An additional 375' left-turn lane along the I-526 eastbound off-ramp approach of the intersection of Long Point Road & I-526 eastbound off-ramp (C).
- An additional northeast through lane along Long Point Road beginning as a receiving lane for the left turns from the I-526 eastbound off-ramp and continuing towards the intersection with the I-526 westbound on-ramp (D).

Figure 10.3: Long Point Road (S-97) Interchange

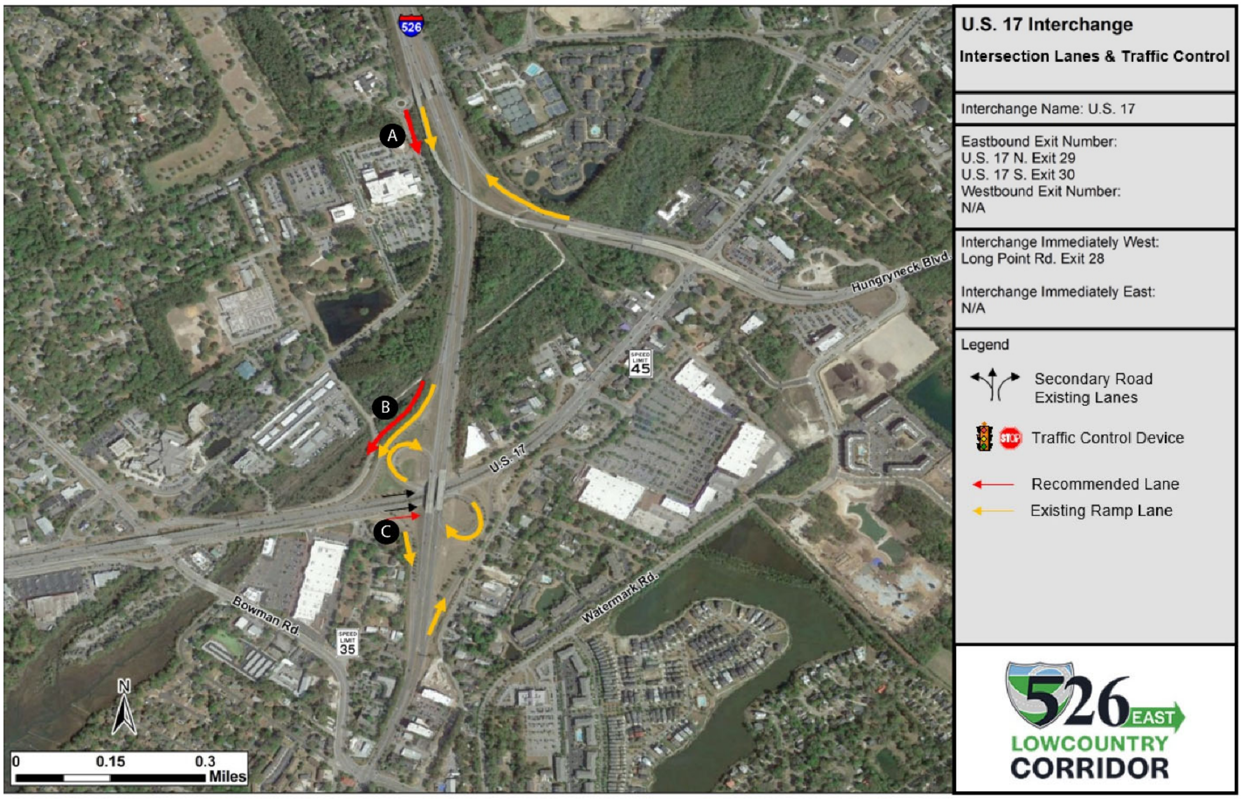


10.2.4 U.S. 17 Interchange

Based on traffic projections and directional movement estimates, the overall interchange traffic demand increases 63 percent by the year 2050 at US 17. Recommended modifications to the U.S. 17 interchange include:

- An additional lane along the I-526 eastbound off-ramp to US 17 North (A).
- An additional lane along the I-526 eastbound off-ramp to US 17 South (B).
- An additional northbound through lane along US 17 (C).

Figure 10.4: U.S. 17 Interchange



10.3 END-TO-END CONCEPTUAL ALTERNATIVES FOR LEVEL 3 SCREENING

The seven mainline improvement conceptual alternatives (described previously) include further refinement to provide for a smooth transition between each of the three defined sections. These refinements also include the incorporation of interchange modifications as they relate to each of the mainline improvement alternatives. The refined end-to-end conceptual alternatives are evaluated in the Level 3 screening. Conceptual end-to-end alternatives are described below, and figures showing each of the conceptual alternatives are located in **Appendix A**.

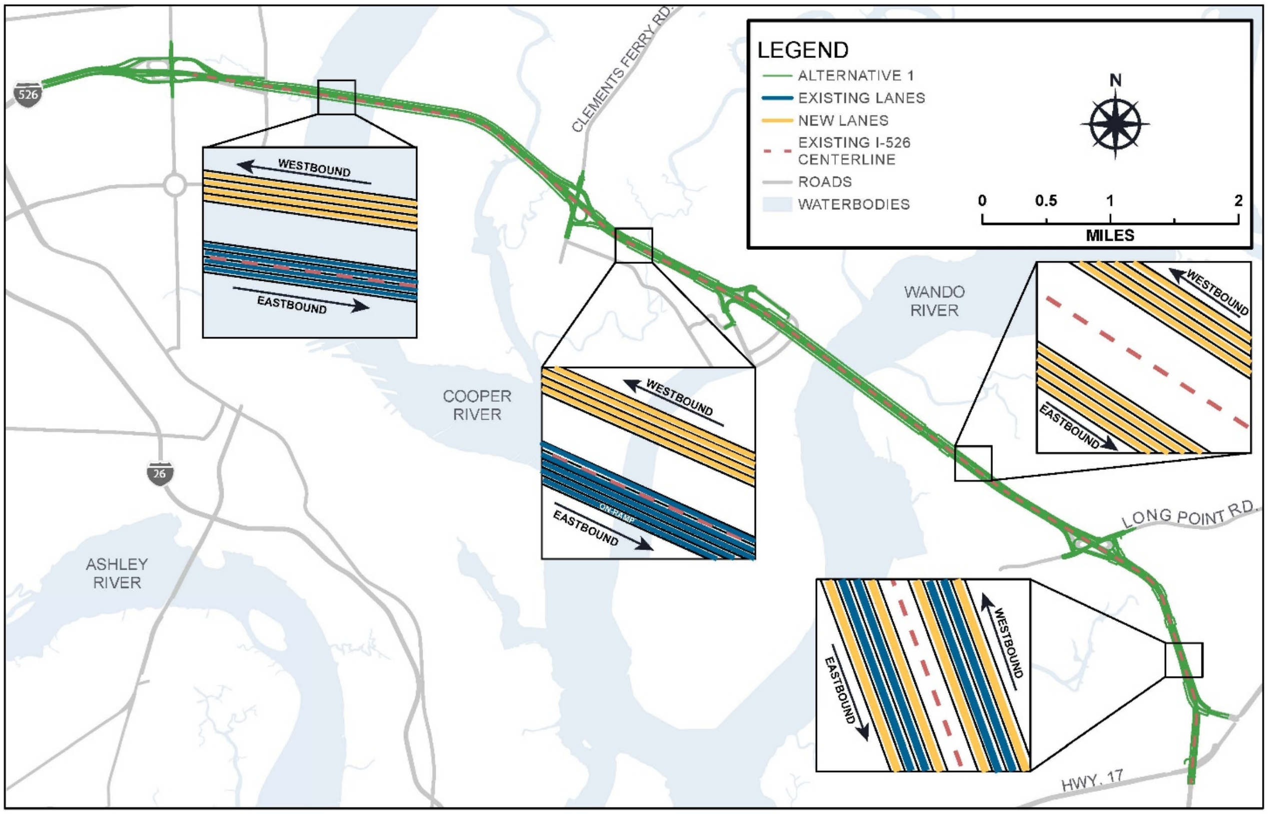
10.3.1 Alternative 1

Alternative 1 would retain the Don Holt bridge and add a new four-lane bridge north of the existing bridge to carry westbound traffic. The existing Don Holt bridge would carry eastbound traffic. The four-lane section would be carried through the Clements Ferry Road interchange. The existing roadway facility would carry all eastbound traffic.

Traveling east of the Clements Ferry Road interchange, the Wando bridges would be replaced by adding two-lane parallel bridge structures on each side of the existing structures. Then the existing Wando bridges would be removed and the newly constructed bridges would be widened to four lanes each way.

The existing facility's remaining segment would be widened to the inside and outside using the existing median. This widening would begin before the Long Point Road interchange and travel east to the U.S. 17 interchange.

Figure 10.5: Alternative 1 Design



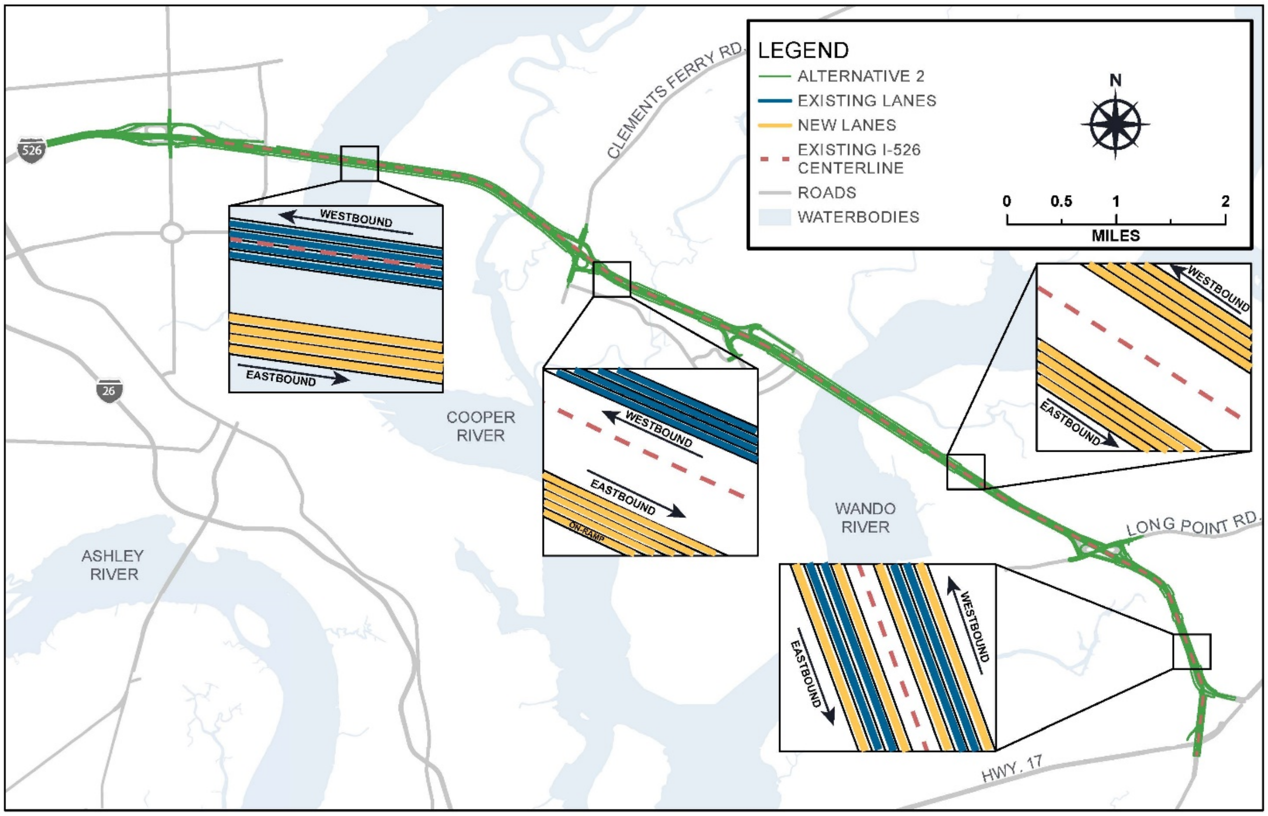
10.3.2 Alternative 2

Alternative 2 would retain the Don Holt bridge and add a new four-lane bridge south of the existing bridge to carry eastbound traffic. The existing Don Holt bridge would carry westbound traffic. The four-lane section would be carried through the Clements Ferry Road interchange. The existing roadway facility would carry all westbound traffic.

Traveling east of the Clements Ferry Road interchange, the Wando bridges would be replaced by adding two-lane parallel bridge structures on each side of the existing structures. Then the existing Wando bridges would be removed and the newly constructed bridges would be widened to four lanes each way.

The existing facility's remaining segment would be widened to the inside and outside using the existing median. This widening would begin before the Long Point Road interchange and travel east to the U.S. 17 interchange.

Figure 10.6: Alternative 2 Design



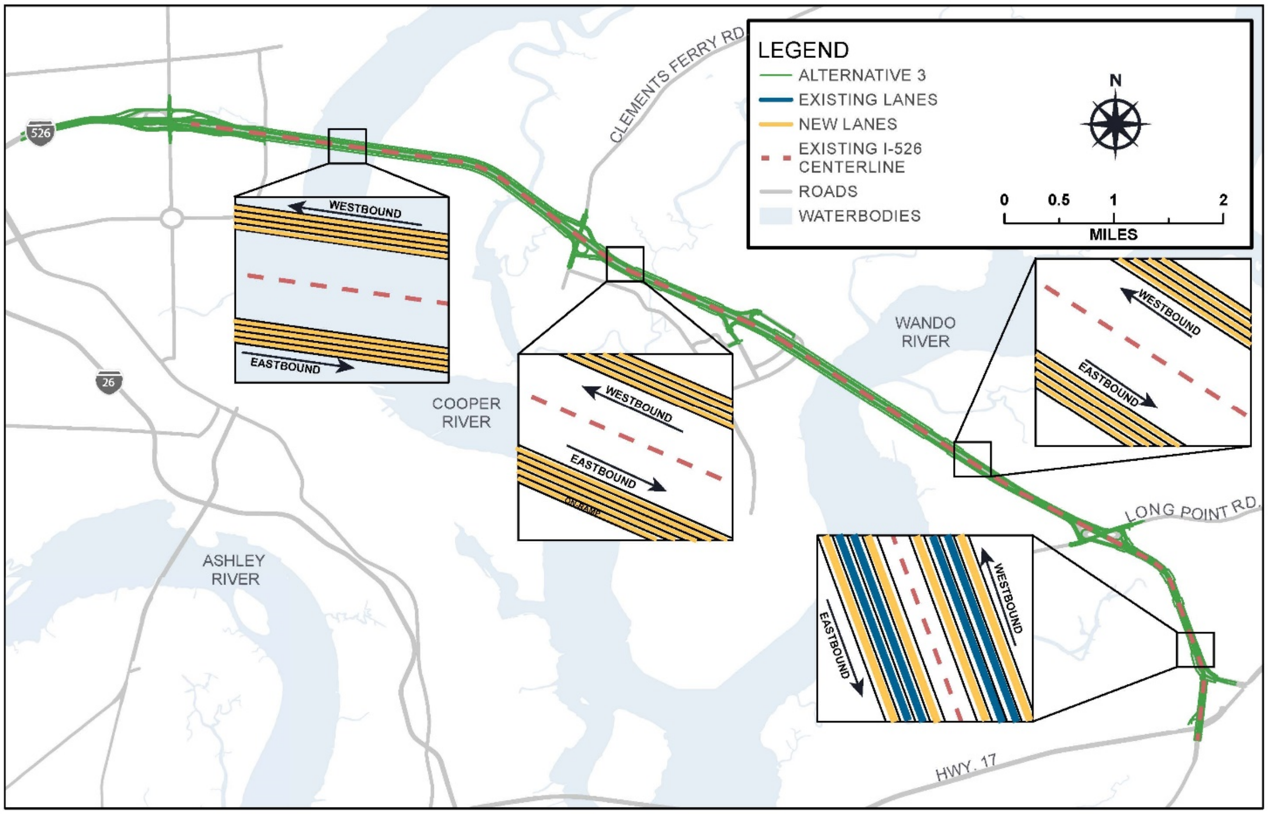
10.3.3 Alternative 3

Alternative 3 replaces the Don Holt bridge by constructing two new four-lane bridges on each side of the existing bridge. The new bridge structure would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge and making passage of the same sized vessel possible. The four-lane sections to the north and the south of the existing facility would be carried through the Clements Ferry Road interchange.

Traveling east of the Clements Ferry Road interchange, the Wando bridges would be replaced by constructing two new four-lane bridges on each side of the existing structures (single-stage with larger footprint). The existing Wando bridges would then be removed.

The existing facility's remaining segment would be widened to the inside and outside using the existing median. This widening would begin before the Long Point Road interchange and travel east to the U.S. 17 interchange.

Figure 10.7: Alternative 3 Design



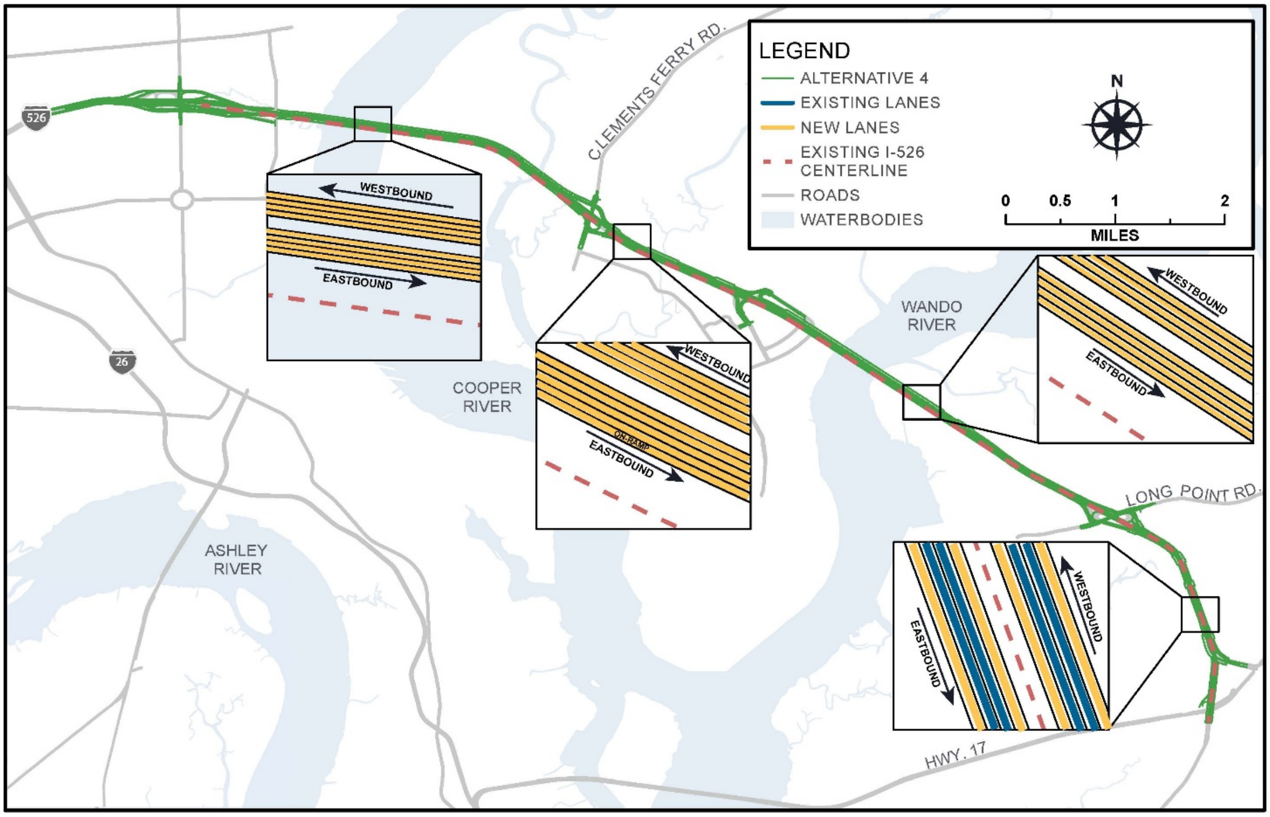
10.3.4 Alternative 4

Alternative 4 replaces the Don Holt bridge by constructing a new eight-lane bridge north of the existing bridge. The new bridge structure would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge and making passage of the same size vessel possible. The new eight-lane section would continue north of the existing facility, east of the Clements Ferry Road interchange.

Moving east, the Wando bridges would be replaced by constructing a new eight-lane bridge north of the existing structures (single-stage construction). The existing Wando bridges will then be removed.

The existing facility's remaining segment would be widened to the inside and outside using the existing median. This widening would begin before the Long Point Road interchange and travel east to the U.S. 17 interchange.

Figure 10.8: Alternative 4 Design



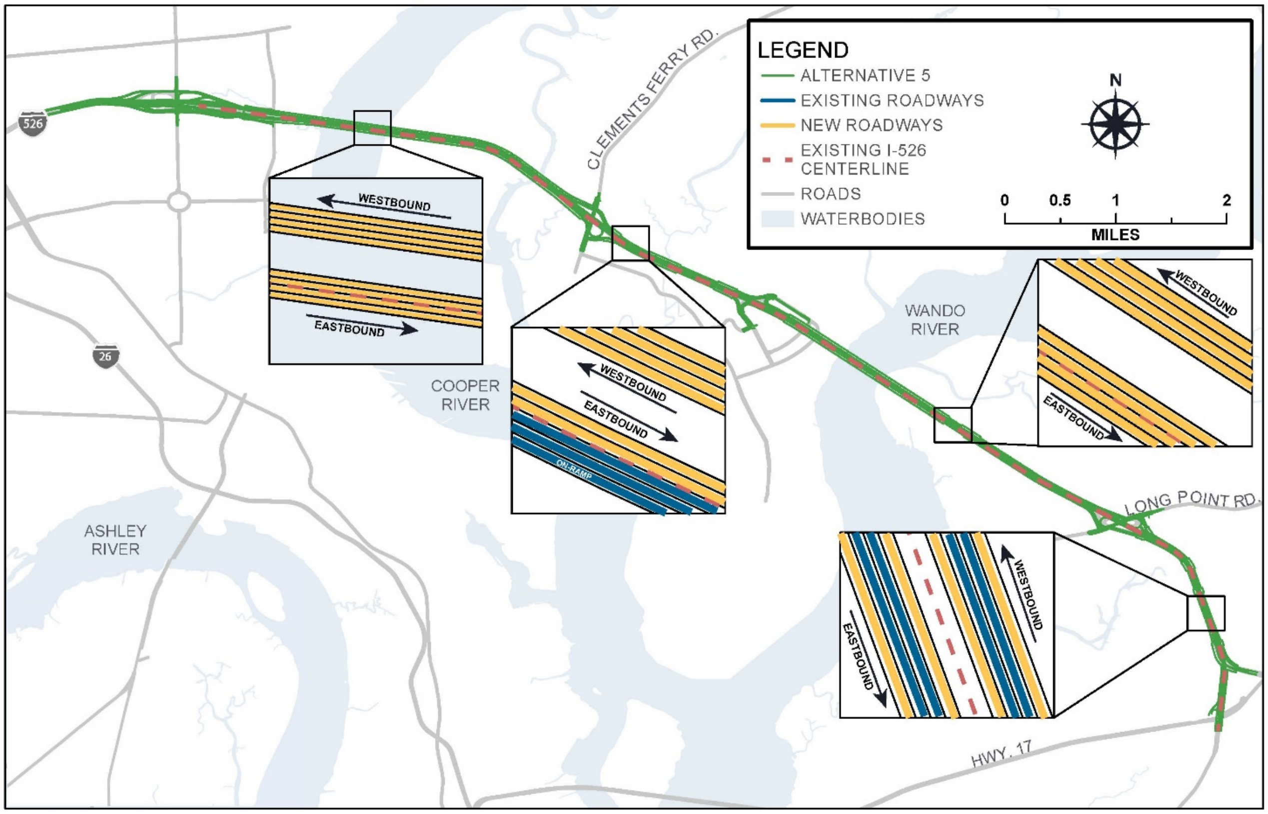
10.3.5 Alternative 5

Alternative 5 consists of constructing a new, higher four-lane bridge north of the existing Don Holt bridge. The new bridge structure would be set so that it would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge and making passage of the same size vessel possible. Traffic would be moved to the new facility, the existing Don Holt bridge would be removed, and a new four-lane structure would be constructed where the current alignment is located. East of the Clements Ferry Road interchange, a new four-lane section would be constructed north of the existing facility and the existing eastbound roadway would be widened to include two additional travel lanes for eastbound traffic.

Traveling east of the Clements Ferry Road interchange, the Wando bridges would be replaced with a new four-lane bridge to the north. The existing Wando bridges would then be removed, and a new four-lane bridge would be built within the footprint of the existing structure.

The existing facility's remaining segment would be widened to the inside and outside using the existing median. This widening would begin before the Long Point Road interchange and travel east to the U.S. 17 interchange.

Figure 10.9: Alternative 5 Design



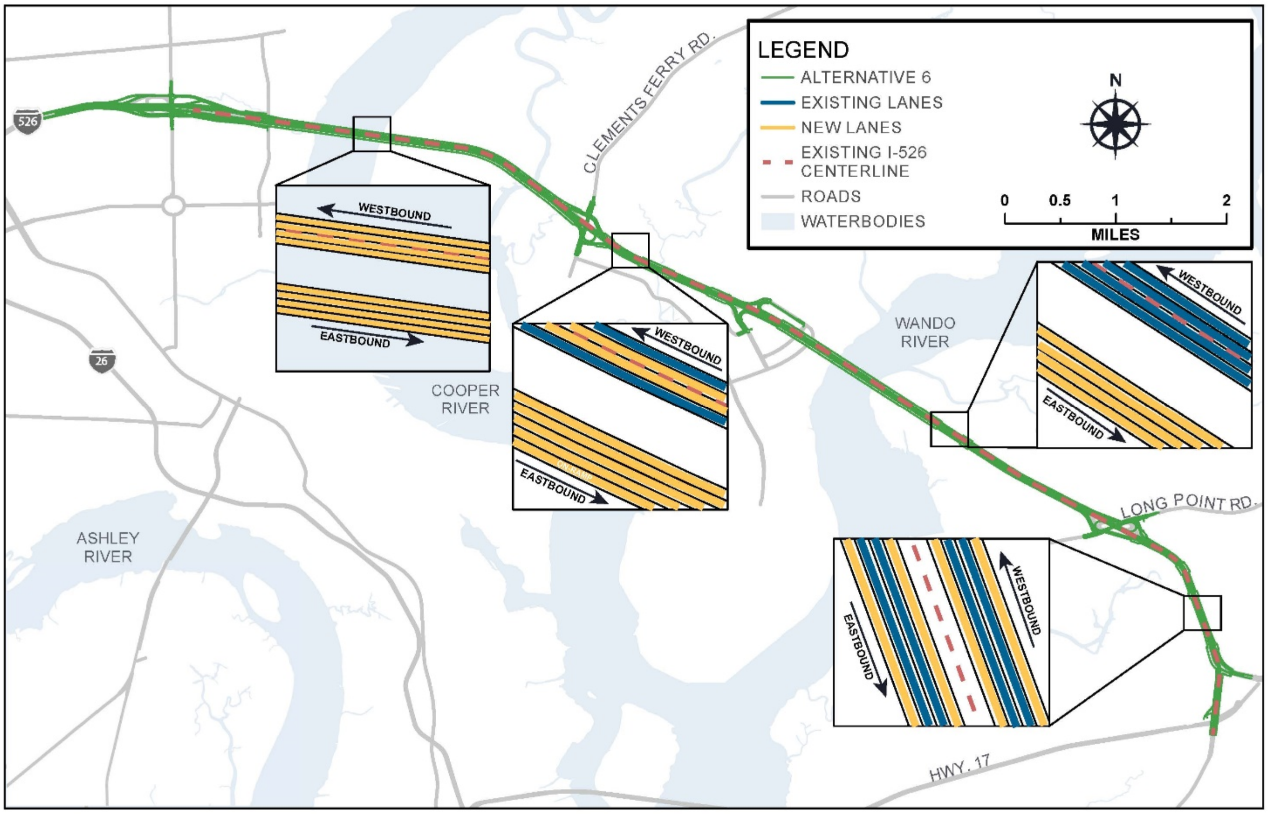
10.3.6 Alternative 6

Alternative 6 consists of constructing a new, higher four-lane bridge south of the existing Don Holt bridge. The new bridge structure would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge and making passage of the same size vessel possible. Traffic would be moved to the new facility, the existing Don Holt bridge would be removed, and a new four-lane structure would be constructed where the current alignment is located. East of the Clements Ferry Road interchange, a new four-lane section would be constructed to the south of the existing facility and the existing westbound roadway would be widened to include two additional travel lanes for westbound traffic.

Traveling east of the Clements Ferry Road interchange, the Wando bridges would be replaced with a new four-lane bridge to the south. The existing Wando bridges would then be removed, and a new four-lane bridge would be built within the footprint of the existing structure.

The existing facility's remaining segment would be widened to the inside and outside using the existing median. This widening would begin before the Long Point Road interchange and travel east to the U.S. 17 interchange.

Figure 10.10: Alternative 6 Design



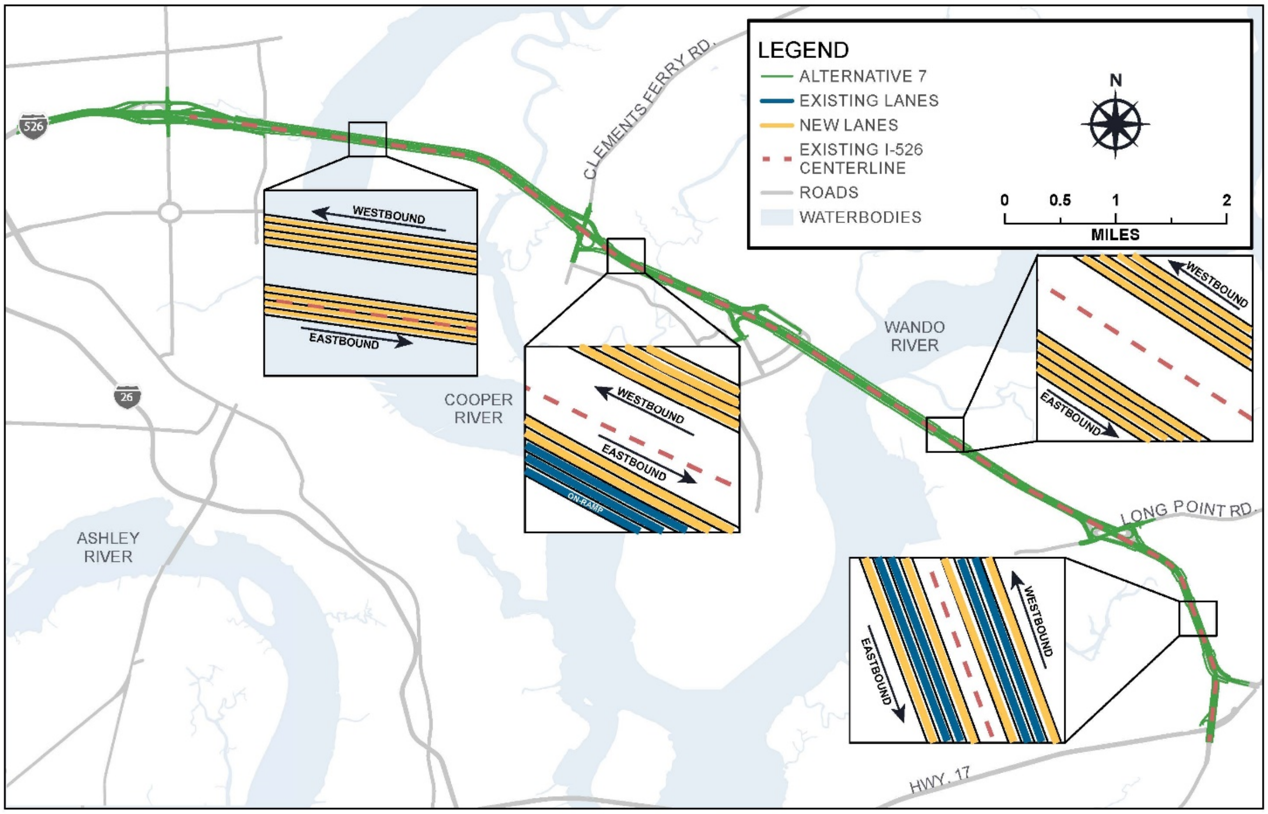
10.3.7 Alternative 7

Alternative 7 consists of constructing a new, higher four-lane bridge north of the existing Don Holt bridge. The new bridge structure would increase the navigational clearance by 31 feet, equaling the navigational clearance of the Arthur J. Ravenel bridge and making passage of the same size vessel possible. Traffic would be moved to the new facility, the existing Don Holt bridge would be removed, and a new four-lane structure would be constructed where the current alignment is located. East of the Clements Ferry Road interchange, a new four-lane section would be constructed north of the existing facility and the existing eastbound roadway would be widened to include two additional travel lanes for eastbound traffic.

Traveling east of the Clements Ferry Road interchange, the Wando bridges would be replaced by adding two-lane parallel bridge structures on each side of the existing structures. Then the existing Wando bridges would be removed and the newly constructed bridges would be widened to four lanes each way.

The existing facility's remaining segment would be widened to the inside and outside using the existing median. This widening would begin before the Long Point Road interchange and travel east to the U.S. 17 interchange.

Figure 10.11: Alternative 7 Design



11.0 Level 3 Screening

The Level 3 screening uses a similar approach as the Level 2 screening. A multi-disciplinary team of engineers (roadway design, bridge, construction, and traffic) and planners (transportation and environmental) collaborated on the Level 3 screening criteria and scoring requirements for each conceptual alternative.

11.1 Level 3 Screening Criteria

The Level 3 screening categories and criteria are the same as Level 2 with the exception of the VISSIM traffic model used for the purpose and need criteria. The Level 3 screening categories and evaluation methods are summarized in Table 11.1 and further described below.

Table 11.1: Level 3 Screening Categories and Methods

Category	Criteria	Key Measures	Quantification for Screening
Purpose and Need	VISSIM Traffic Model Results	Travel Time Index	Travel Time Index
Engineering (Design and Constructability)	**Design**		
	Compatibility with local plans and projects	Connections to the existing roadway improvement projects	Sum of Scores from Section 1-3 (1 to 5)
	Improves seismic resiliency	Bridge replacement/new bridge structures/ modification to existing bridges	Sum of Scores from Section 1-3 (1 to 5)
	Ports and transit access	Improves access to ports and transit facilities	Sum of Scores from Section 1-3 (1 to 5)
	Constructability		
	Constructability	Potential construction and staging issues, traffic disruption, construction complexity	Scored (1 to 5)
Natural Resources	Aquatic resources	Acreage of impact	Scored (1 to 5)
Community and Built Environment	Residential/business and recreational facilities	Residential/business and recreational facilities impacted by the ROW footprint	Scored (1 to 5)
	Park facilities	Impacts to park facilities	Scored (number of parks impacted)
	Cultural Resources	Impacts to cultural resources	Yes/No

11.1.1 Purpose and Need

Purpose and need is evaluated in Level 3 using a VISSIM[28] microsimulation model. The VISSIM model assesses the travel time and speed on the I-526 mainline with the added capacity improvements of the conceptual alternatives, interchange configurations recommended, and the geometric features of the corridor. Each of the seven conceptual alternatives considers the same 8-lane capacity improvements and has traffic operational similarities. Individual microsimulation models for each of the conceptual alternatives will not provide significantly different results between shifts in the alignment to the north or south. Therefore, the results of the VISSIM model assessment for the added capacity to the I-526 mainline are considered to be the same for each of the seven conceptual alternatives for this PEL study.

The microsimulation model uses a combination of origins and destinations that simulate the potential routes of drivers. These simulations are executed twenty-three times to develop an average travel time for each route during periods with no traffic (free-flow) and periods of congestion, typically during A.M. and P.M. rush hour.

The average travel time during periods of free-flow is compared to the average travel time during periods of congestion to develop a travel time index (TTI), which is expressed as a unitless ratio. TTI shows the variation of roadway conditions throughout the day. The TTI ratios for the corridor widening (conceptual alternative) are compared with those of the No-build alternative to evaluate potential relative improvements in congestion and travel time. The decision to use TTI in this analysis was based on the use of this performance measure in the CHATS Long Range Transportation Plan[29]. The TTI ratio is a more informative performance measure for monitoring changes in congestion when compared to travel time because it accounts for the variability of travel distances that arise from differing roadway improvements between the No-build alternative and the conceptual alternative that would skew travel time results. It is also a relatable performance metric when communicating with the traveling public, better describing the expected experience for drivers compared with metrics such as LOS.

Travel Time Index (TTI): *is the average peak-period travel time compared to free flow travel time. TTI is expressed as a ratio. For example, a TTI value of 1.3 means the average peak travel times are 30 percent longer than travel times during free-flow.*

The Level 1 and Level 2 screening removed the conceptual design options that do not meet the purpose and need, and it is assumed the seven end-to-end conceptual alternatives meet the purpose and need of the project. The VISSIM analysis intends to determine how well the conceptual alternatives meet the purpose and need. Additional information on the VISSIM analysis can be found in the *I-526 LCC EAST Travel Time Reliability Analysis Technical Memorandum under separate cover*.

11.1.2 Engineering

The engineering scores for each conceptual design option from the Level 2 screening are also utilized in the Level 3 screening. Each end-to-end conceptual alternative is a combination of conceptual design options from each section of the I-526 LCC EAST corridor as described in **Chapter 11**. The sum of the design option scores represents the engineering score for the conceptual alternatives. The project team

[28] PTV Group's VISSIM, Version 9 is a microscopic computer software that simulates realistic and detailed traffic flow while considering human behavior. This software is used to build a model network based on the design of an 8-lane scenario.
[29] CHATS 2040 Long Range Transportation Plan, https://bcdcog.com/long-range-transportation-plan/

reviewed the summed scores for the conceptual alternatives to confirm the validity of those cumulative scores.

11.1.3 Natural Resources

Aquatic habitat impacts are evaluated under the natural resources screening category in Level 3. This evaluation consists of the quantification of potential impacts to aquatic resources within the ROW boundary, using the engineering designs and field data collected within the study area. The aquatic resources include but are not limited to wetlands, streams, tidal creeks, ponds, and marshes. Open water was not included in the quantification.

The impacted acreage for each conceptual alternative is quantified, and the difference between the highest and lowest value is identified to develop a scoring range. A score of 1 would have potentially fewer impacts on the resource, and a score of 5 will have more impacts.

11.1.4 Community and Built Environment

During the Level 2 screening, community resources were identified within the study area, including residential and business facilities, parks, and cultural resources. Impacts on residential and business properties are quantified to determine the highest and lowest number of impacts between the conceptual alternatives. A scoring range was developed that allowed for a score of 1 for those conceptual alternatives having fewer relocations and a score of 5 for the conceptual alternatives having more relocations. Parks impacted by the ROW of conceptual alternatives are also counted; however, these ranged between 0 to 3 due to the number of potentially impacted parks in the study area. Since no option had more than 3 park impacts, the impact number was used for the score rather than a 1 to 5 range.

Cultural resources within the study area are also evaluated in Level 3. The Long Point Schoolhouse, located on Long Point Road north of I-526, is a resource eligible for the National Register of Historic Places (NRHP) due to its contribution to the Snowden Community Historic District[30]. In 2018, community members planned to relocate the schoolhouse to William Ladson Road because the property was purchased by a developer. The schoolhouse has been put on blocks in preparation for the move as shown in **Figure 11.1**. While some of the ROW boundaries of the conceptual alternatives may impact the property where the schoolhouse is located, it was not included as an evaluation metric due to the impending relocation. The project team will continue to monitor this location as alternatives continue to develop.

[30] Cultural Resources Survey of the I-526 Phase II Corridor Improvements Project, February 2019

Figure 11.1: Long Point Schoolhouse

In addition to the impacts described above, a cemetery is located adjacent to the existing I-526 LCC EAST corridor west of Long Point Road along Wando Park Boulevard. Cemeteries are protected from disturbance and desecration under South Carolina state law 16-17-600, making the avoidance of this resource a critical factor in screening the conceptual alternatives. Scores for each conceptual alternative can be found in **Appendix C**.

11.2 Level 3 Screening Results

The results of each Level 3 screening category for the conceptual alternatives are summarized in a scoring matrix located in **Appendix C** and briefly discussed below. The Level 3 evaluation determines constraints or a combination of constraints and problems that would prevent a conceptual alternative from being successfully implemented.

11.2.1 Purpose and Need Screening Results

A conceptual alternative that expands I-526 LCC EAST corridor from a 4-lane facility to an 8-lane facility was utilized to develop a microsimulation model in VISSIM. The lane configuration of this model is representative of all seven end-to-end alternatives. This model is used for comparison between the No-build alternative and an 8-lane conceptual alternative to assess the degree of congestion relief. The results of this analysis are not used to eliminate alternatives but rather assist in the continued refinement in the project design and potential traffic operations to further improve the overall performance of the project at an appropriate scale.

Origins and Destinations

To develop an understanding of the operational challenges that contribute to congestion along the I-526 LCC EAST corridor, travel patterns that will occur along the facility in the 2050 analysis year are examined. It is important to note that due to the need to incorporate future improvements on the I-526 LCC WEST corridor with future improvements on the I-526 LCC EAST corridor, the current direct access to Virginia Avenue will be relocated to have access to North Rhett Avenue in the eastbound direction and a new on-ramp location in the westbound direction. The subsequent origin and destination figures reflect the proportional traffic demands experienced along both I-526 travel directions[31]. The thickness of the line indicates the relative traffic demand for that segment of the facility. The origins are shown on the figures horizontally and the destinations are shown vertically. **Figure 11.2** shows that Long Point Road is a significant source of traffic demand and Clements Ferry Road is a major destination in the westbound travel direction.

[31] Data used to develop figures in this section are based on outputs from the VISSIM models built using *PTV VISSIM 9.00.*

Figure 11.2: Origin and Destination Matrix, I-526 LCC EAST Corridor Westbound

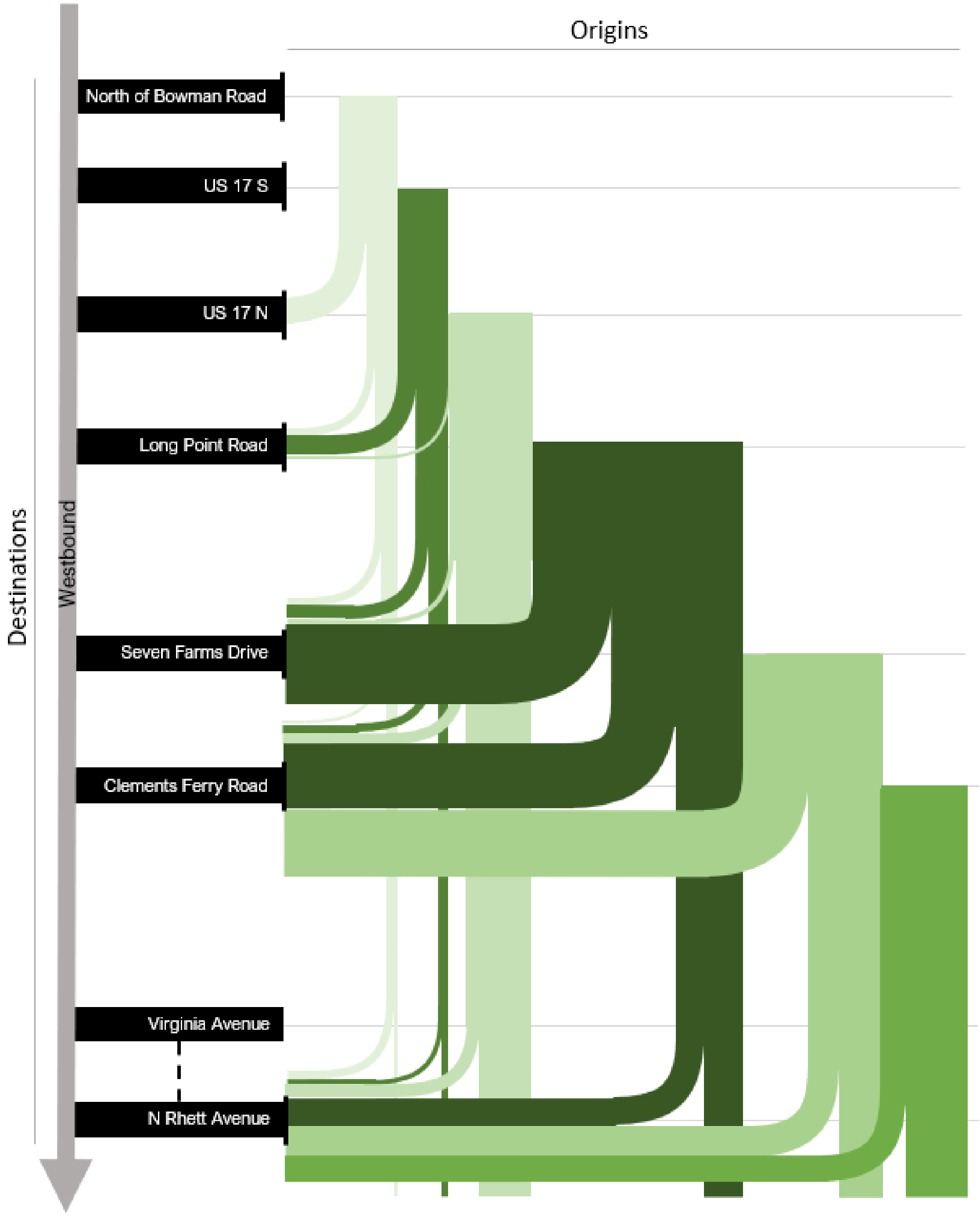
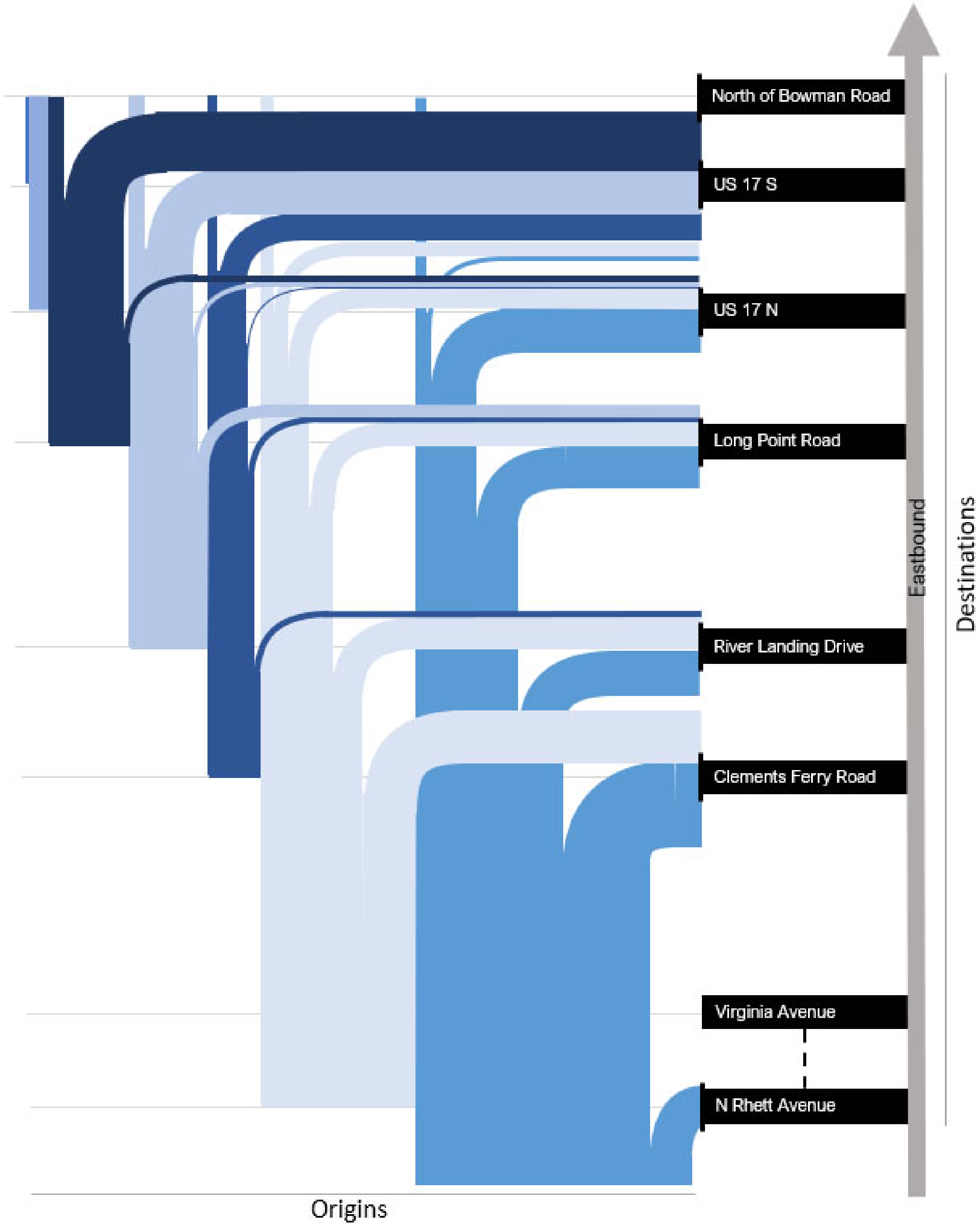


Figure 11.3 illustrates the proportional traffic demands experienced along the I-526 eastbound routes. As the figure shows, a majority of the traffic demand begins along I-526 near North Rhett Avenue and disperses primarily to Clements Ferry Road, Long Point Road, and U.S. 17 North. U.S. 17 South is a significant destination for the eastbound travel direction. This is explained due to the geographical layout of the Charleston area where the prevalence of waterways restricts many travel routes resulting in limited options to U.S. 17. I-526 is one of two options to reach the Mount Pleasant area from North Charleston.

Figure 11.3: Origin and Destination Matrix, I-526 LCC EAST Corridor Eastbound



Peak Period Speeds

Figure 11.4 illustrates the average AM Peak Hour speeds along the I-526 LCC EAST corridor for the 2050 No-build alternative. As shown in the figure, speeds are significantly slower near the beginning of the eastbound direction upon approaching the Don Holt Bridge. The eastbound travel direction shows slower speeds in the last 15-minute period of the peak hour approaching North Rhett Avenue.

Figure 11.4: No-build Alternative, AM Peak Period Speeds

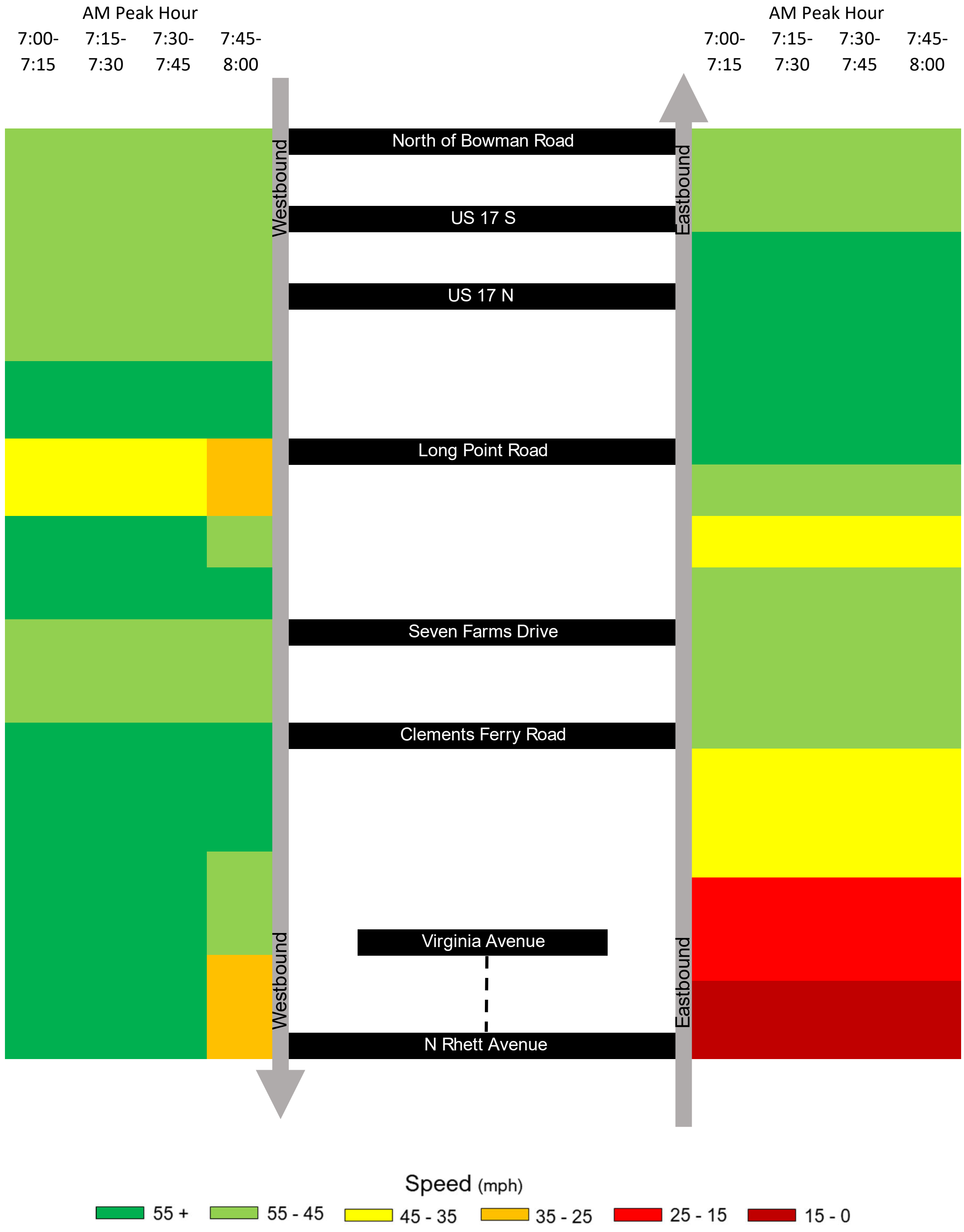


Figure 11.5 illustrates the average PM Peak Hour speeds along the I-526 LCC EAST corridor for the 2050 No-build alternative. As shown in the figure, speeds are significantly slower near the beginning of the eastbound corridor. Speeds are also slow crossing the Don Holt Bridge and near Long Point Road. The eastbound direction in the model experiences traffic metering due to heavy congestion, resulting in false acceptable speeds. Since the traffic cannot pass the bottleneck, only a few cars can proceed and therefore can travel at a faster speed than would realistically happen if all vehicles could pass without hindrance. The results also indicate drastically higher speeds in the westbound direction after slower speeds leading to the Seven Farms Drive interchange. This is also a result of severe traffic metering in the model.

Figure 11.5: No-build Alternative, PM Peak Period Speeds

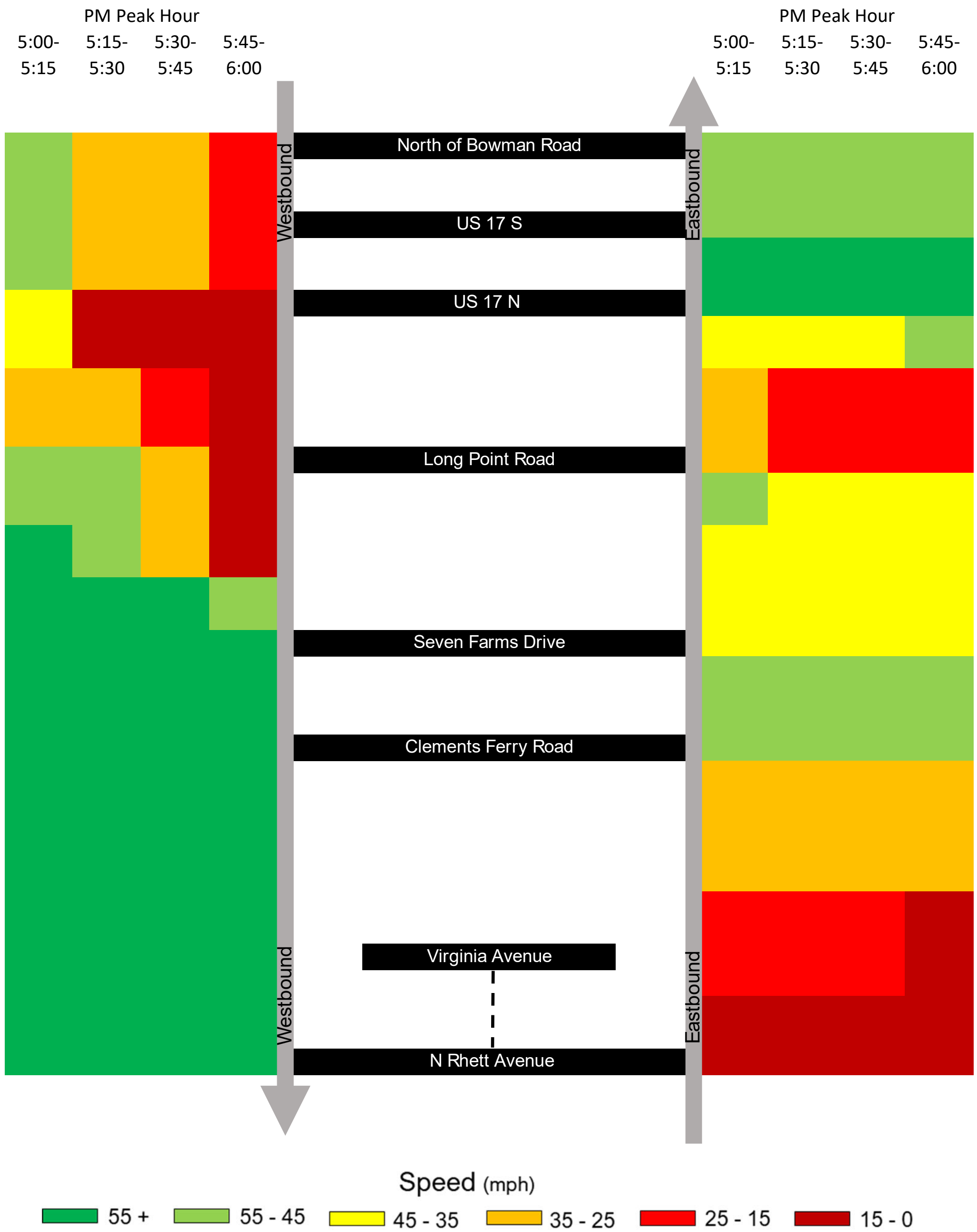


Figure 11.6 shows the average AM Peak Hour speeds along the I-526 LCC EAST corridor for the 2050 8-lane conceptual alternative. The speeds which were significantly slower near the beginning of the eastbound direction in the 2050 AM No-build alternative are shown to be alleviated in the 2050 AM Peak Hour for the 8-lane conceptual alternative. Speeds near the Bowman Road project limit slow slightly compared to the 2050 AM No-build alternative due to approaching a signalized intersection which will reduce speeds and create a delay; however, this is acceptable based on the 45-mph speed limit in this area. It should be noted that the lanes near the project limit near Bowman Road gradually reduce back down to a 4-lane facility to align with the existing footprint at Bowman Road.

Figure 11.6: 8-lane Conceptual Alternative, AM Peak Period Speeds

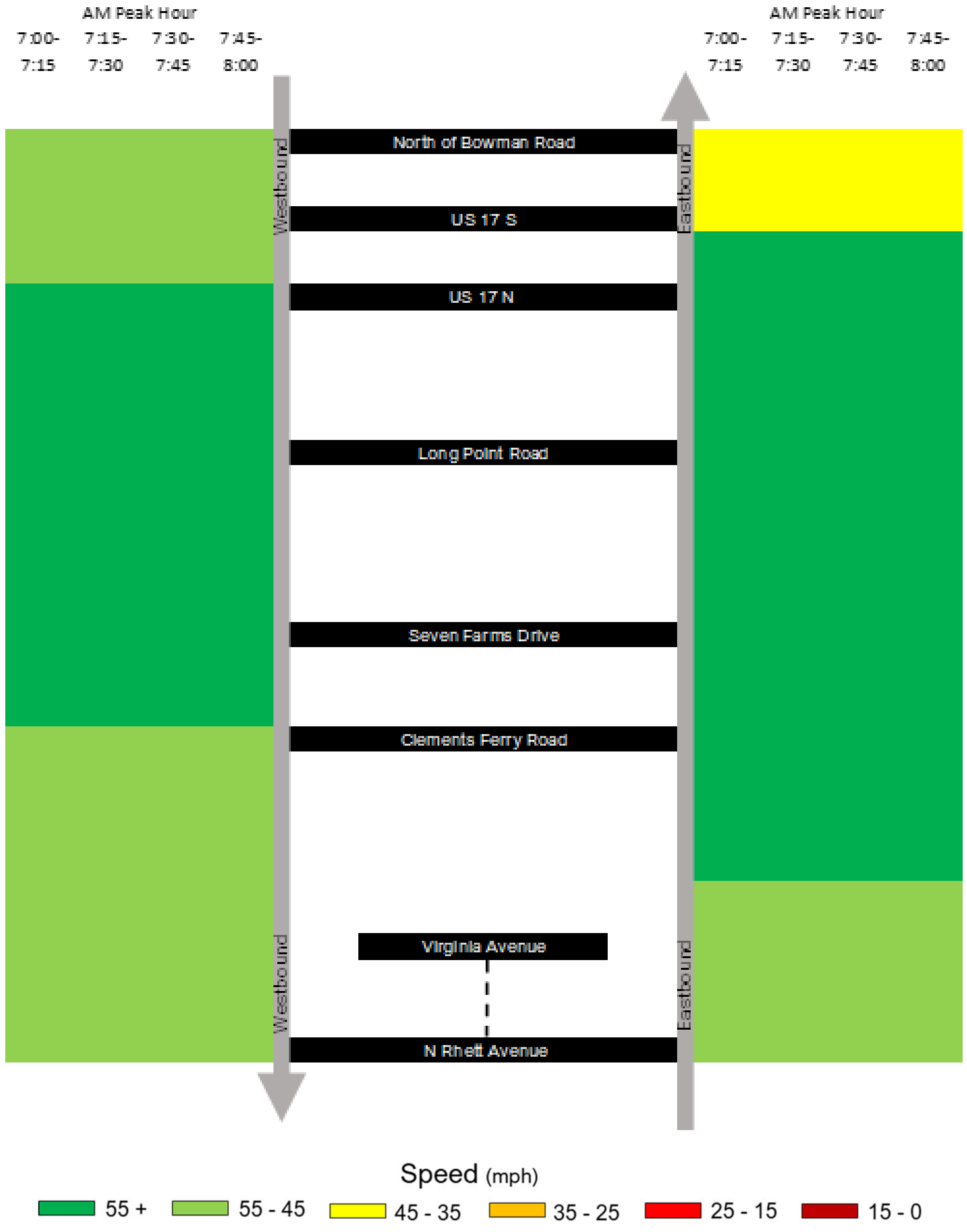


Figure 11.7 shows the average PM Peak Hour speeds along the I-526 LCC EAST corridor for the 2050 PM 8-lane conceptual alternative. The speeds shown in the 2050 PM No-build alternative which were significantly slower near the beginning of the eastbound direction and slow as crossing the Don Holt Bridge as well as near Long Point Road improve in the 2050 PM 8-lane conceptual alternative. Speeds near the Bowman Road project limit slow slightly similar to the 2050 AM 8-lane conceptual alternative. The traffic metering in the eastbound direction near Seven Farms Drive is alleviated where traffic can move freely on the corridor.

Figure 11.7: 8-lane Conceptual Alternative, PM Peak Period Speeds

Peak Period Density

Figure 11.8 and **Figure 11.9** show the correlating densities of the average AM and PM Peak Hours along the I-526 LCC EAST corridor for the 2050 No-build. These figures show how the densities, which directly relate to congestion, fluctuates over the peak hours. Densities shown in the red hues reflect results that are generally not acceptable. The westbound congestion in the last 15-minute period of the AM peak hour approaching North Rhett Avenue is shown to cause a backup along the Don Holt Bridge that correlates to the minimal speed reductions are noted in **Figure 12.4**. The remaining AM and PM No-build densities in red reflect where traffic metering occurs in the model as previously discussed.

Figure 11.8: No-build Alternative, AM Peak Period Density

Figure 11.9: No-build Alternative, PM Peak Period Density

Figure 11.10 and **Figure 11.11** show the densities of the average AM and PM Peak Hours along the I-526 LCC EAST corridor for the 2050 8-lane conceptual alternative. A review of the densities along the I-526 LCC EAST corridor shows that the 2050 8-lane conceptual alternative addresses congestion experienced in the 2050 No-build alternative. However, there are two areas along the corridor that experience higher density than the No-build. The AM Peak Hour shows higher densities in the westbound travel direction approaching Virginia Avenue. In the 2050 analysis years, there will be changes in access that will create new decision points where traffic will change routes. This congestion is related to the left-side merge ramp as the I-526 LCC EAST connects to the I-526 LCC WEST project due to limited space to tie into the I-526 LCC westbound corridor.

Figure 11.10: 8-lane Conceptual Alternative, AM Peak Period Density

Figure 11.11 shows the densities of the average PM Peak Hours along the I-526 LCC EAST corridor for the 2050 8-lane conceptual alternative. The results reflect similar eastbound results near the project limit at Bowman Road as traffic slows due to the approaching signalized intersection resulting in increased delay.

Figure 11.11: 8-lane Conceptual Alternative, PM Peak Period Density

Travel Time Index

Table 11.2 presents the travel time results from VISSIM for the critical routes. These travel times are used to produce the resulting TTI for each route. This metric assists in determining a relative improvement in congestion because it negates the impact of travel distance. The TTI metric is a unitless ratio that represents a comparison of free-flow conditions and peak hour conditions throughout the same travel route. TTI can be used to describe the severity of congestion under the following scheme[32]:

- Moderate Congestion: 1.1<TTI≤1.5
- Significant Congestion: 1.5<TTI≤2.0
- Severe Congestion: TTI>2.0

The TTI of both the AM and PM 2050 No-build conditions reflect severe congestion along all routes with a TTI greater than 2.0. The 2050 8-lane conceptual alternative show TTI metrics are less than 2.0 for all routes except four routes in the westbound direction.

Table 11.2: VISSIM Results for Critical Routes

Common Origin-Destination Path		2050 No Build Free Flow Travel Time (minutes)	2050 No Build Average Peak-Hour Travel Time (minutes)	2050 No Build Average Peak-Hour TTI	2050 Build Free Flow Travel Time (minutes)	2050 Build Average Peak-Hour Travel Time (minutes)	2050 Build Average Peak-Hour TTI
Eastbound	I-526 west of N. Rhett Ave. to. U.S. 17 S	9.27	48.91	5.28	9.27	16.97	1.83
	N. Rhett Ave. to Clements Ferry Rd. NB	2.54	15.51	6.11	2.83	4.62	1.63
	N. Rhett Ave. to Long Point Rd.	6.26	27.50	4.39	6.57	12.63	1.92
	Clements Ferry Rd. to U.S. 17 N	4.85	17.59	3.62	4.89	9.29	1.90
	River Landing Drive to U.S. 17 S	4.35	15.14	3.48	4.34	7.90	1.82
	Long Point Rd. to U.S. 17 N	1.12	2.81	2.50	1.15	1.42	1.23
Westbound	U.S. 17 N to I-526 west of N Rhett Ave.	9.55	57.80	6.05	9.56	20.91	2.19
	U.S. 17 N to Seven Farms Drive.	4.54	53.79	11.85	4.55	7.67	1.69
	Long Point Rd. to Clements Ferry Rd.	3.93	42.13	10.73	4.03	7.59	1.88
	Long Point Rd. to I-526 west of N. Rhett Ave.	7.81	42.63	5.46	7.87	18.56	2.36
	Seven Farms Dr. to N Rhett Ave.	3.51	9.16	2.61	3.60	9.47	2.63
	Clements Ferry Rd. to I-526 west of N Rhett Ave.	3.47	10.10	2.91	3.45	10.66	3.09

[32] Sisiopiku, V. P., and S. Rostami-Hosuri. "Congestion Quantification Using the National Performance Management Research Data Set." Data 2, № 4 (2017): 39.

Table 11.3 shows the change in TTI for the critical routes. Although four routes in the westbound are over 2.0 there were relative improvements in congestion by a TTI reduction for two of the routes. The remaining two routes that experienced an increase in TTI are Seven Farms Drive to North Rhett Avenue and Clements Ferry Road to I-526 west of North Rhett Avenue. This occurs due to the severe traffic metering in the No-build model which reduces the congestion in those segments. Since the No-build is the basis for comparison and the Build model allows for traffic to access these segments the TTI ratio reports as an increase in congestion. However, the Build condition improves congestion by adding capacity. TTI for all routes in the corridor is provided in the *I-526 LCC EAST Travel Time Analysis Technical Memorandum* under a separate cover.

Table 11.3: TTI Change Critical Routes

Common Origin-Destination Path		2050 No Build Average Peak-Hour TTI	2050 Build Average Peak-Hour TTI	2050 TTI Change
Eastbound	I-526 west of N. Rhett Ave. to. U.S. 17 S	5.28	1.83	-3.44
Eastbound	N. Rhett Ave. to Clements Ferry Rd. Northbound	6.11	1.63	-4.47
Eastbound	N. Rhett Ave. to Long Point Rd.	4.39	1.92	-2.47
Eastbound	Clements Ferry Rd. to U.S. 17 N	3.62	1.90	-1.73
Eastbound	River Landing Drive to U.S. 17 S	3.48	1.82	-1.66
Eastbound	Long Point Rd. to U.S. 17 N	2.50	1.23	-1.27
Westbound	U.S. 17 N to I-526 west of N Rhett Ave.	6.05	2.19	-3.86
Westbound	U.S. 17 N to Seven Farms Drive.	11.85	1.69	-10.17
Westbound	Long Point Rd. to Clements Ferry Rd.	10.73	1.88	-8.85
Westbound	Long Point Rd. to I-526 west of N. Rhett Ave.	5.46	2.36	-3.10
Westbound	Seven Farms Dr. to N Rhett Ave.	2.61	2.63	+0.02
Westbound	Clements Ferry Rd. to I-526 west of N Rhett Ave.	2.91	3.09	+0.18

The results of VISSIM model indicate that all but two critical routes in the study area show a reduction in TTI when compared to the No-build. Furthermore, the majority of critical routes show a reduction in TTI to a level below the severe congestion threshold of 2.0. Although the 2050 8-lane conceptual alternative addresses several of the congestion concerns along the corridor compared to 2050 No-build, additional TSMO measures should be considered as mentioned in the Level 1 Screening as the TTI results indicate significant or severe congestion. As traffic demands grow, there are limits to construction of additional lanes, creating a need for additional TSMO measures which are summarized in the Supplemental Options in the next chapter.

11.2.2 Engineering, Natural Resource, and Community and Built Environment Resources Screening Results

The results of the engineering, natural resources, and community and built environment resources screening are provided in **Table 11.4**.

Table 11.4: Level 3 Engineering and Environmental Impact Scoring Results

Alternative	Engineering		Natural Resource	Community and Built Environment**		Total Score
	Constructability*	Design*		Relocations	Park	
Alternative 1	9.0	7.5	1.0	4.0	3.0	24.5
Alternative 2	9.0	7.5	1.0	4.0	3.0	24.5
Alternative 3	7.8	5.8	5.0	5.0	3.0	26.6
Alternative 4	9.8	7.6	1.0	4.0	2.0	24.4
Alternative 5	9.0	8.8	1.0	3.0	3.0	24.8
Alternative 6	9.0	7.5	1.0	1.0	3.0	21.5
Alternative 7	9.0	7.5	2.0	4.0	3.0	25.5

*Sum of Level 2 scoring for Sections 1-3.

The goal of the Level 3 screening is to ensure that those conceptual alternatives having the most potential to be implemented move forward. A detailed discussion of each of the conceptual alternatives removed from further consideration is provided below.

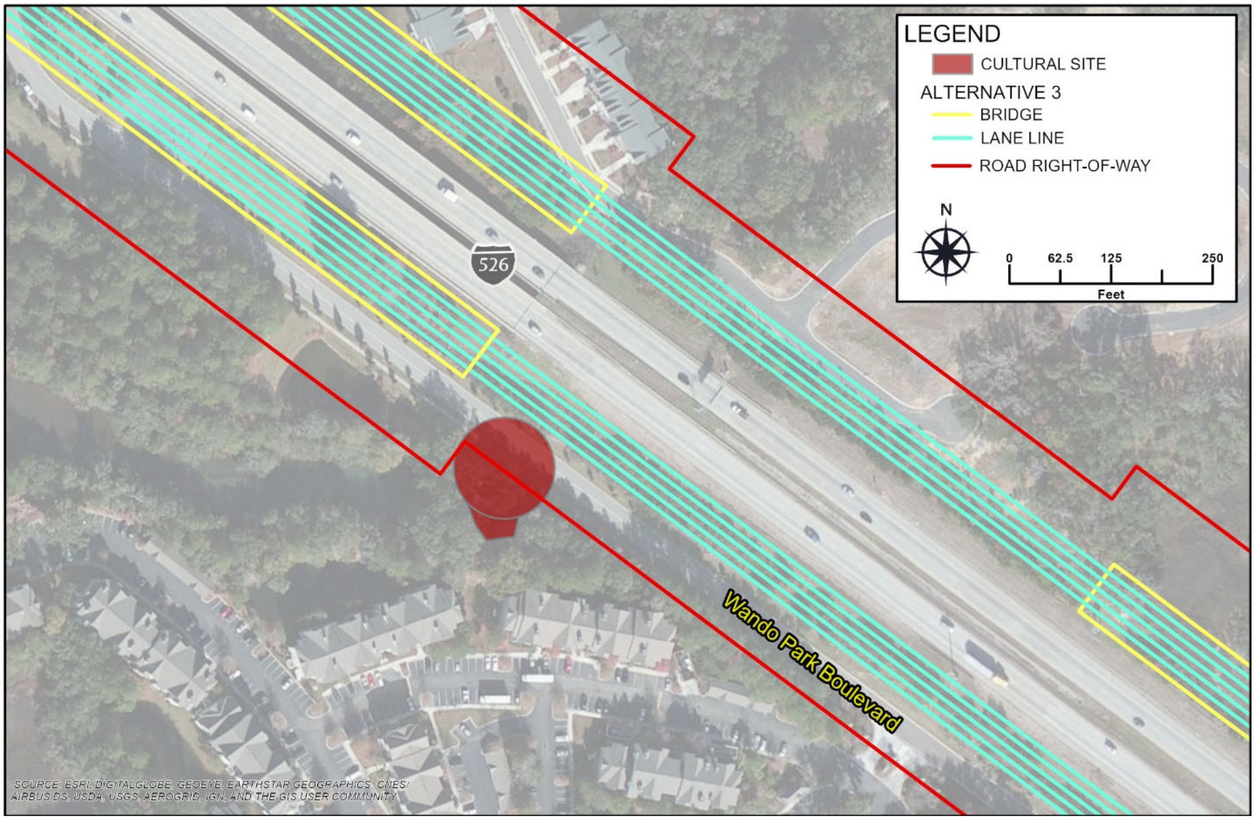
11.2.3 Level 3 Screening – Conceptual Alternatives Eliminated

The Level 3 screening identified Alternative 3 and Alternative 6 to be removed from further consideration due to constraints that would prevent them from being successfully implemented.

Alternative 3

Alternative 3 replaces the Don Holt bridge by constructing two new four-lane bridges. The new bridge structures would be built north and south of the existing bridge structure. The Wando bridges would be replaced by constructing two new four-lane bridges on each side of the existing structures (single-stage with larger footprint). The existing Wando bridges would then be removed. The symmetrical expansion to the north and south of the current facility results in the largest ROW footprint of all the conceptual alternatives. To accommodate the southward expansion of Alternative 3, Wando Park Boulevard would need to be relocated. The relocation of Wando Park Boulevard would impact a cultural site (African-American cemetery) illustrated in **Figure 11.12.** In addition, due to the larger footprint, Alternative 3 impacts 215 acres of aquatic resources, resulting in the greatest number of impacts when compared to the other alternatives. This alternative would also significantly impact LTP Daniel Island (tennis complex). Due to the combination of constraints from impacts to the cultural site, aquatic resources, and the tennis complex, that may prevent successful implementation, Alternative 3 is eliminated from further evaluation.

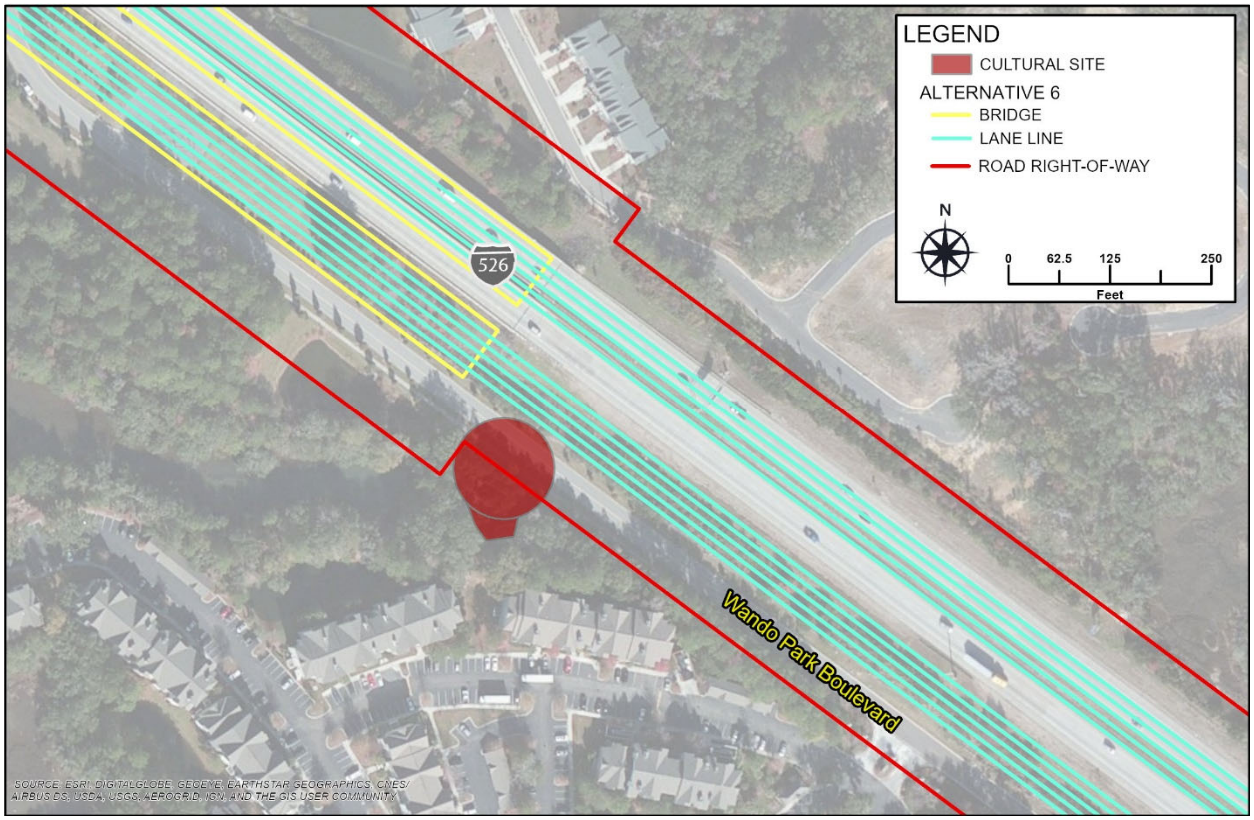
Figure 11.12: Alternative 3 Cultural Site Impact



Alternative 6

Alternative 6 will construct a new four-lane bridge structure south of Don Holt bridge. The existing Don Holt bridge will be removed, and a new four-lane structure will be constructed. The Wando bridge will be replaced with a new four-lane bridge to the south. The existing Wando bridge would be removed, and a new four-lane bridge would be built within the footprint of the existing structure. Due to the new four-lane section to the south, the project would impact the existing Wando Park Boulevard west of Long Point Road. This impact would require Wando Park Boulevard's relocation and will impact a protected cemetery (African-American cemetery) **Figure 11.13**. This alternative would also significantly impact the tennis complex on Daniel Island. Due to the combination of constraints from impacts to the cultural site and the tennis complex, that may prevent successful implementation, Alternative 6 is eliminated from further evaluation.

Figure 11.13: Alternative 6 Cultural Site Impact



11.2.4 Summary of Level 3 Screening

The Level 3 screening resulted in the removal of two conceptual alternatives from further analysis and five conceptual alternatives are carried forward. Alternative 3 and Alternative 6 are removed due to their potential impact on a cultural site. The five alternatives carried forward include two conceptual alternatives that retain the Don Holt Bridge while adding capacity to the north or south (Alternative 1 and Alternative 2). The other three conceptual alternatives replace both bridge structures while adding capacity to the north, south, or symmetrically (Alternatives 4, 5, and 7).

12.0 Public Response to Reasonable Alternatives

12.1 Public Presentation of Reasonable Alternatives

The five alternatives that were advanced through levels 1-3 of the alternatives analysis screening process were presented to the public as reasonable alternatives in the fall of 2021. These reasonable alternatives were presented in a variety of methods including a project website and two in-person public information meetings.

The goals of the meetings were to present the following:

- Range of alternative
- Alternative screening process
- Reasonable alternative performance
- Conceptual options for the Long Point Road Interchange

During these meetings and during the associated public comment periods, frequently expressed comments included:

- Support for the Long Point Road interchange improvements
- Concerns about impacts to residential relocations
- Truck traffic concerns
- Noise and safety concerns

Public and stakeholder comments on the reasonable alternatives following the second round of public meetings indicated a desire to look at ways to reduce impacts to the residential areas. This sentiment was expressed specifically in the area north of I-526 between the Wando River and Long Point Road.

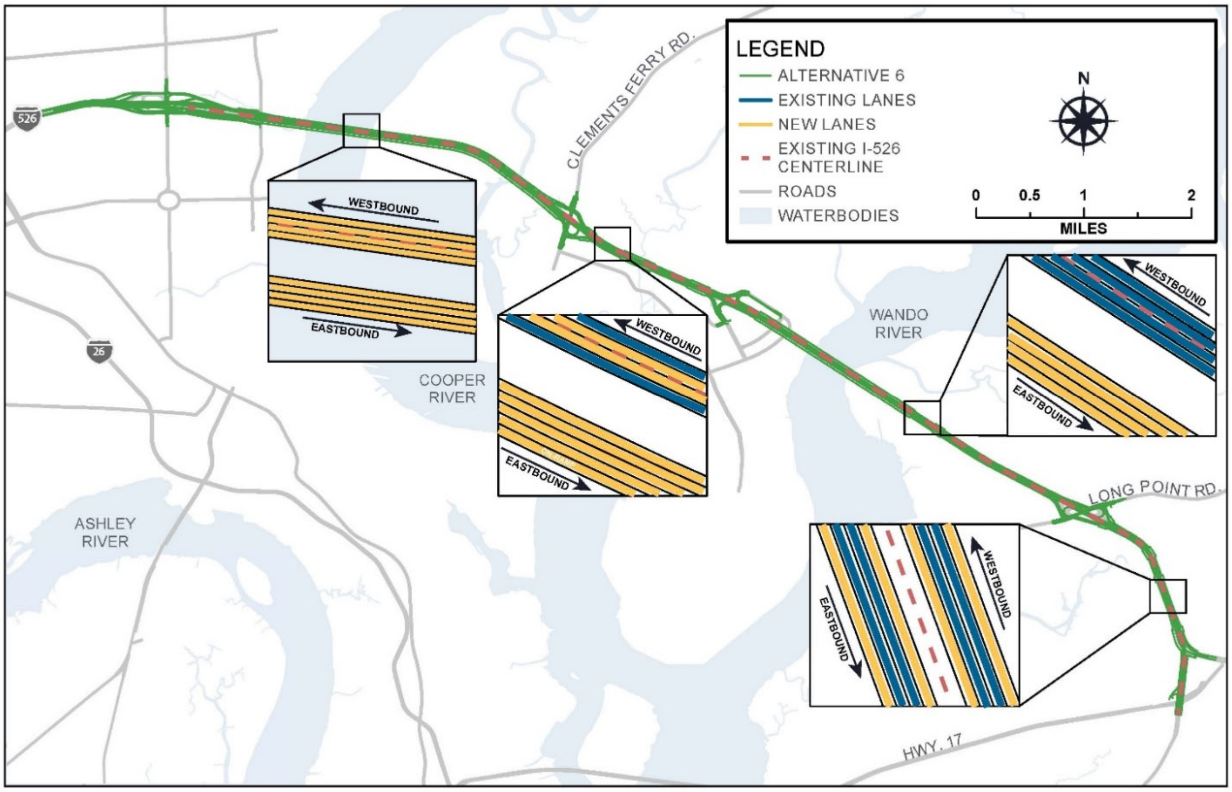
12.2 Additional Alternatives To be Carried Forward

Feedback from SCDOT and FHWA following the public meetings indicated the need to advance alternatives that were previously eliminated due to potential impacts to a cultural site (African American Cemetery). The potential impact to the cultural site should not be considered a fatal flaw at the level of detail used in this planning study. In addition, public feedback received during the public comment period indicated a desire to have additional options that not only meet the project needs, but also reduce the number of relocations. Due to this, the project team advanced Alternative 6 and Alternative 8 as Reasonable Alternatives which are further described below.

12.2.1 Alternative 6

Alternative 6 was previously eliminated in the Level 3 screening due to potential impacts on a cultural site. This alternative consists of constructing a new, four-lane bridge south of the existing Don Holt bridge, then the existing Don Holt bridge will be removed, and a new four-lane structure would be constructed where the current alignment is located. Traveling east of the Clements Ferry Road interchange, the Wando bridges would be replaced with a new four-lane bridge to the south. The existing Wando bridges would then be removed, and a new four-lane bridge would be built within the footprint of the existing structure. The existing facility's remaining section would be widened to the inside and outside using the existing median. This widening would begin before the Long Point Road interchange and travel east to the U.S. 17 interchange.

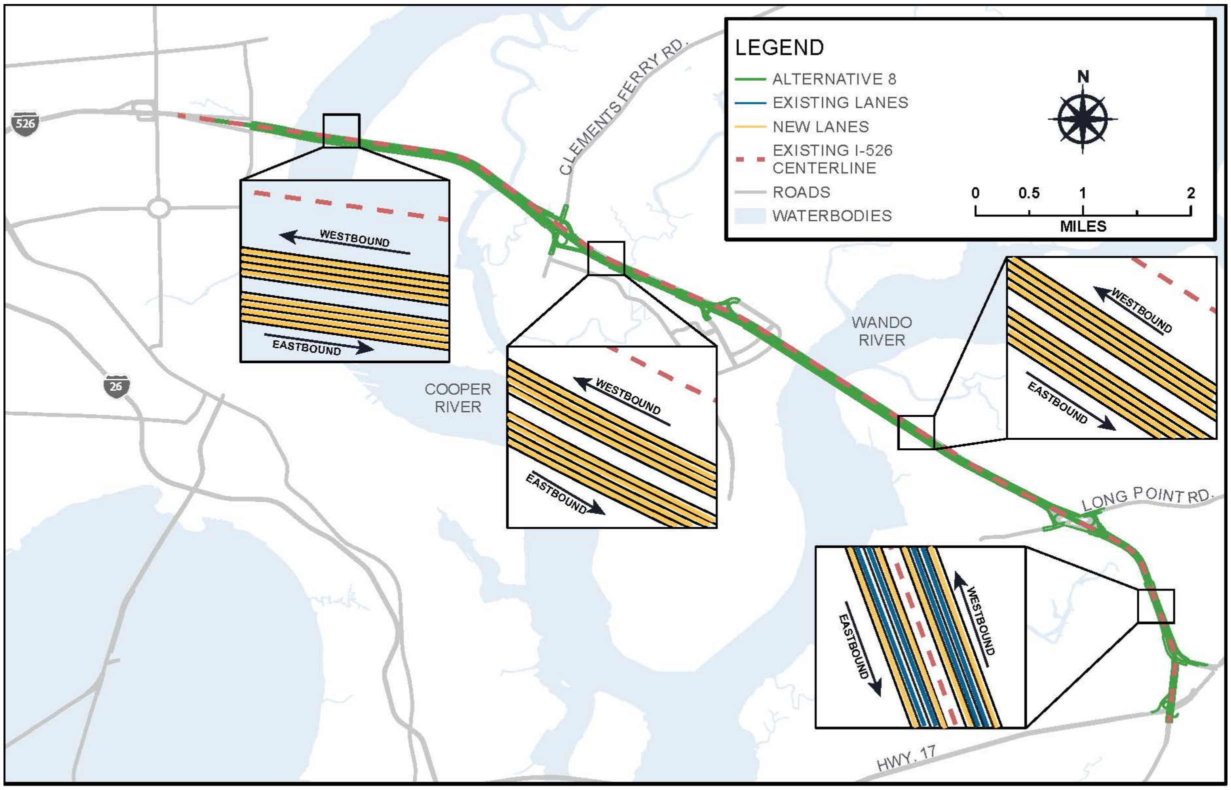
Figure 12-1: Alternative 6



12.2.2 Alternative 8

Alternative 8 was developed using conceptual design options 1-G and 2-G which were previously eliminated in the Level 2 screening due to potential impacts on a cultural site combined with option 3-A. This alternative consists of constructing a new eight-lane bridge south of the existing Don Holt bridge, then the existing Don Holt bridge will be removed. The new eight-lane section would continue along the south of the existing facility to the east of Clements Ferry Road interchange. This concept would replace the Wando bridge by constructing a new eight-lane bridge south of the existing structures, the existing Wando bridge would then be removed. The existing facility's remaining section would be widened to the inside and outside using the existing median. This widening would begin before the Long Point Road interchange and travel east to the U.S. 17 interchange.

Figure 12-2: Alternative 8



12.2.3 Alternative 3

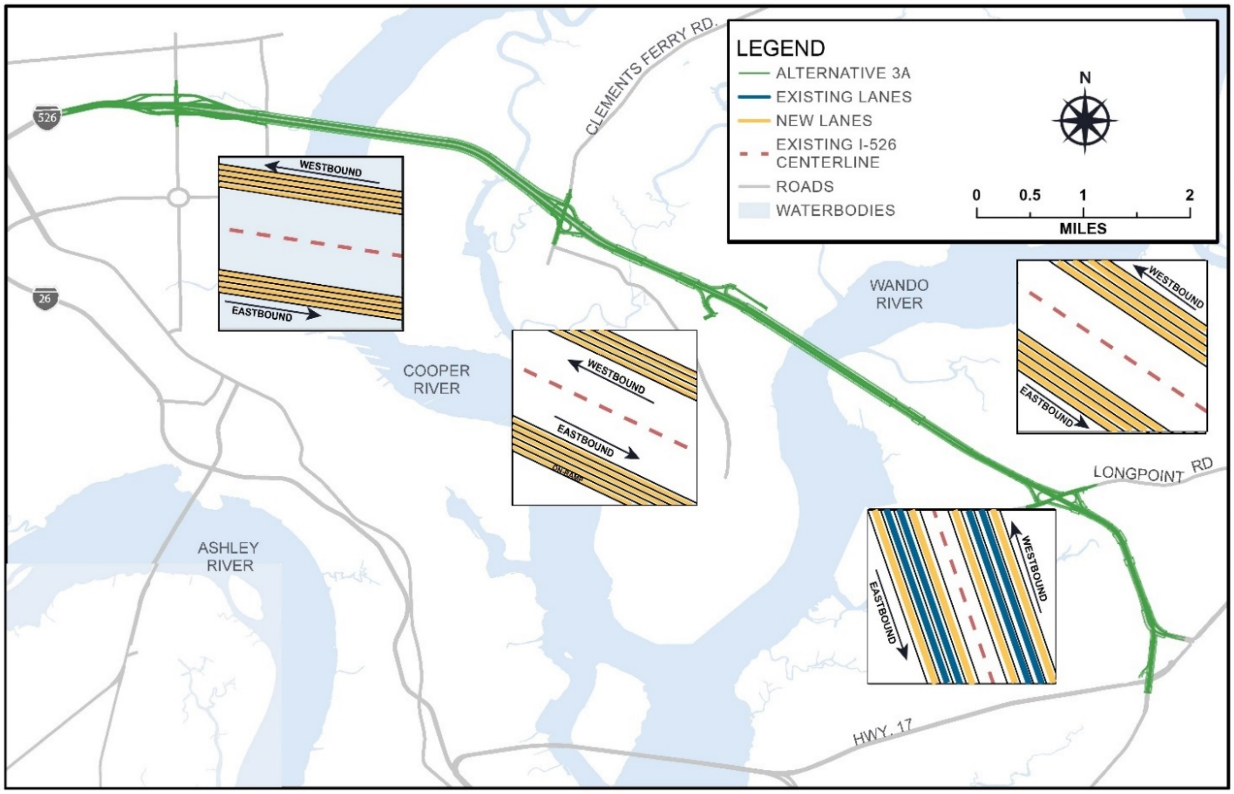
Alternative 3 was eliminated in screening Level 3 due to poor performance and potential impacts on a cultural site. Due to its larger footprint, Alternative 3 impacts 82 relocations and 215 acres of aquatic resources resulting in the greatest number of impacts when compared to the other alternatives. This alternative would also significantly impact LTP Daniel Island (tennis complex). Due to the combination of constraints from relocation and aquatic resource impacts, resulting in a poor score, Alternative 3 remained eliminated from further evaluation.

12.2.4 Alternative 3A

Alternative 3 was the best performing alternative from a constructability and design perspective due to its compatibility with the I-526 LCC WEST project and ability to redirect traffic during the construction process. As a result, the project team developed an additional alternative that retains some of the constructability and design performance from Alternative 3 while also reducing environmental and community impacts between the Wando River and Long Point Road based on comments received from the public.

Alternative 3A was developed to be included as a reasonable alternative to reduce the size of the facility's footprint between the Wando River and Long Point Road. This alternative would replace the Wando River bridges in stages by first constructing two new parallel two-lane bridges, then removing the existing bridges, and widening the newly built bridges to four lanes as illustrated in **Figure 12-3**. This alternative was developed based on a modification of Alternative 3 and provides the benefit of a more compatible connection with the I-526 LCC WEST project that were present in Alternative 3, while also significantly reducing the footprint in areas that will result in fewer community and natural impacts.

Figure 12-3: Alternative 3A



While Alternatives 3A and 8 were not included in the initial screening process, the overall evaluation scores are comparable with other reasonable alternatives as outlined in **Table 12-1**. Alternatives 3A, 6, and 8 meet the criteria to be moved forward as a reasonable alternative.

Table 12-1: Alternative 3A Engineering and Environmental Impact Scoring Results

Alternative	Engineering		Natural Resource	Community and Built Environment		Total Score
	Constructability	Design		Relocations	Park	
Alternative 3A	8.6	5.9	4.0	4.0	2.0	24.5
Alternative 6	9.0	7.5	1.0	1.0	3.0	21.5
Alternative 8	9.8	7.6	1.0	5.0	2.0	25.4

12.3 Impact Comparison for Reasonable Alternatives

Figure 12-4 illustrates how each of the reasonable alternatives compare based on the identified criteria discussed previously in this chapter.

Figure 12-4: Reasonable Alternatives Impact Matrix

	Alternative 1	Alternative 2	Alternative 4	Alternative 5	Alternative 7	Alternative 3A	Alternative 6	Alternative 8
Replaces Don Holt Bridge?	Keep	Keep	NEW Replace + Raise	NEW Replace + Raise	NEW Replace + Raise	NEW Replace + Raise	NEW Replace + Raise	NEW Replace + Raise
Replaces Wando Bridge?	NEW Replace + Lower	NEW Replace + Lower	NEW Replace + Lower	NEW Replace + Lower	NEW Replace + Lower	NEW Replace + Lower	NEW Replace + Lower	NEW Replace + Lower
Impacts to Aquatic Resources (acres)	175 Acres	177 Acres	167 Acres	174 Acres	178 Acres	203 Acres	165 Acres	146 Acres
Relocations	73 (48 residential, 25 commercial)	73 (46 residential, 27 commercial)	80 (68 residential, 12 commercial)	64 (49 residential, 15 commercial)	72 (46 residential, 26 commercial)	72 (48 residential, 24 commercial)	39 (11 residential, 28 commercial)	83 (50 residential, 33 commercial)

13.0 ALTERNATIVES CARRIED FORWARD TO NEPA

The alternatives carried forward for further evaluation in the NEPA phase are summarized below. The alternatives include the No-build Alternative and eight infrastructure improvement alternatives that range in cost from $2.2 to 4.2 billion. In addition to the alternatives carried forward, the supplemental options including TSMO strategies and a dedicated truck ramp to the Wando Welch Port Terminal are also recommended for further evaluation in the NEPA phase.

13.1 NO-BUILD ALTERNATIVE

The No-build Alternative is included as an alternative in the NEPA process as a benchmark against which the impacts of other alternatives can be compared.

13.2 INFRASTRUCTURE IMPROVEMENT ALTERNATIVES

Based on the analysis described above, six conceptual alternatives listed in **Table 13.1** satisfy the project's purpose and need and are determined to be Reasonable Alternatives.

Table 13.1: Reasonable Alternatives

Mainline Build Alternatives	Capacity Option	Costs[1]
Alternative 1	• Retain the Don Holt bridge while adding four lanes to the north. • Replace the Wando bridges with two new parallel two-lane bridges, remove existing bridges, and then widen newly built bridges to four lanes.	$2.2 billion
Alternative 2	• Retain the Don Holt bridge while adding four lanes to the south. • Replace the Wando bridges with two new parallel two-lane bridges, remove existing bridges, and then widen newly built bridges to four lanes.	$2.4 billion
Alternative 3A	• Replace the Don Holt bridge with two new four-lane bridges on either side of the existing facility. • Replace the Wando bridges with two new parallel two-lane bridges, remove existing bridges, and then widen newly built bridges to four lanes.	$3.9 billion
Alternative 4	• Replace the Don Holt bridge with a new eight-lane bridge north of the existing bridge. • Replace Wando bridges with an eight-lane bridge north of the existing bridges.	$3.9 billion
Alternative 5	• Replace the Don Holt bridge with a new four-lane bridge north of the existing bridge, remove the existing bridge, and add a new four-lane bridge where the existing bridge is located. • Replace the Wando bridges with a new four-lane bridge north of the existing bridge, remove the existing bridges, and add a new four-lane bridge where the existing bridge is located.	$4.2 billion

Mainline Build Alternatives	Capacity Option	Costs[1]
Alternative 6	• Replace the Don Holt bridge with a new four-lane bridge south of the existing bridge, remove the existing bridge, and add a new four-lane bridge where the existing bridge is located. • Replace the Wando bridges with a new four-lane bridge south of the existing bridge, remove the existing bridges, and add a new four-lane bridge where the existing bridge is located.	$3.8 billion
Alternative 7	• Replace the Don Holt bridge with a new four-lane bridge north of the existing bridge, remove the existing bridge, and add a new four-lane bridge where the existing bridge is located. • Replace the Wando bridges with two new parallel two-lane bridges, remove existing bridges, and then widen newly built bridges to four lanes.	$3.9 billion
Alternative 8	• Replace the Don Holt bridge with a new eight-lane bridge south of the existing bridge. • Replace Wando bridges with eight-lane bridge south of the existing bridges.	$3.9 billion

13.3 Supplemental Options

13.3.1 TSMO Options

Due to the constraints of the existing bridges along the I-526 LCC EAST corridor, it is not possible to retrofit the existing facility with enough mainline capacity using TSMO strategies alone. However, some TSMO strategies can further support project goals by improving upon the performance of the infrastructure improvement as a supplemental option. The following TSMO options should be incorporated into the continued refinement, design, traffic operational design, and design criteria of the recommended preferred alternative to contribute to meeting project goals and prolonging the performance life of the infrastructure improvements:

- Shoulder lane use
- Traveler information
- Incident management
- Road weather management
- Work zone management
- Enhance lane markings
- Accommodation of connected and autonomous vehicles
- Variable Speed Limits (VSL)
- Park-and-ride lots

13.3.2 Dedicated Truck Ramp to the Wando Welch Port Terminal

A dedicated truck ramp alone cannot provide the appropriate capacity to improve congestion or address roadway deficiencies as a standalone option; however, this truck ramp could be added to any of the mainline infrastructure improvements. This would potentially improve flow and connections to the Wando Welch Terminal by allowing port-related trucks to avoid local traffic on Long Point Road and improve conditions for both trucks and local traffic, helping to achieve the project goal of improving access to port facilities.

APPENDIX A
I-526 PEL Draft Alternative Analysis TM Mapbook

526 EAST
LOWCOUNTRY CORRIDOR

Appendix A: I-526 PEL ALTERNATIVE ANALYSIS TM MAPBOOK

SCDOT

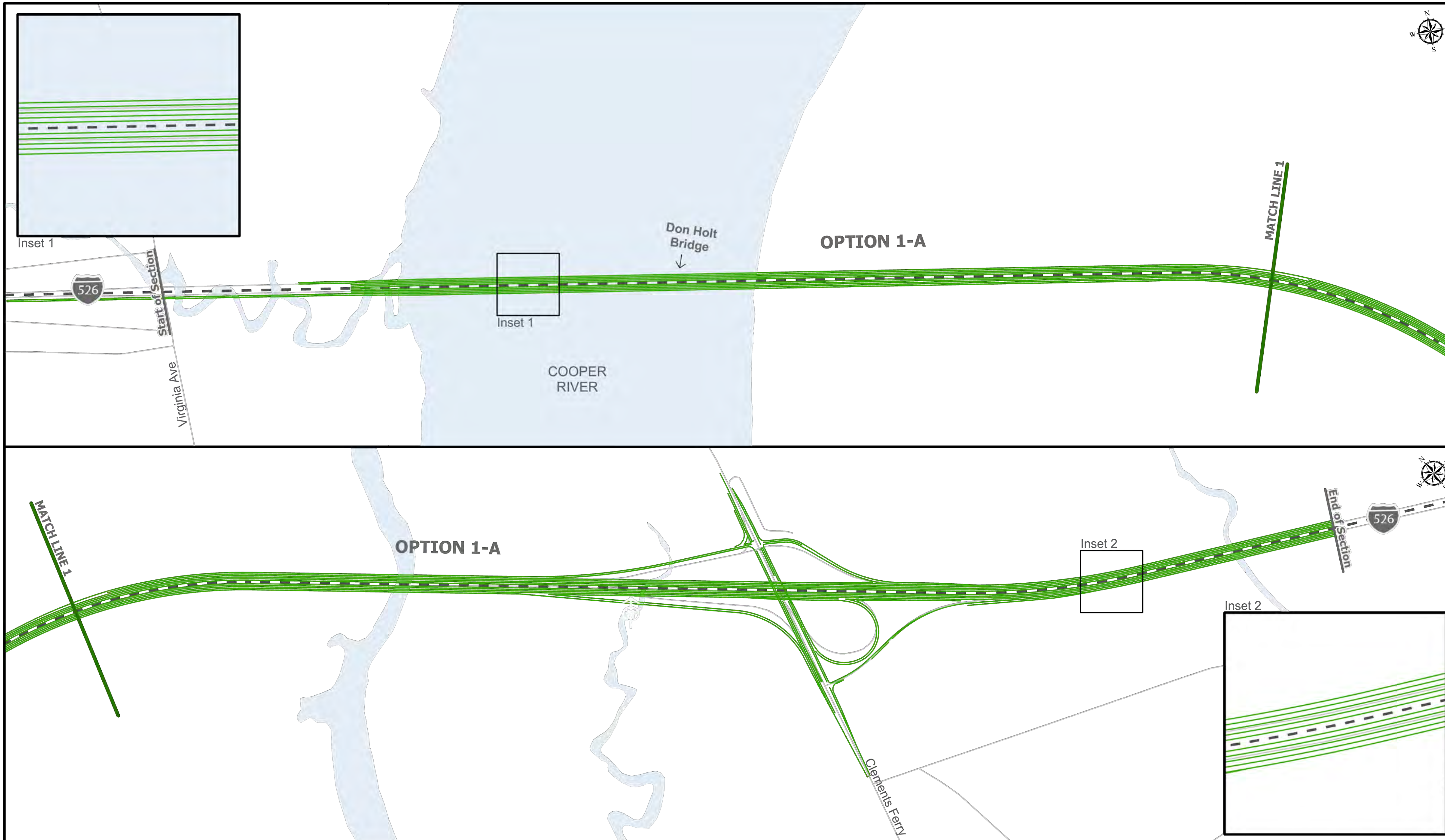
Prepared by:

CDM Smith

June 2021

Level 2

SECTION 01



526 EAST
LOWCOUNTRY
CORRIDOR

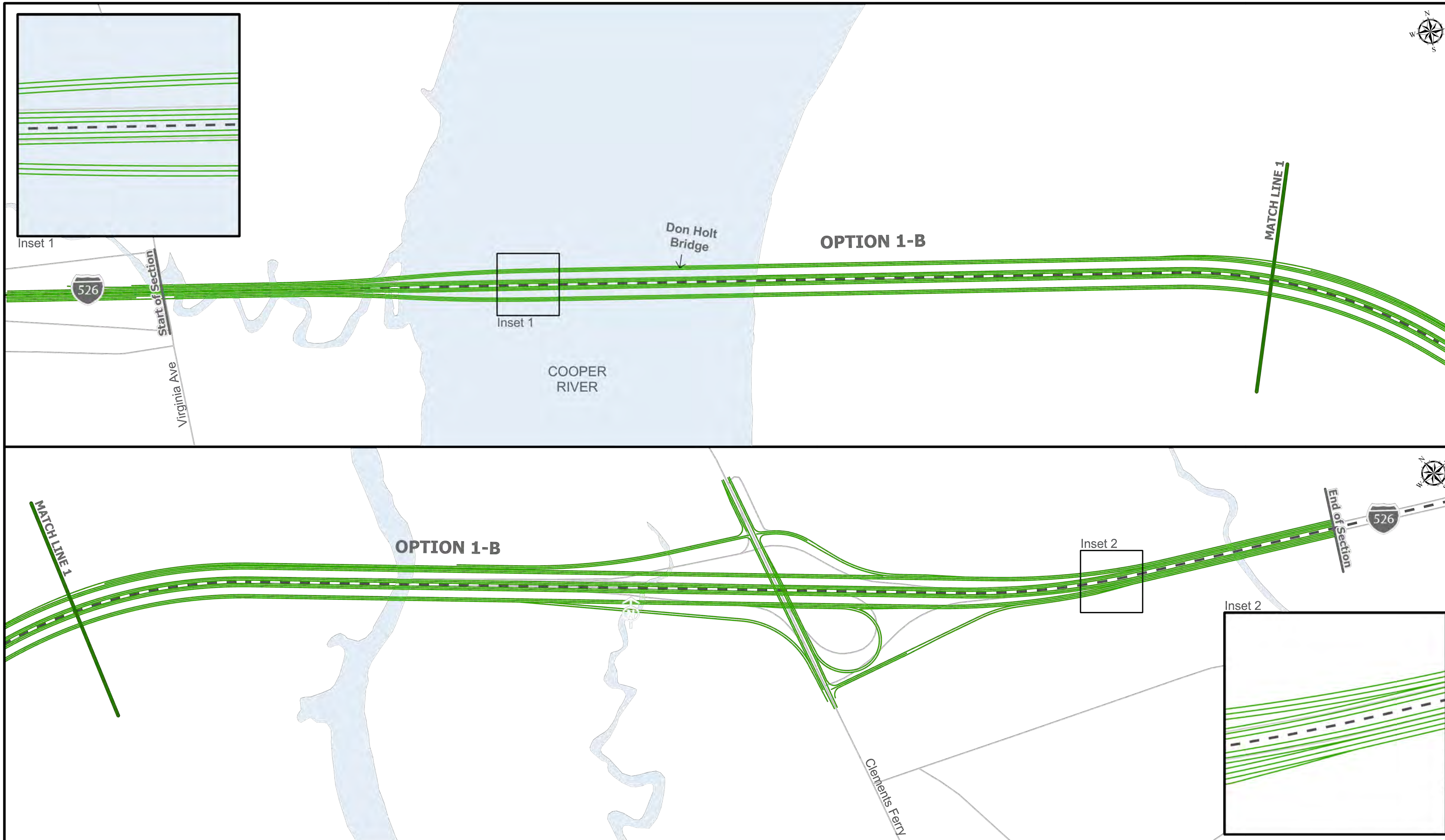
Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 1-A

0 500 1,000 1,500 2,000 Feet

SECTION - 1
OPTION 1-A

Date: 2/8/2021



Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
- - EXISTING I-526 CENTER LINE
— OPTION 1-B

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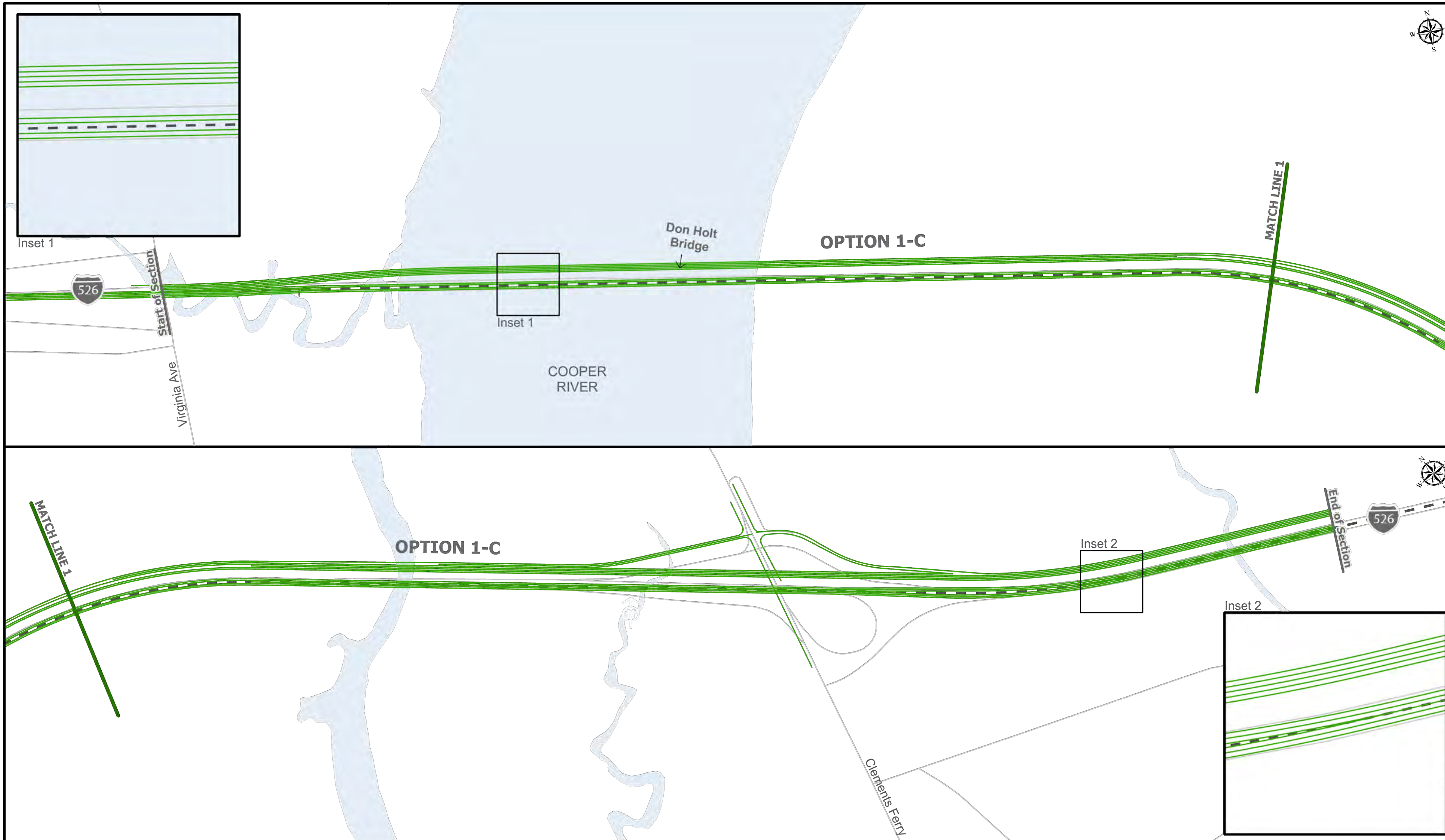
SECTION - 1
OPTION 1-B

Date: 2/8/2021



526 EAST LOWCOUNTRY CORRIDOR

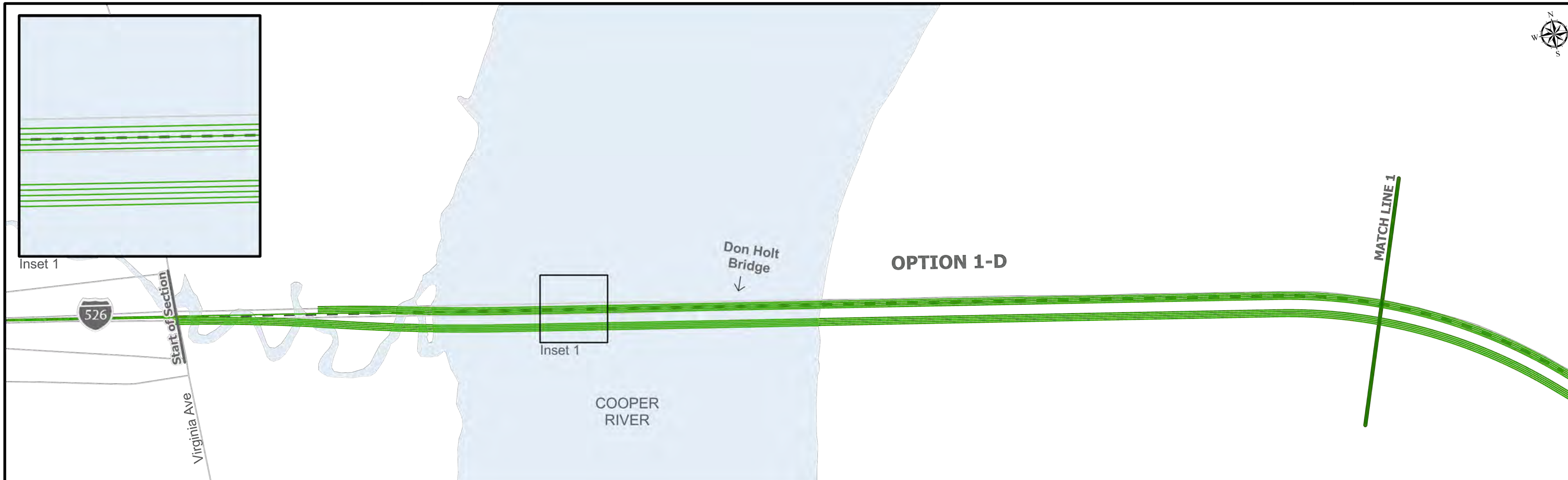
Level 2 Concept Design Options

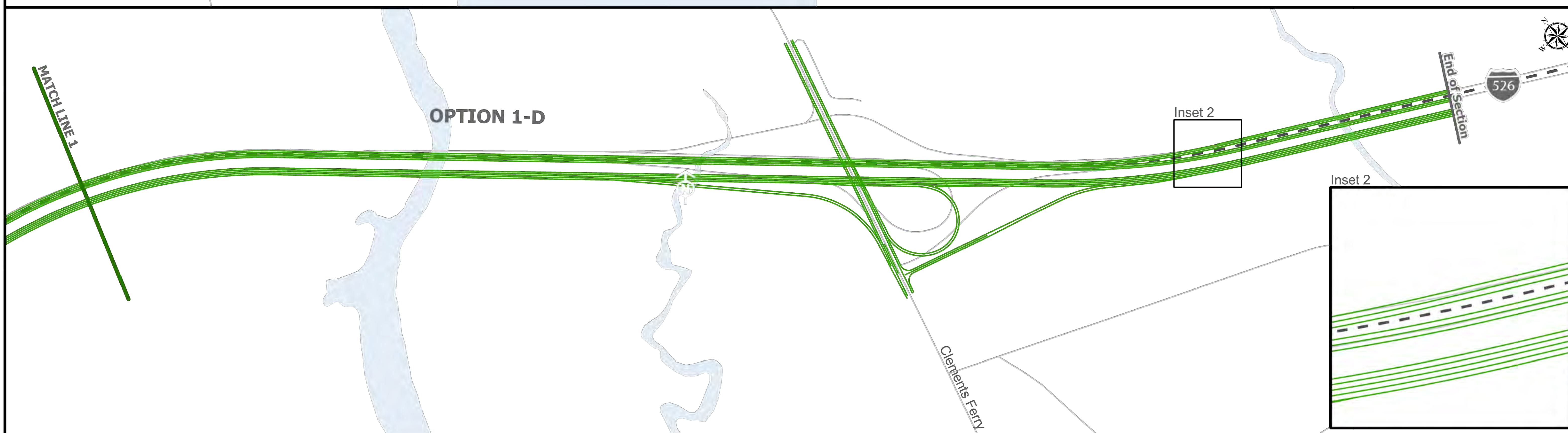
LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 1-C

0 500 1,000 1,500 2,000 Feet

SECTION - 1
OPTION 1-C

Date: 2/8/2021





526 EAST
LOWCOUNTRY CORRIDOR

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 1-D

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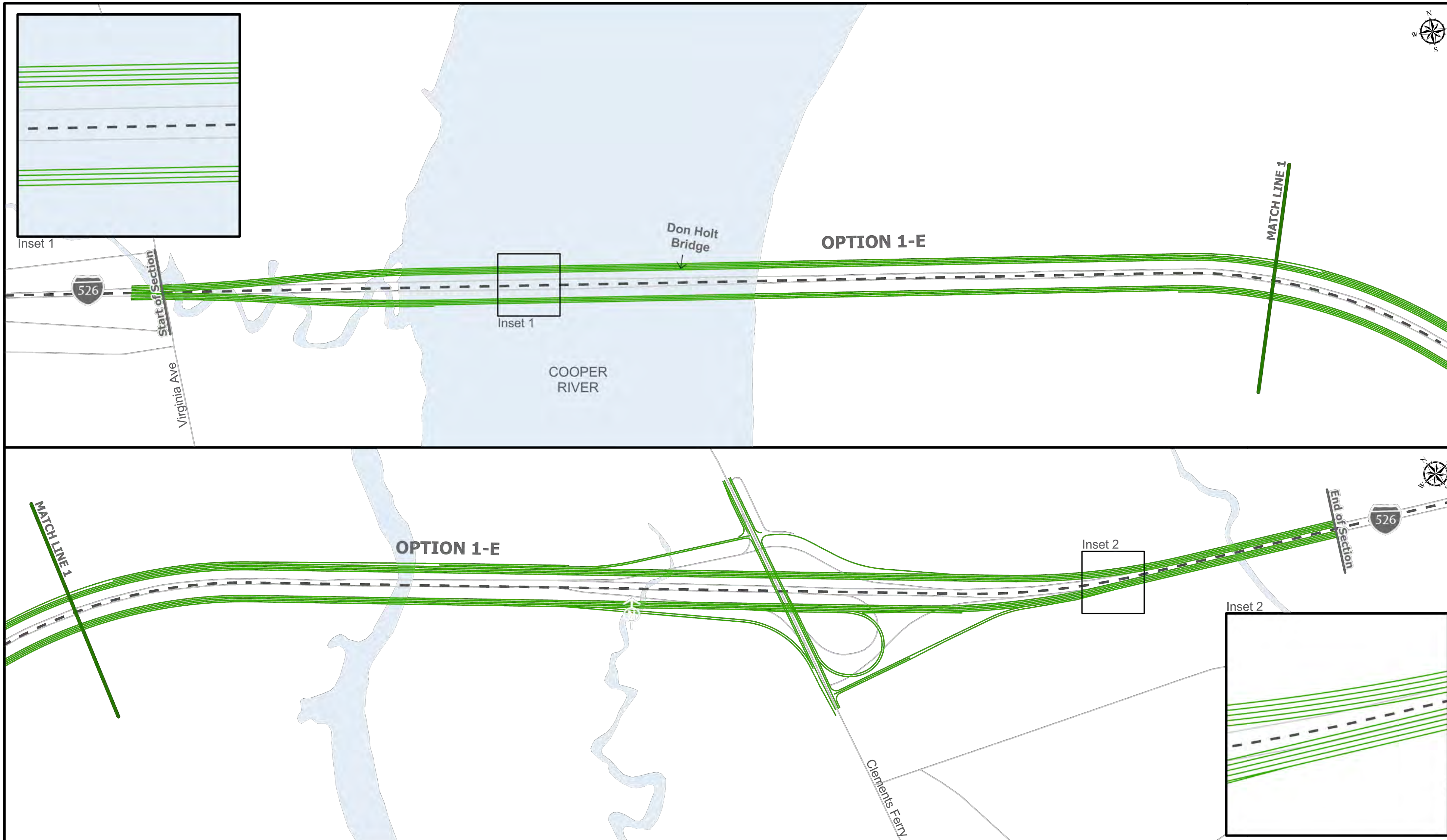
SECTION - 1
OPTION 1-D

Date: 2/8/2021



526 EAST
LOWCOUNTRY CORRIDOR

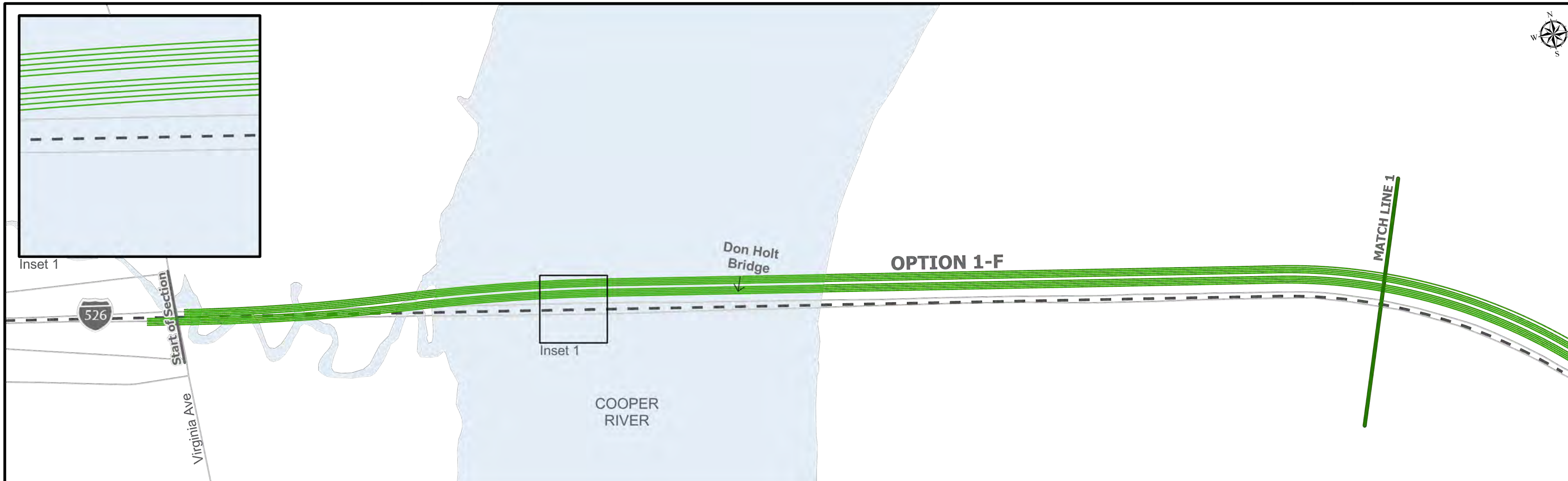
Level 2 Concept Design Options

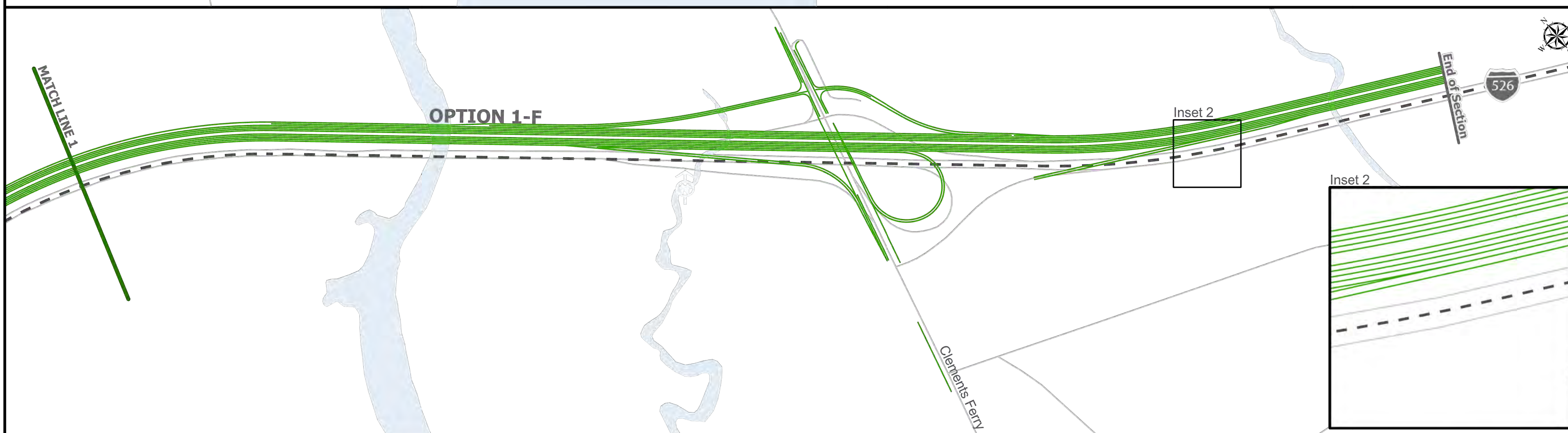
LEGEND
CONCEPTUAL DESIGNS
- - EXISTING I-526 CENTER LINE
— OPTION 1-E

0 500 1,000 1,500 2,000 Feet

SECTION - 1
OPTION 1-E

Date: 2/8/2021





526 EAST
LOWCOUNTRY CORRIDOR

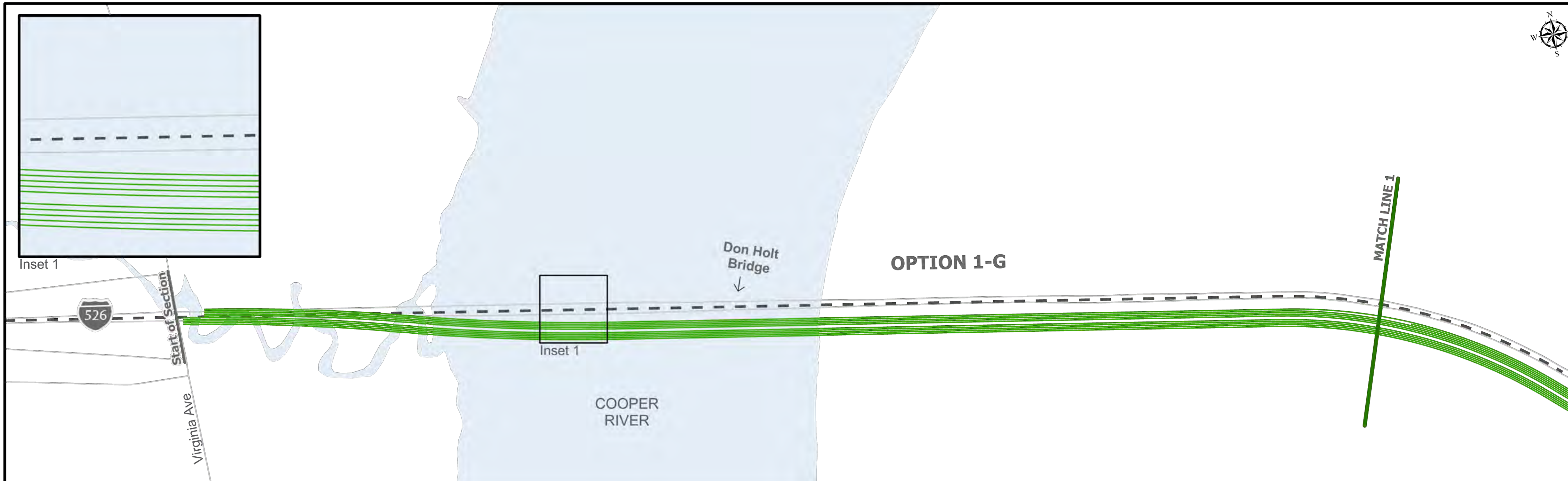
Level 2 Concept Design Options

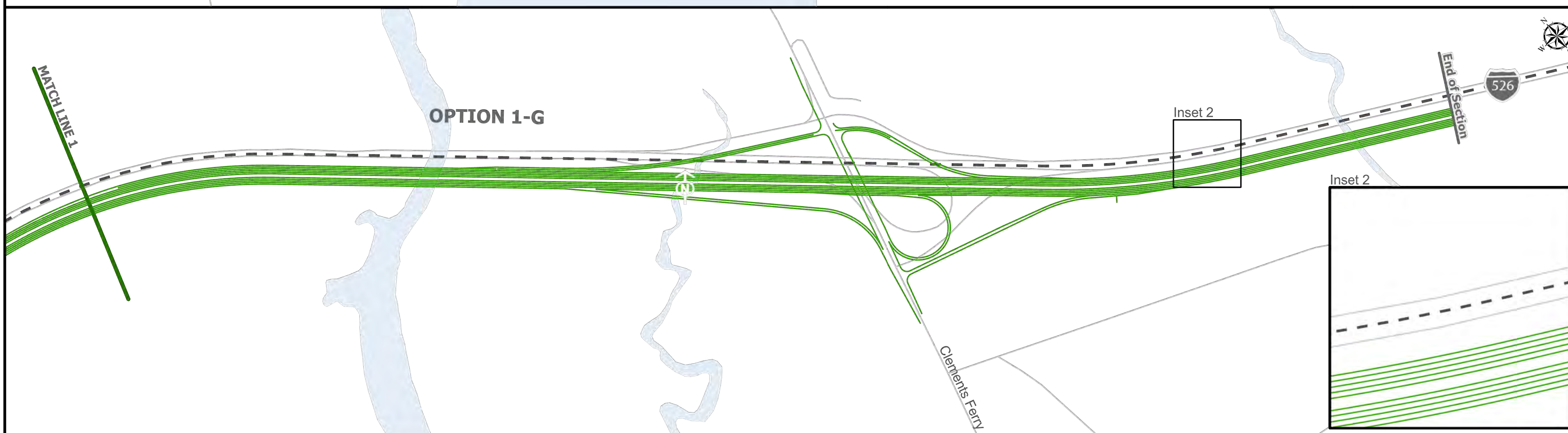
LEGEND
CONCEPTUAL DESIGNS
- - EXISTING I-526 CENTER LINE
— OPTION 1-F

0 500 1,000 1,500 2,000 Feet

SECTION - 1
OPTION 1-F

Date: 2/8/2021





LOWCOUNTRY CORRIDOR

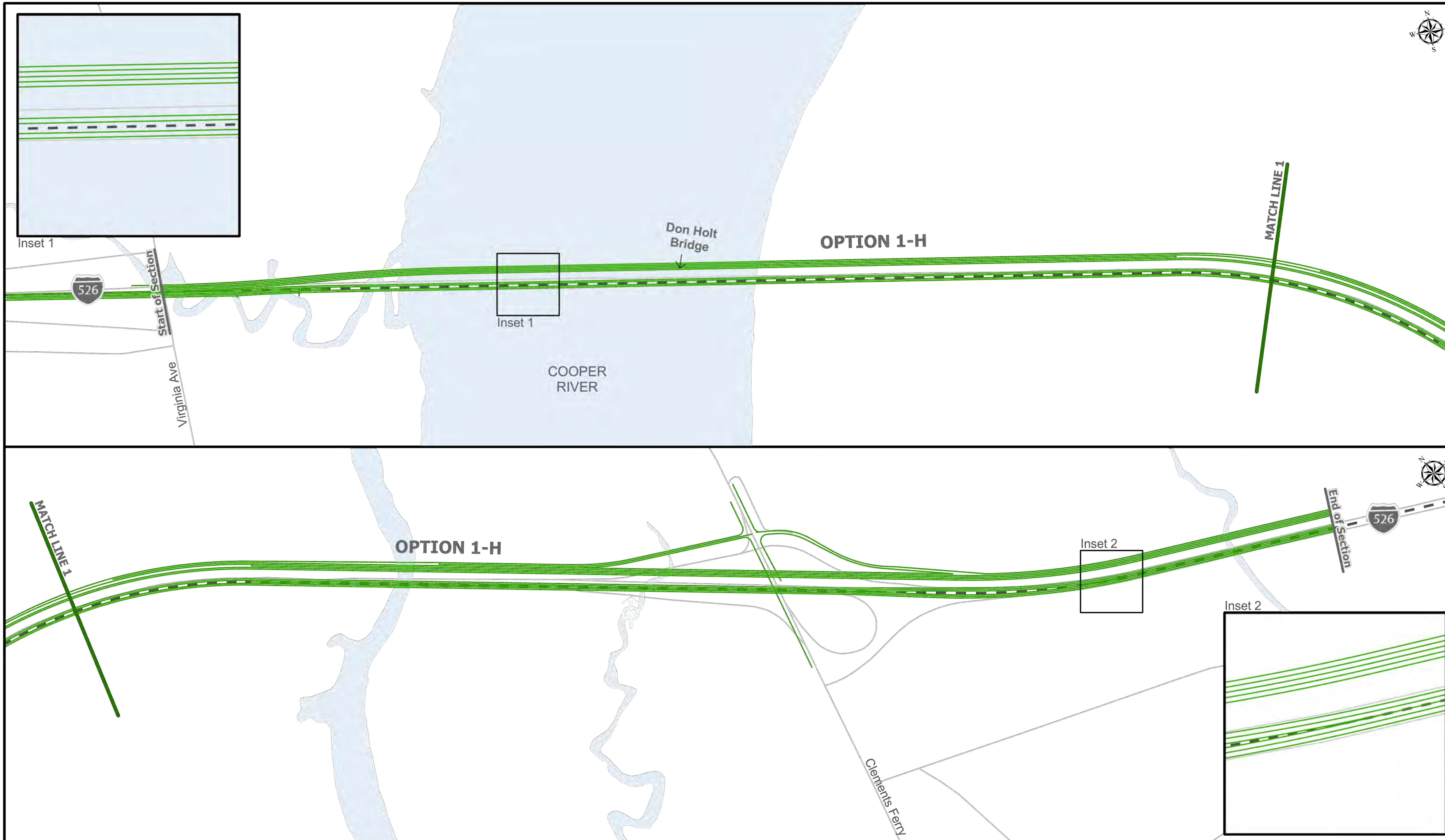
Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 1-G

0 500 1,000 1,500 2,000 Feet

SECTION - 1
OPTION 1-G

Date: 2/8/2021



526 EAST LOWCOUNTRY CORRIDOR

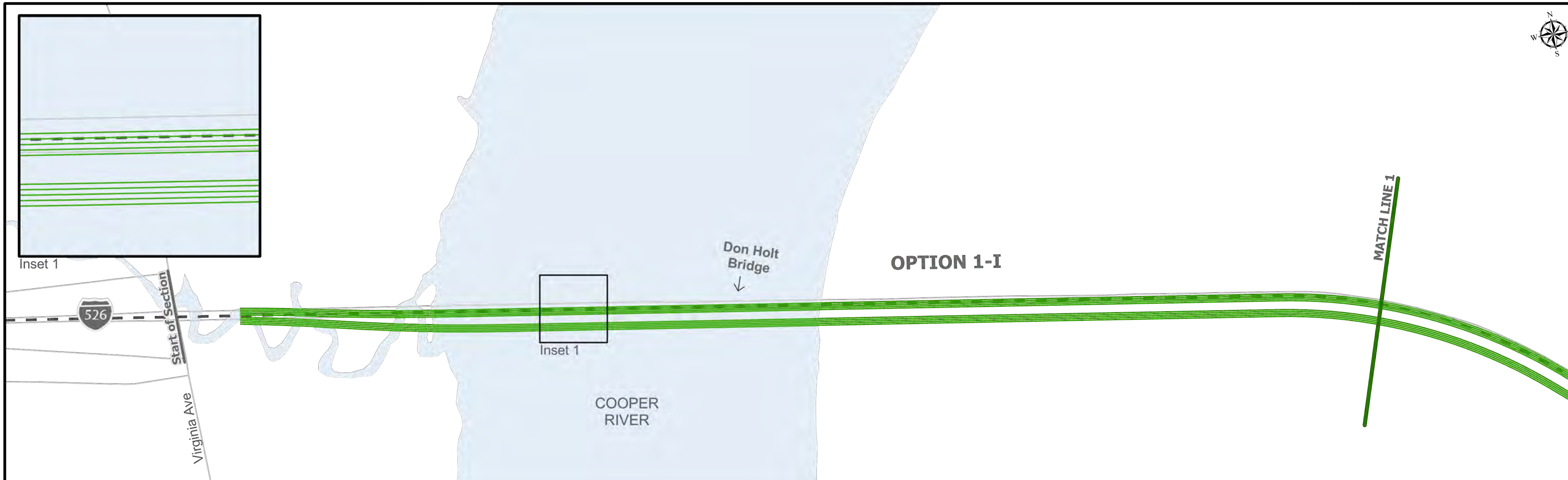
Level 2 Concept Design Options

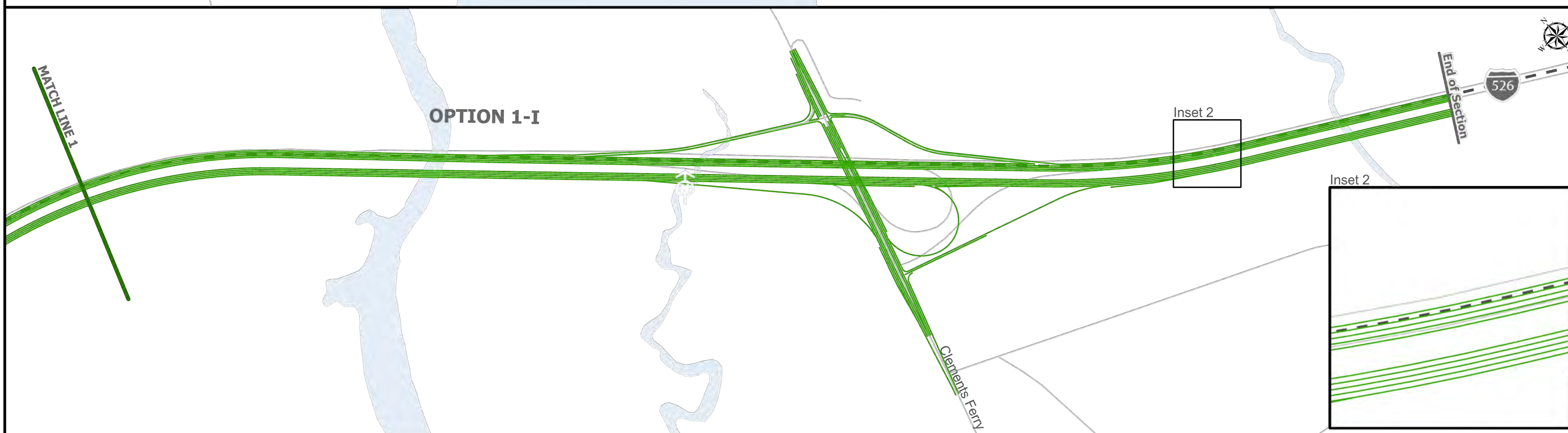
LEGEND
CONCEPTUAL DESIGNS
- - EXISTING I-526 CENTER LINE
OPTION 1-H

0 500 1,000 1,500 2,000 Feet

SECTION - 1
OPTION 1-H

Date: 2/8/2021





526 EAST LOWCOUNTRY CORRIDOR

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 1-I

0 500 1,000 1,500 2,000 Feet

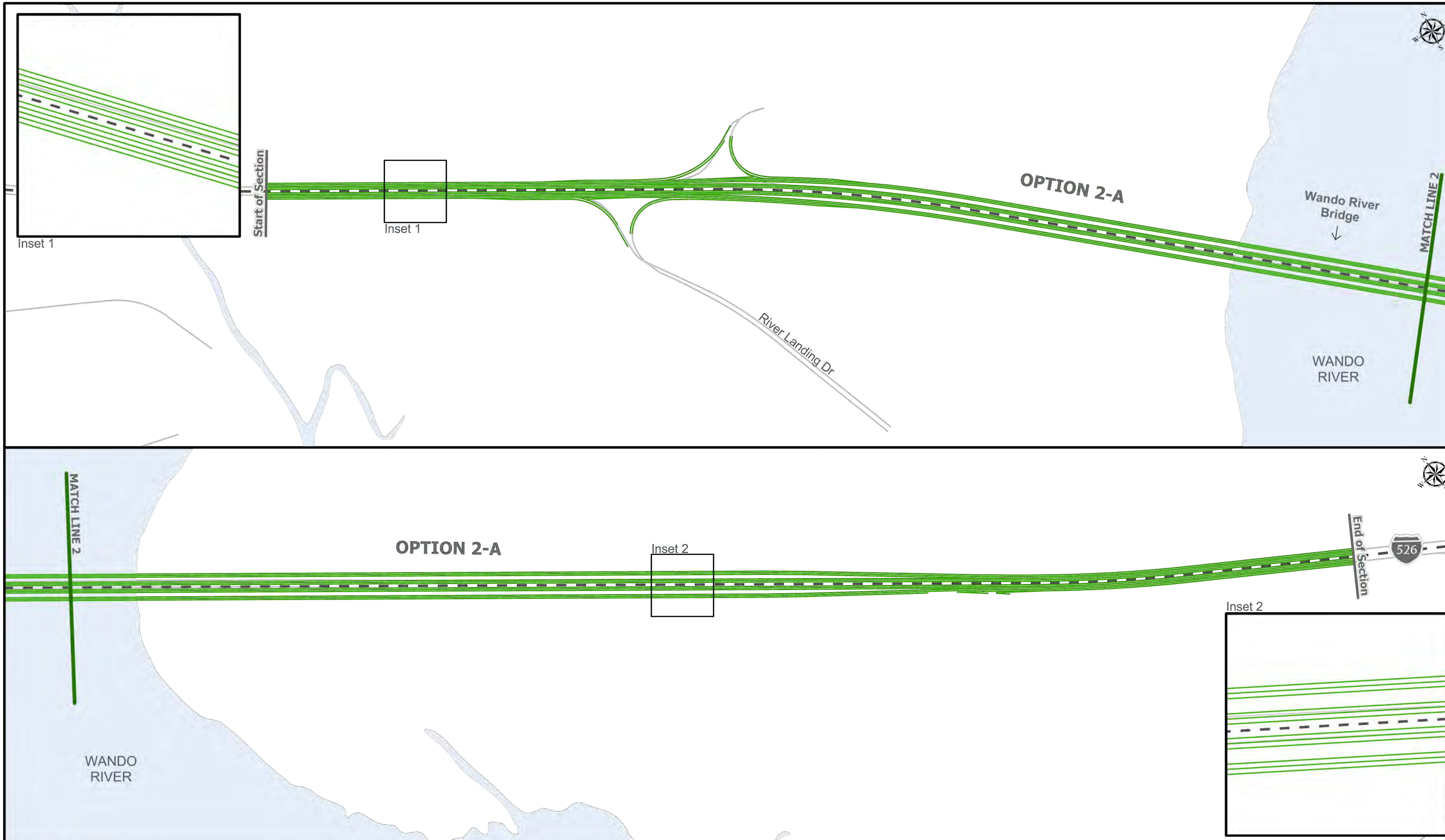
SECTION - 1
OPTION 1-I

Date: 2/8/2021

526 EAST LOWCOUNTRY CORRIDOR

Level 2

Section 02



526 EAST LOWCOUNTRY CORRIDOR

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
- EXISTING I-526 CENTER LINE
- OPTION 2-A

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-A

Date: 2/8/2021

526 EAST LOWCOUNTRY CORRIDOR

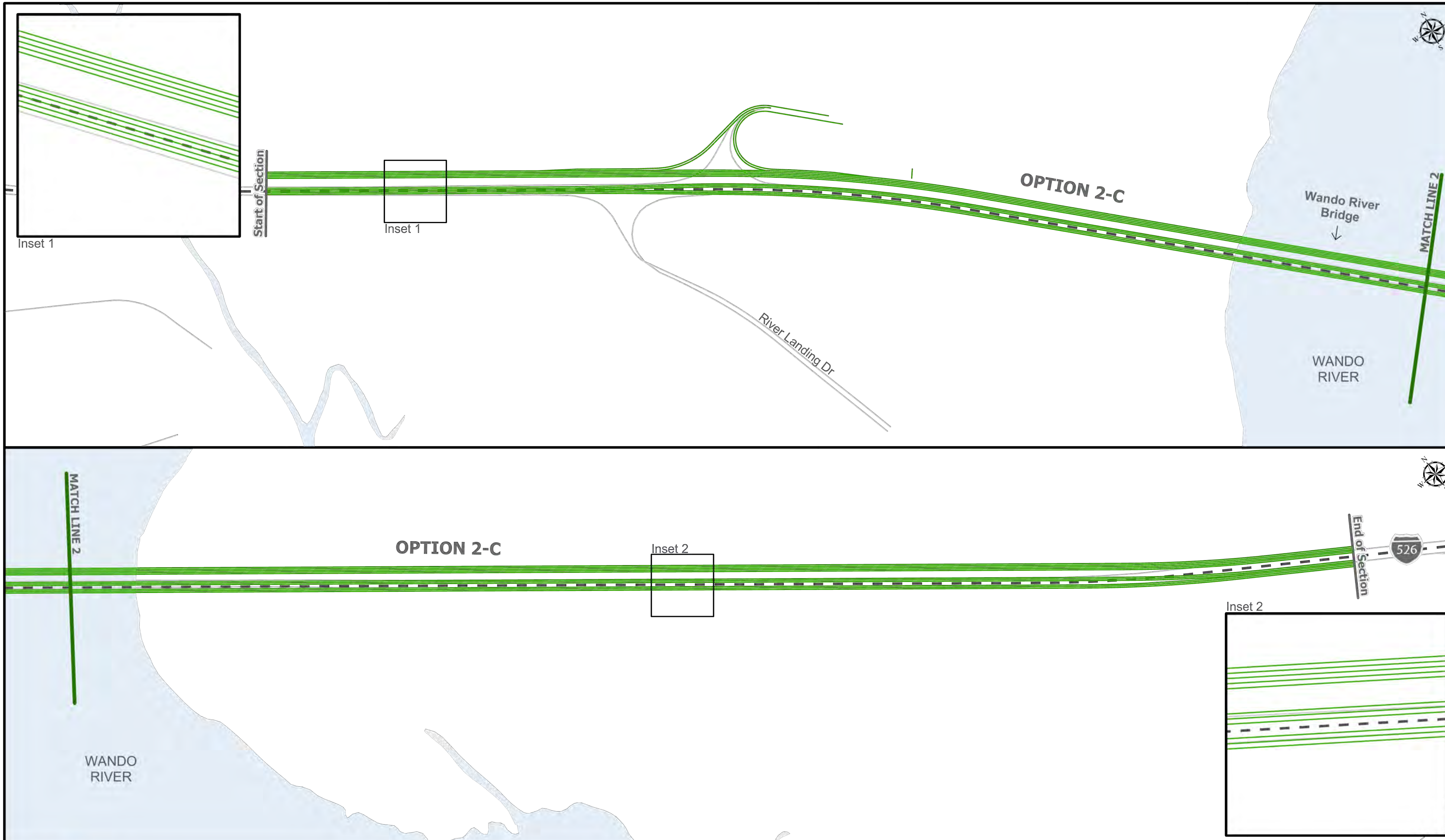
Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
- - EXISTING I-526 CENTER LINE
— OPTION 2-B

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-B

Date: 2/8/2021



LOWCOUNTRY CORRIDOR 526 EAST

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 2-C

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-C

Date: 2/8/2021

526 EAST LOWCOUNTRY CORRIDOR

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
- - EXISTING I-526 CENTER LINE
— OPTION 2-D

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-D

Date: 2/8/2021

LOWCOUNTRY CORRIDOR

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 2-E

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-E

Date: 2/8/2021

526 EAST LOWCOUNTRY CORRIDOR

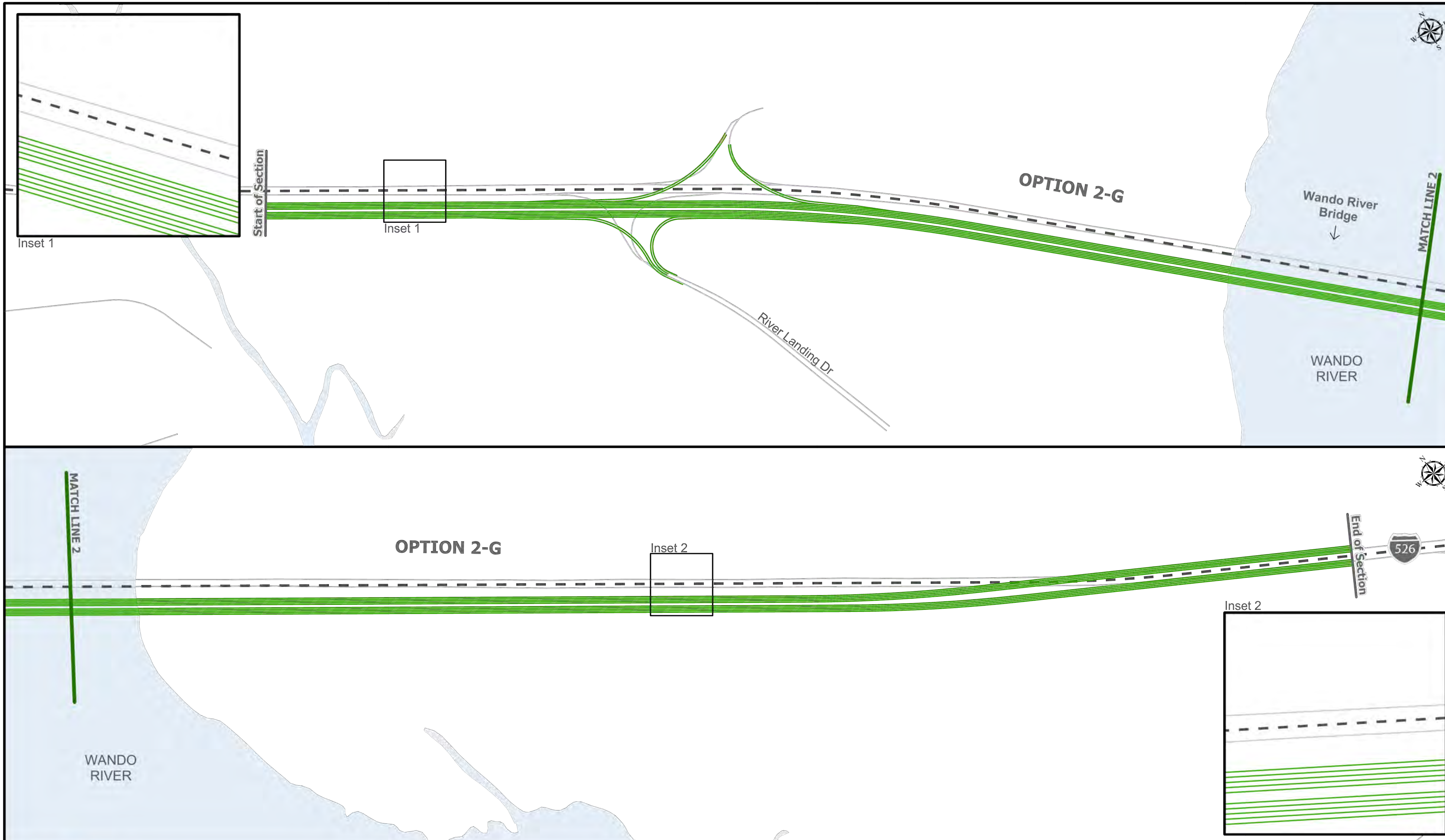
Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
- - EXISTING I-526 CENTER LINE
— OPTION 2-F

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-F

Date: 2/8/2021



LOWCOUNTRY CORRIDOR

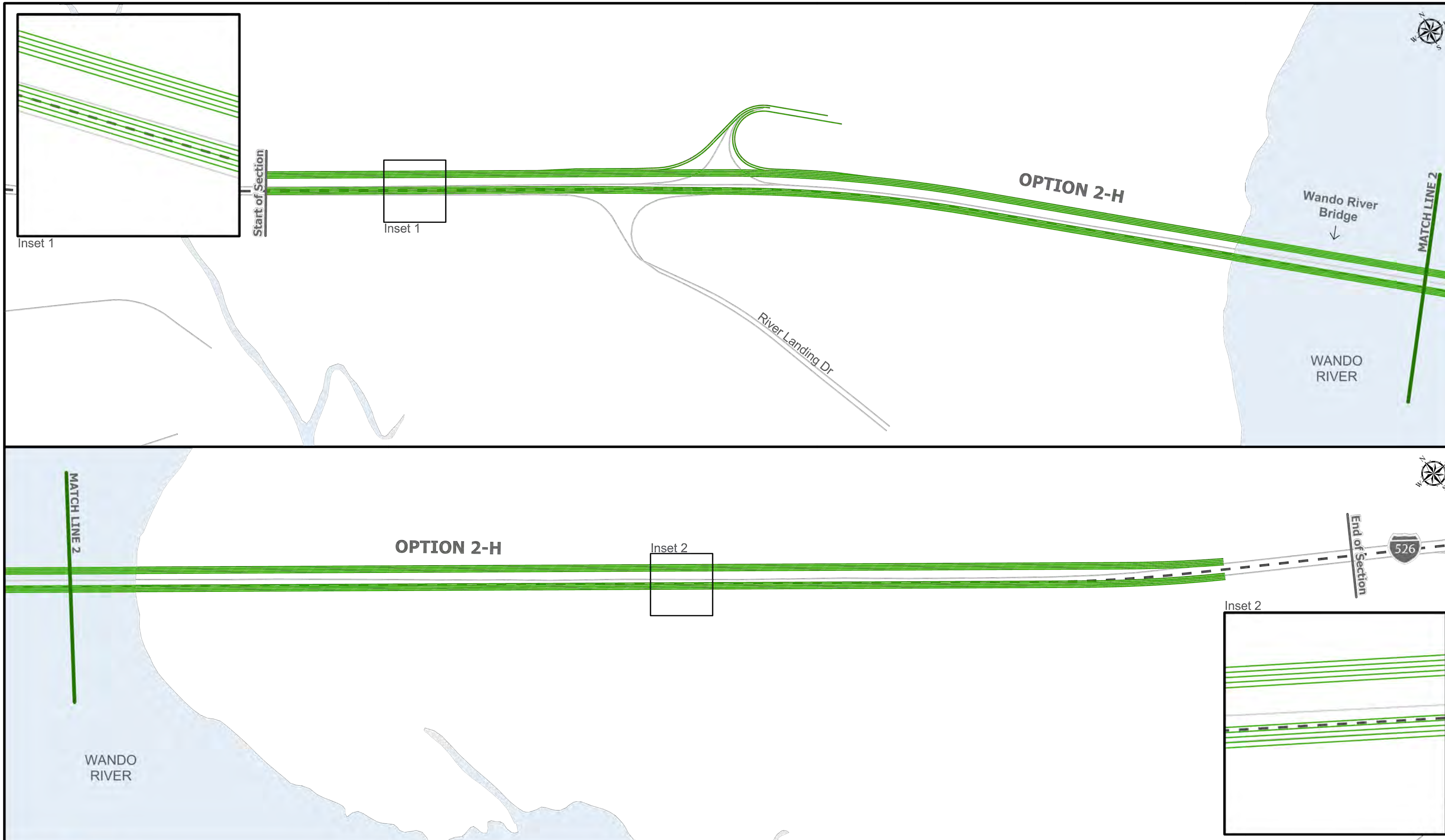
Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 2-G

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-G

Date: 2/8/2021



526 EAST LOWCOUNTRY CORRIDOR

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 2-H

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-H

Date: 2/8/2021

526 EAST LOWCOUNTRY CORRIDOR

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 2-I

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-I

Date: 2/8/2021

526 EAST LOWCOUNTRY CORRIDOR

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
EXISTING I-526 CENTER LINE
OPTION 2-J

0 500 1,000 1,500 2,000 Feet

SECTION - 2
OPTION 2-J

Date: 2/8/2021

526 EAST LOWCOUNTRY CORRIDOR

Level 2

Section 03

LOWCOUNTRY CORRIDOR

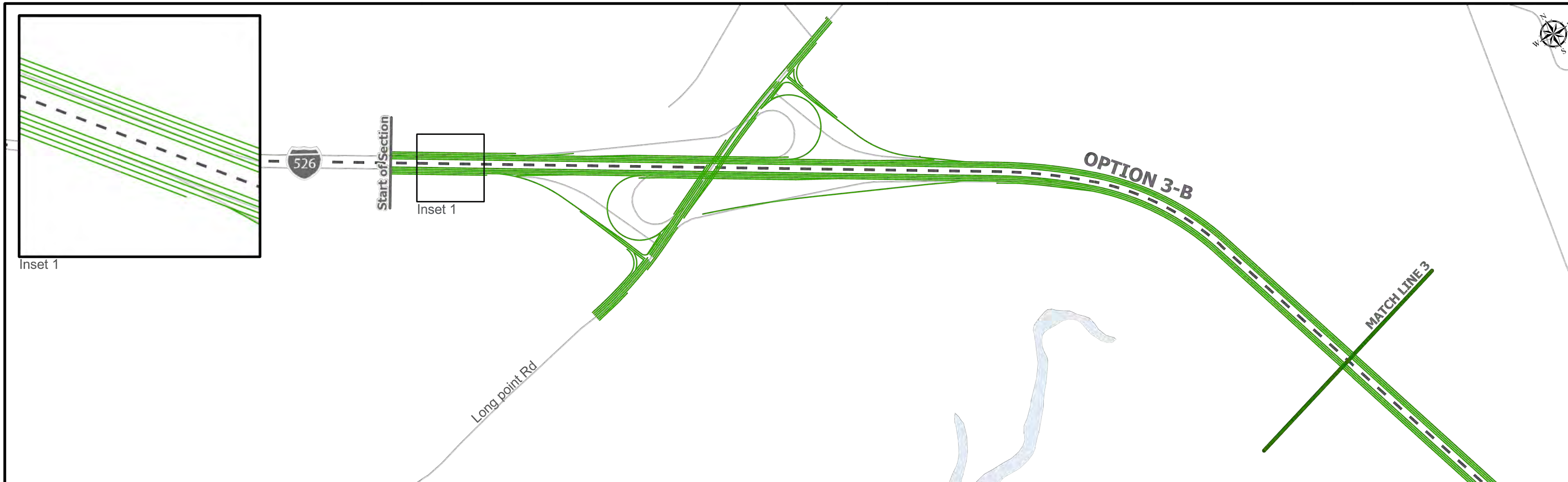
Level 2 Concept Design Options

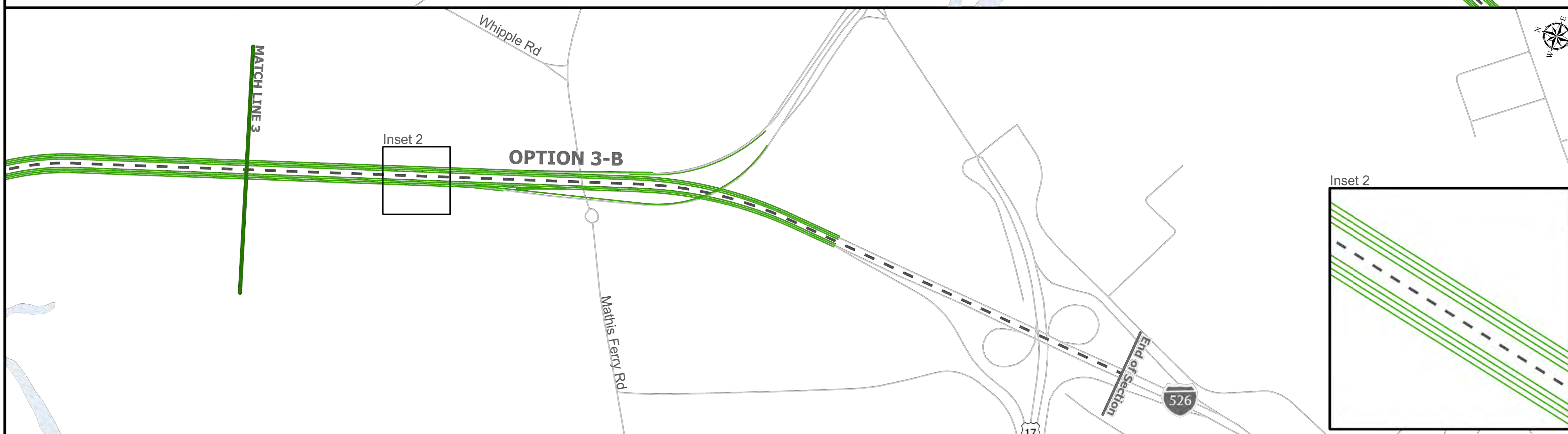
LEGEND
CONCEPTUAL DESIGNS
- - EXISTING I-526 CENTER LINE
— OPTION 3-A

0 500 1,000 1,500 2,000 Feet

SECTION - 3
OPTION 3-A

Date: 2/8/2021





LOWCOUNTRY CORRIDOR

Level 2 Concept Design Options

LEGEND
CONCEPTUAL DESIGNS
- - EXISTING I-526 CENTER LINE
— OPTION 3-B

0 500 1,000 1,500 2,000 Feet

SECTION - 3
OPTION 3-B

Date: 2/8/2021

Level 3
Conceptual Alternatives

526 EAST LOWCOUNTRY CORRIDOR

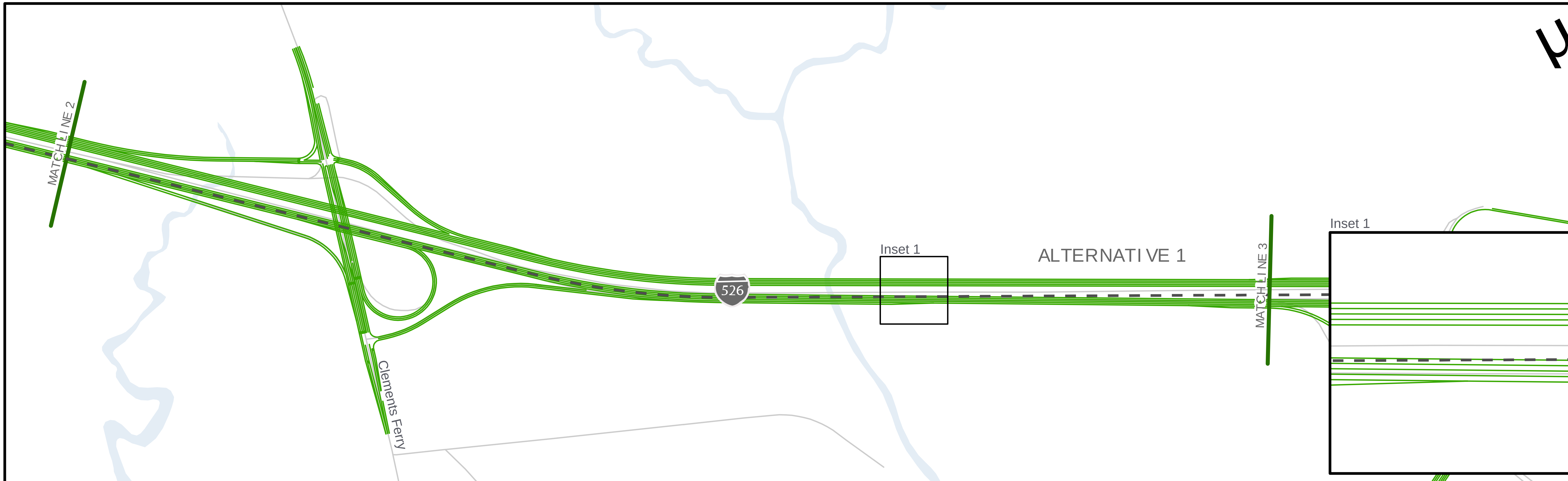
Conceptual Alternatives

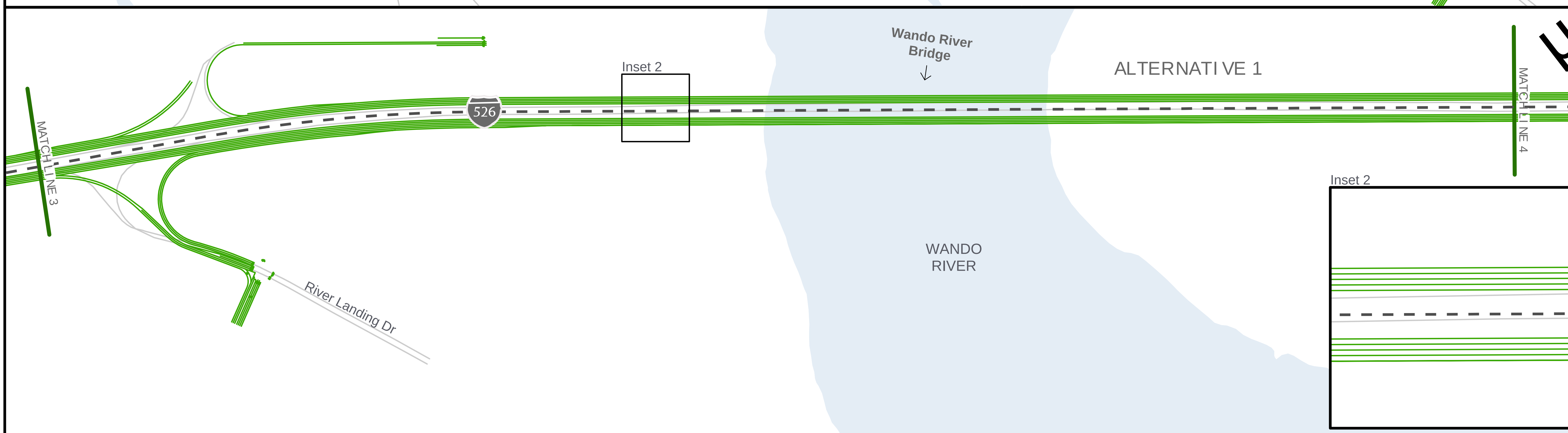
LEGEND
ALTERNATIVE DESIGNS
- - EXISTING I-526 CENTERLINE
— ALTERNATIVE 1

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 1

Date: 4/12/2021





LOWCOUNTRY CORRIDOR

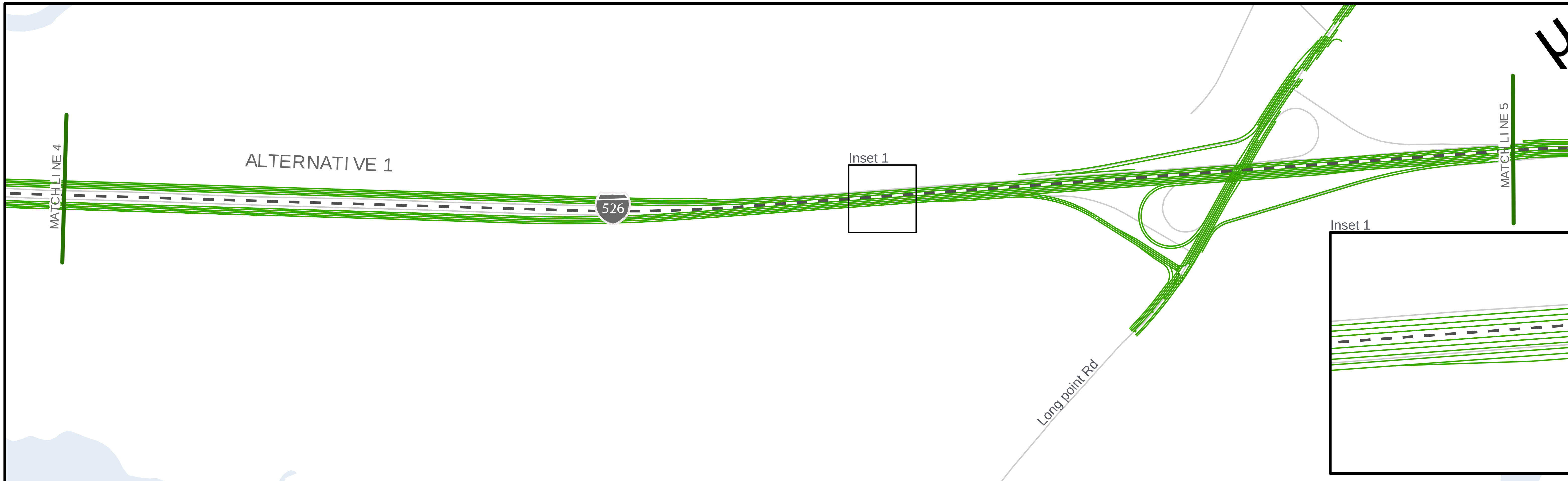
Conceptual Alternatives

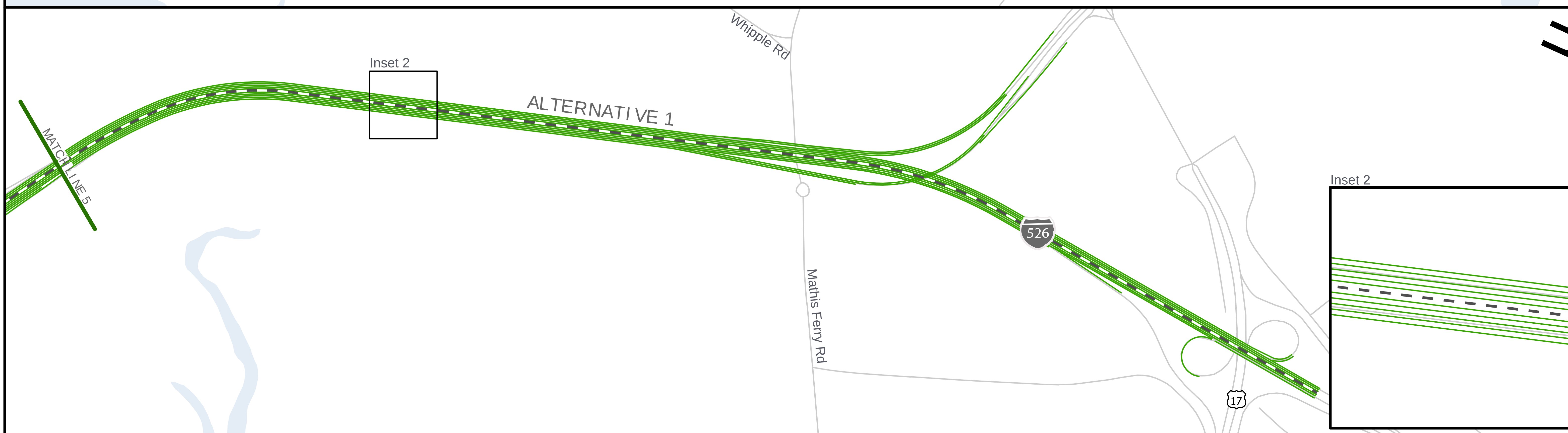
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 1

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 1

Date: 4/12/2021





526 EAST
LOWCOUNTRY CORRIDOR

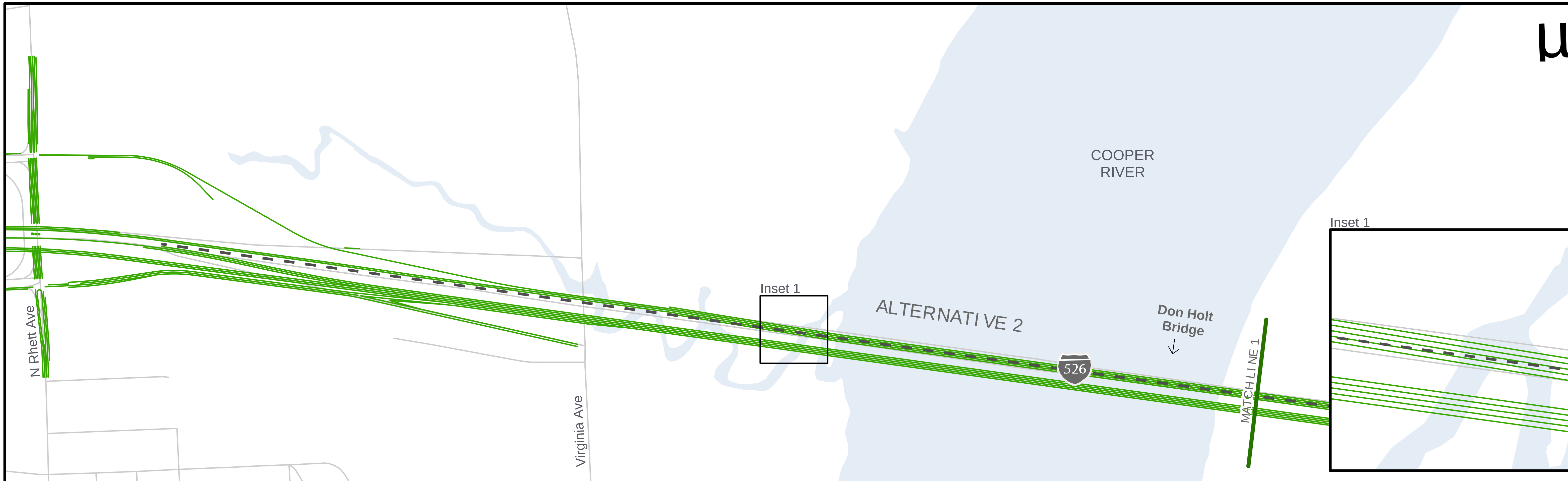
Conceptual Alternatives

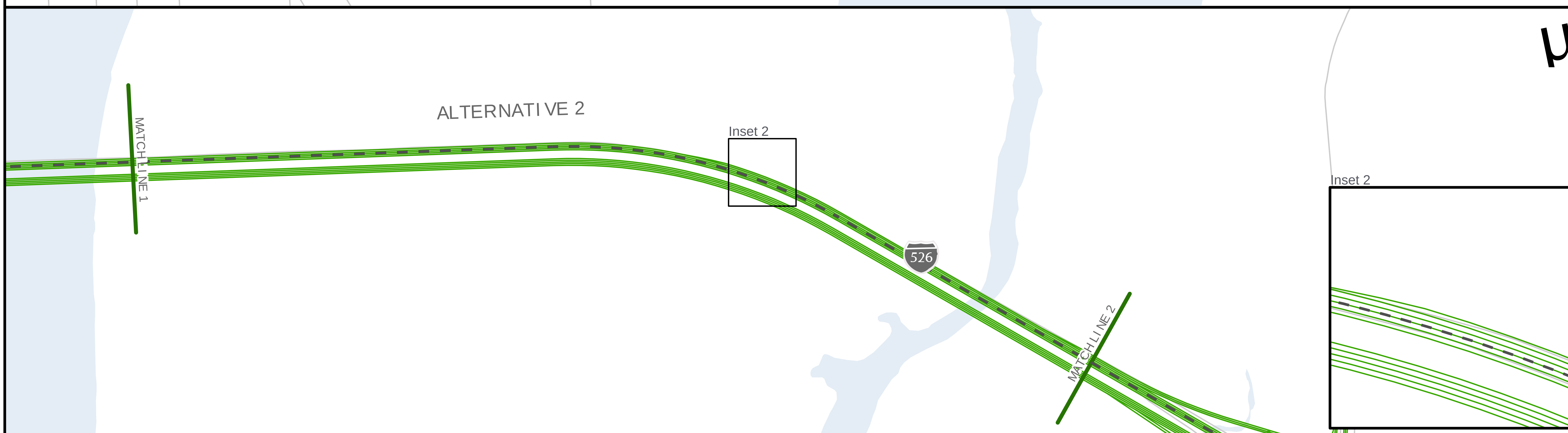
LEGEND
ALTERNATIVE DESIGNS
- - EXISTING I-526 CENTER LINE
— ALTERNATIVE 1

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 1

Date: 4/12/2021





LOWCOUNTRY CORRIDOR

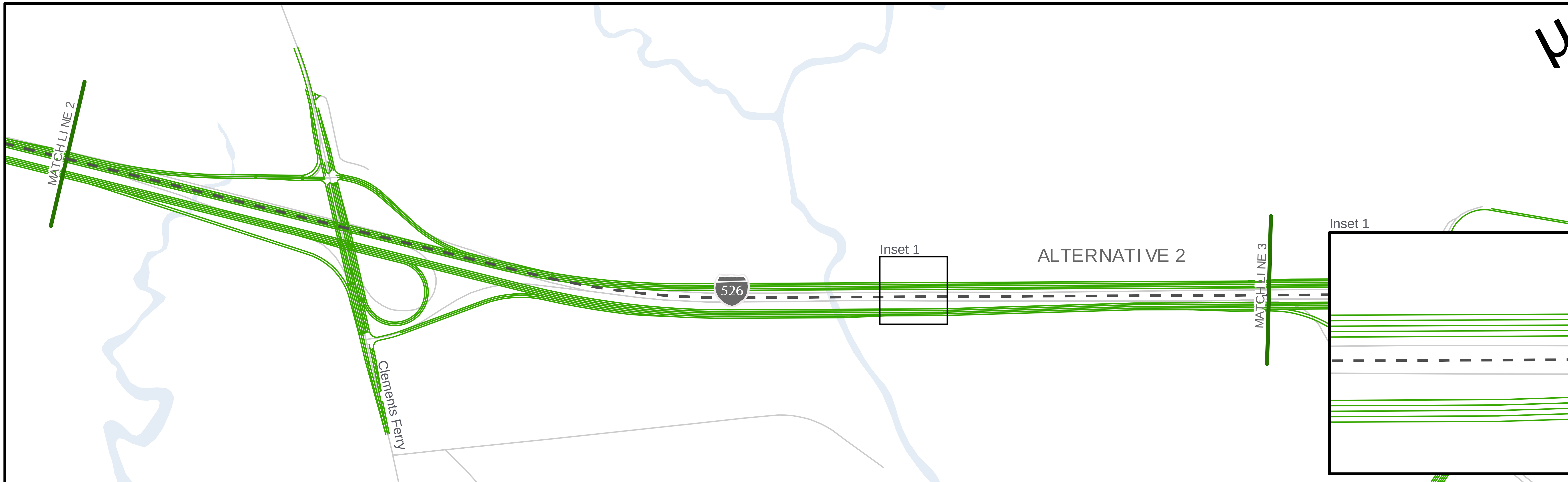
Conceptual Alternatives

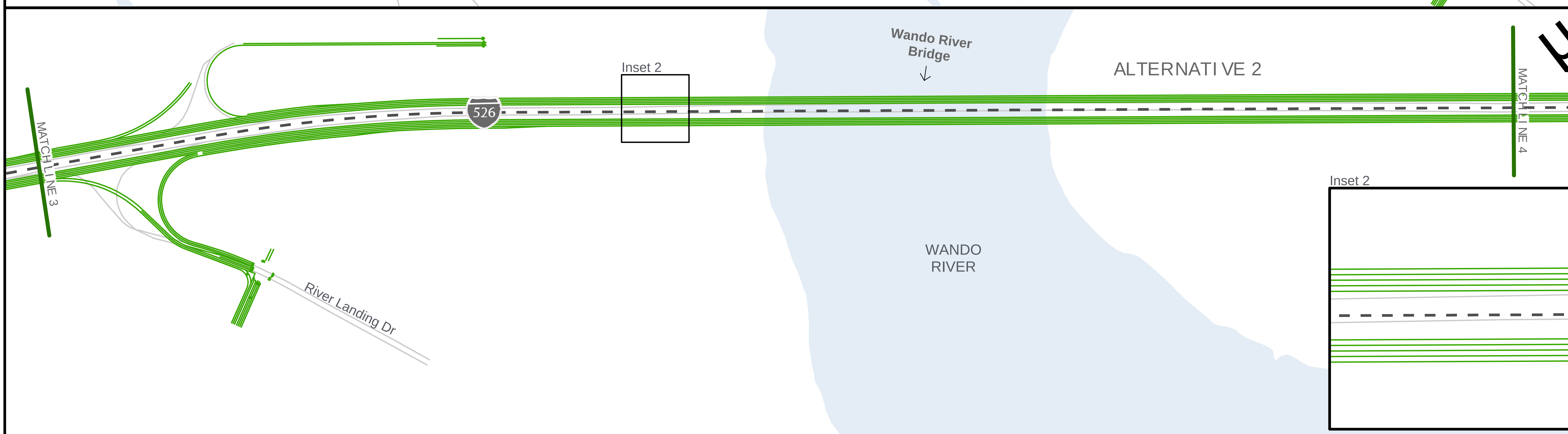
LEGEND
ALTERNATIVE DESIGNS
- EXISTING I-526 CENTER LINE
- ALTERNATIVE 2

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 2

Date: 4/12/2021





526 EAST
LOWCOUNTRY CORRIDOR

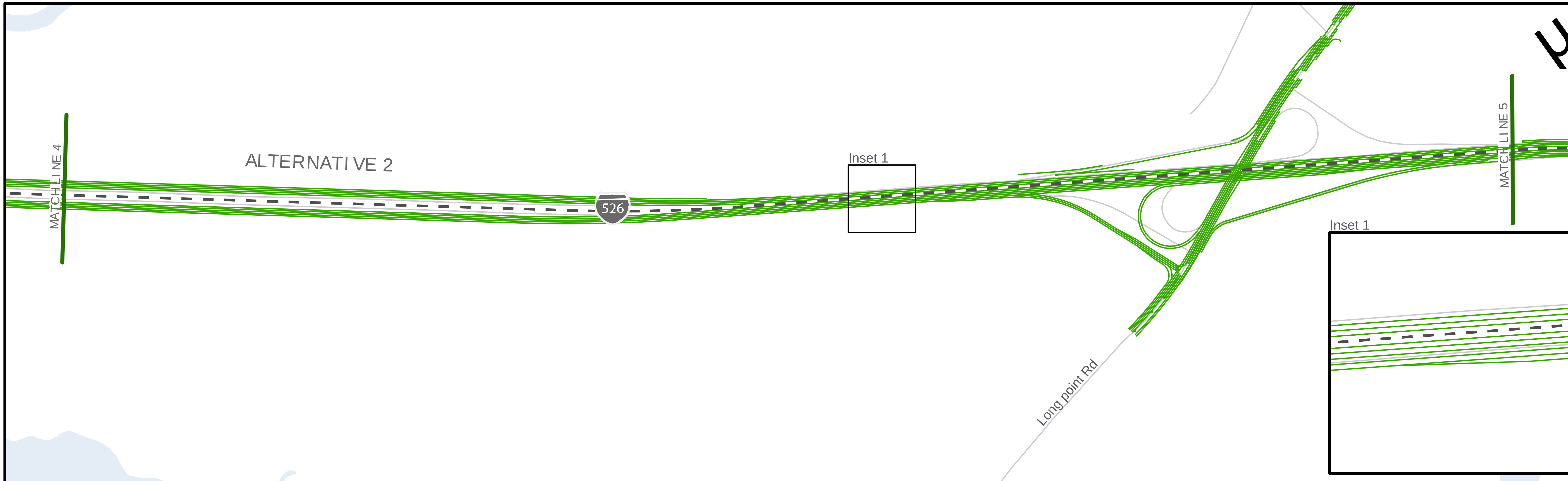
Conceptual Alternatives

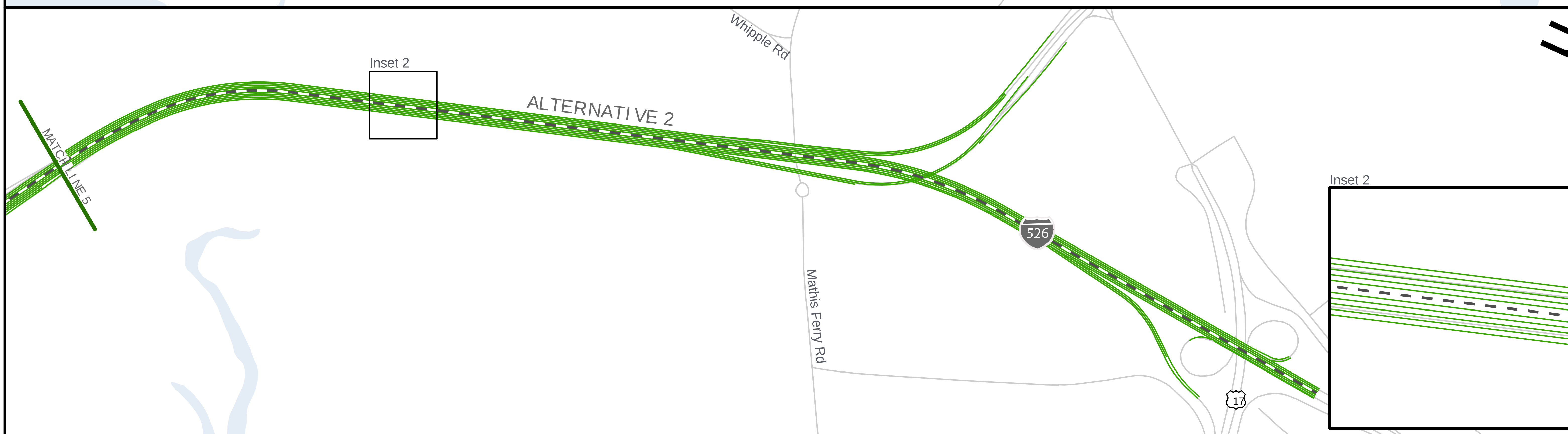
LEGEND
ALTERNATIVE DESIGNS
- EXISTING I-526 CENTER LINE
- ALTERNATIVE 2

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 2

Date: 4/12/2021





LOWCOUNTRY CORRIDOR

Conceptual Alternatives

LEGEND

ALTERNATIVE DESIGNS

- EXISTING I-526 CENTER LINE
- ALTERNATIVE 2

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 2

Date: 4/12/2021

526 EAST
LOWCOUNTRY
CORRIDOR

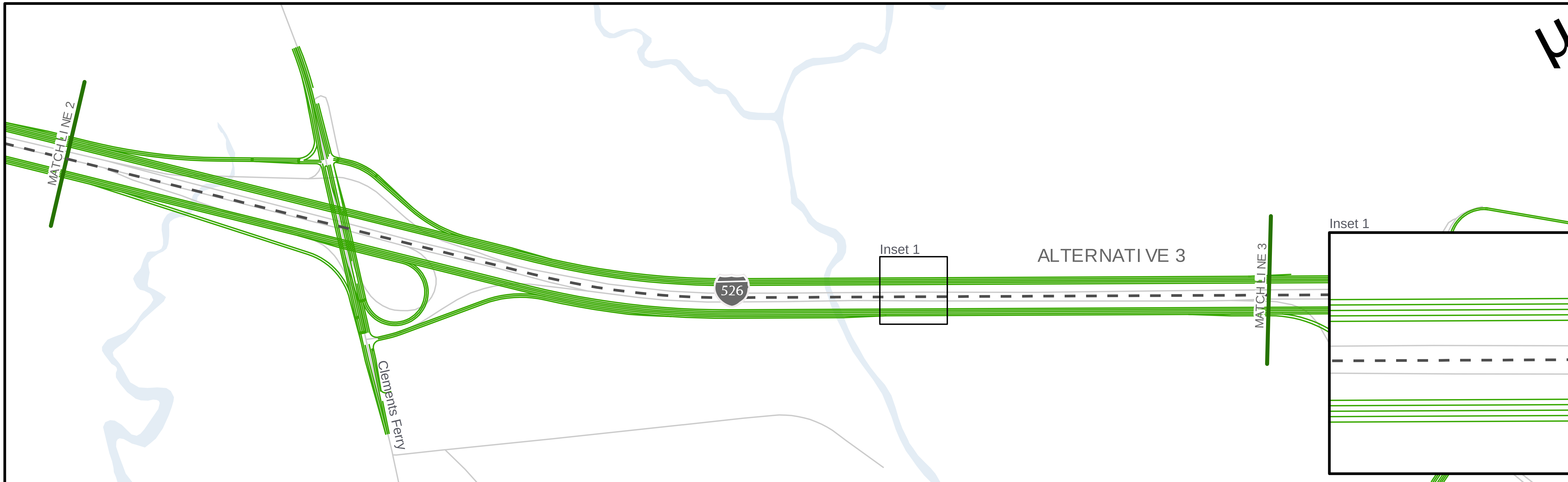
Conceptual Alternatives

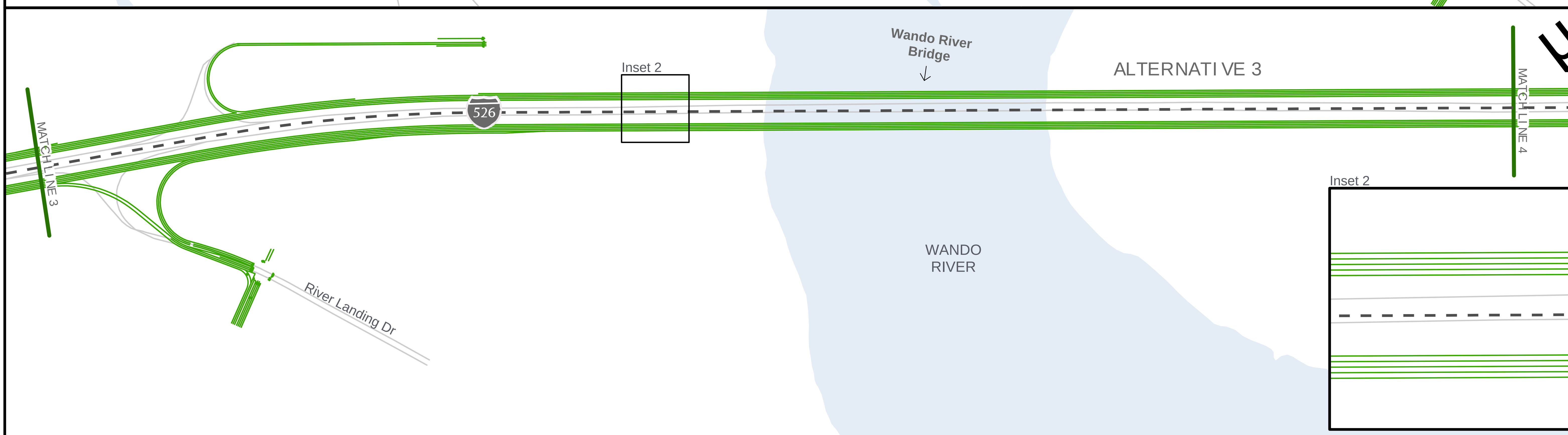
LEGEND
ALTERNATIVE DESIGNS
- - EXISTING I-526 CENTER LINE
— ALTERNATIVE 3

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 3

Date: 4/12/2021





526 EAST LOWCOUNTRY CORRIDOR

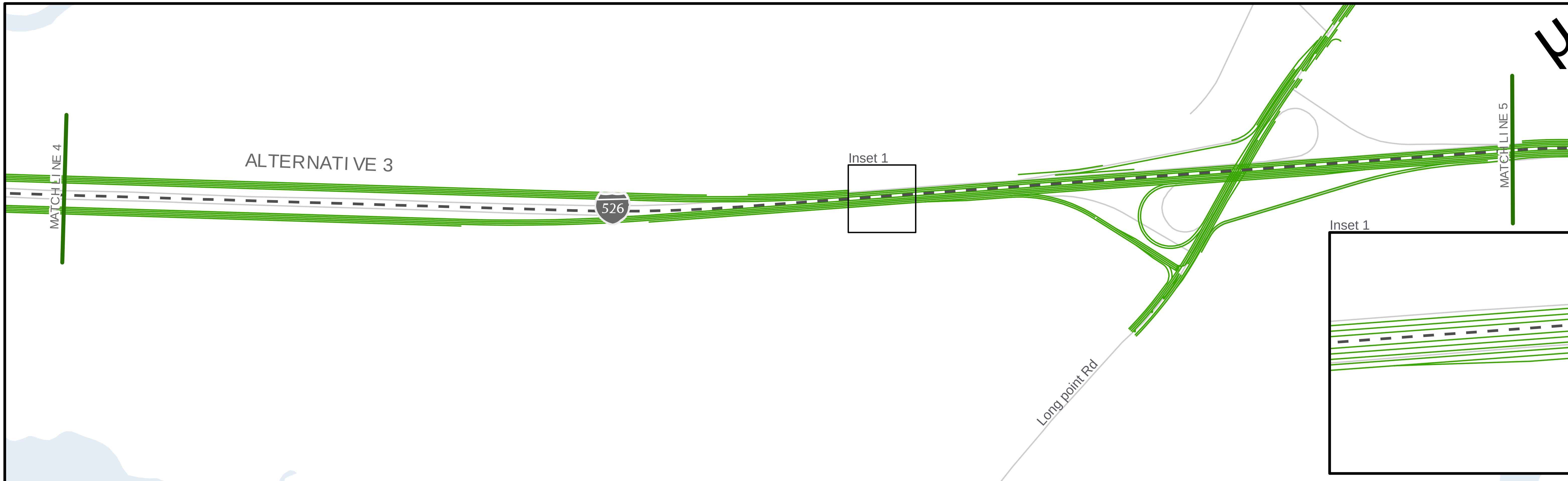
Conceptual Alternatives

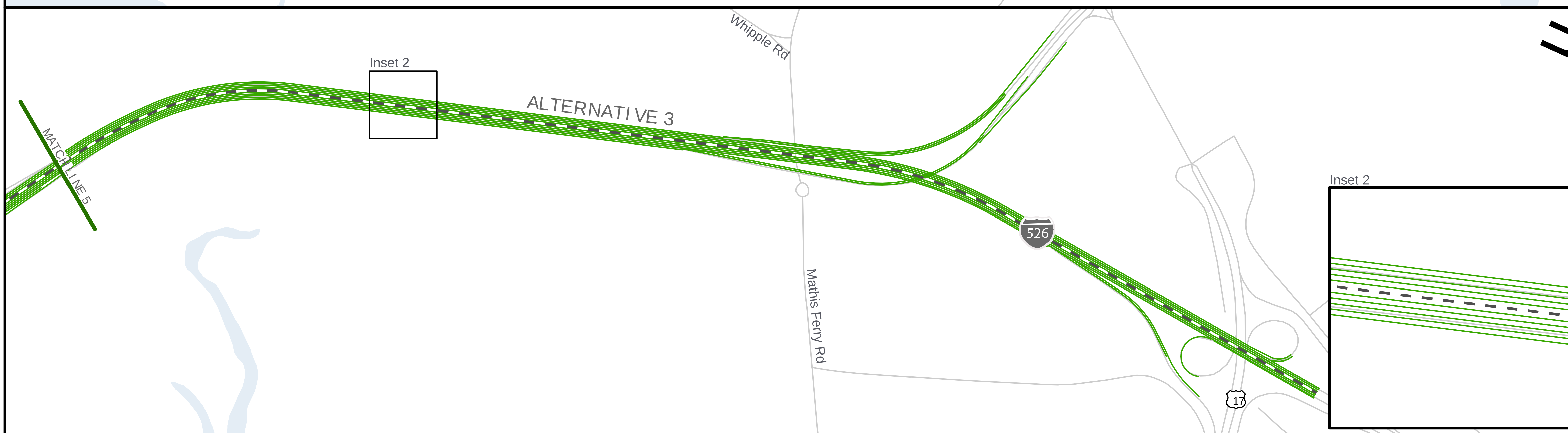
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 3

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 3

Date: 4/12/2021





526 EAST LOWCOUNTRY CORRIDOR

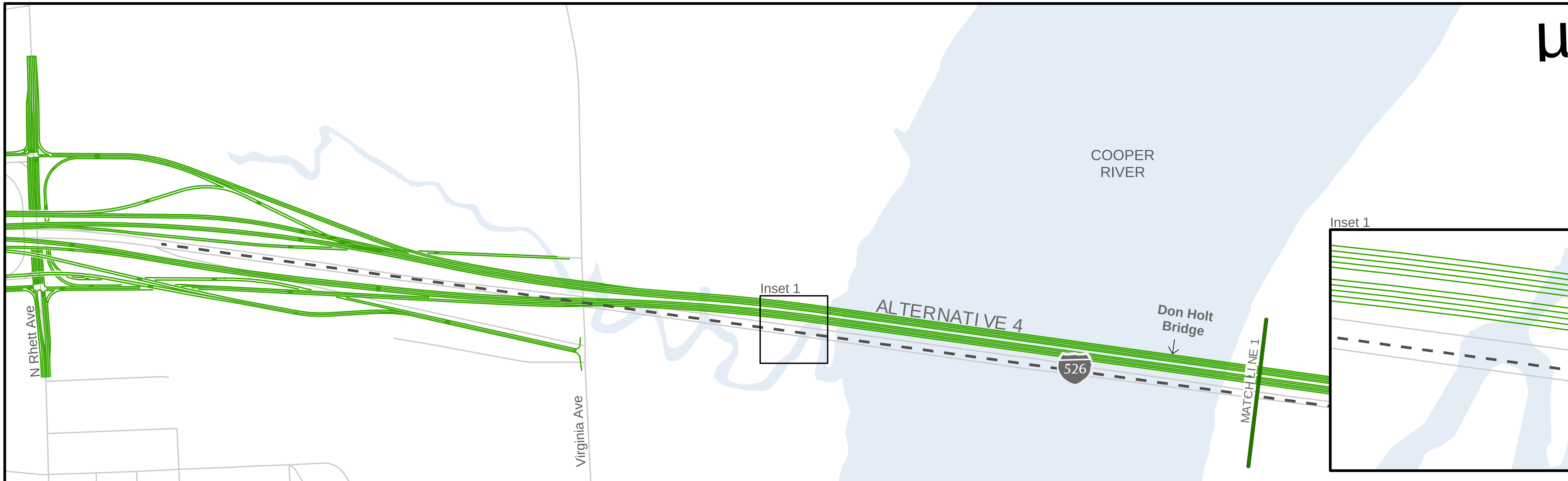
Conceptual Alternatives

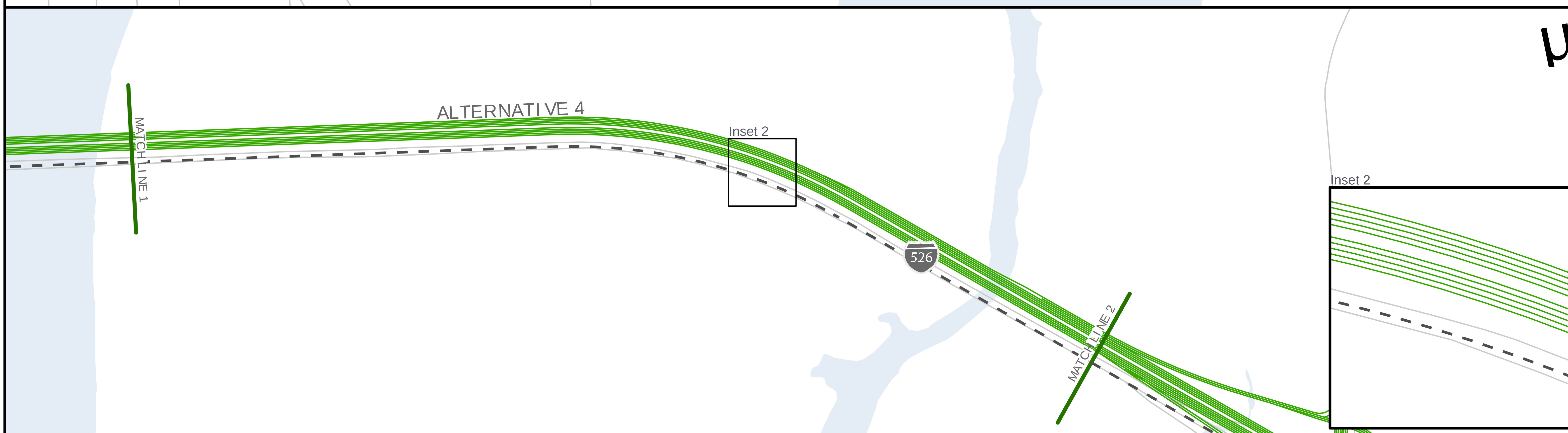
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 3

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 3

Date: 4/12/2021





526 EAST
LOWCOUNTRY CORRIDOR

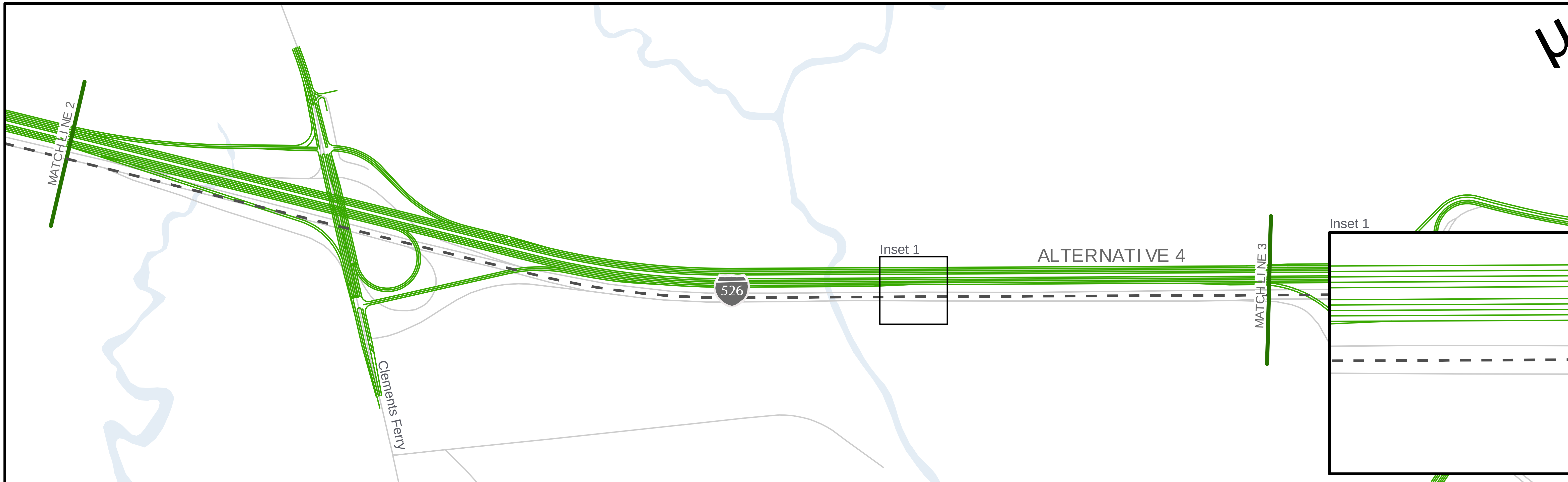
Conceptual Alternatives

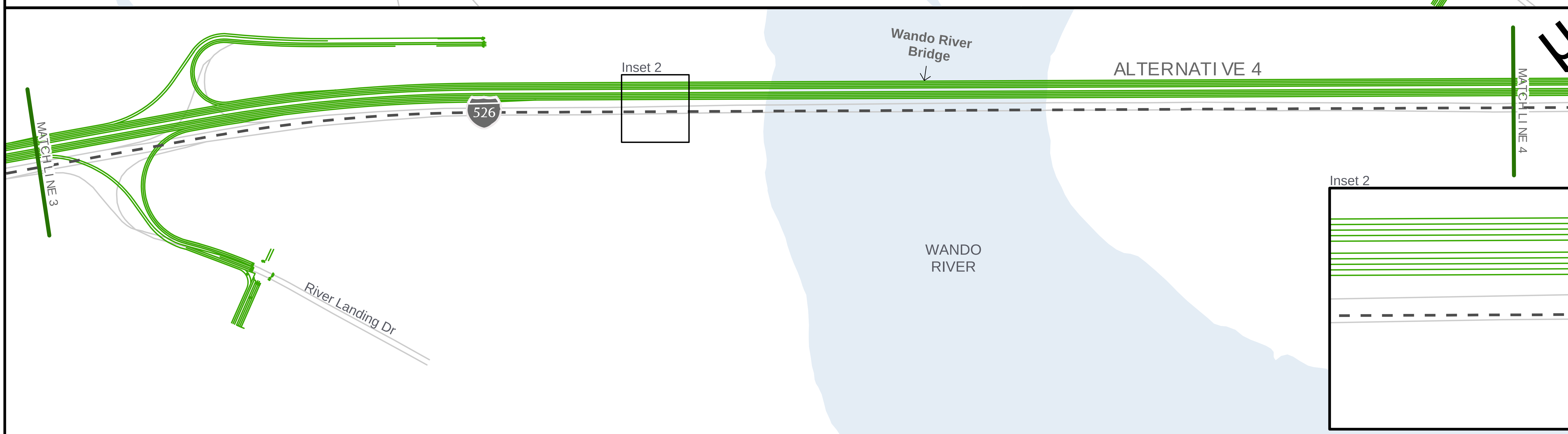
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 4

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 4

Date: 4/12/2021





526 EAST LOWCOUNTRY CORRIDOR

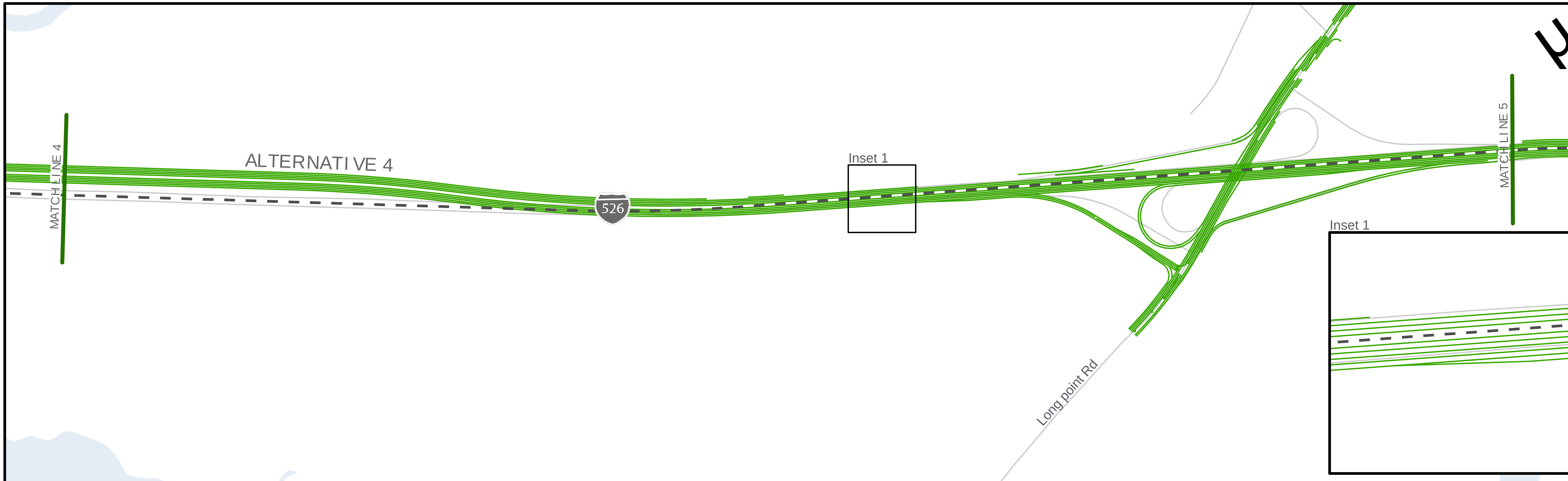
Conceptual Alternatives

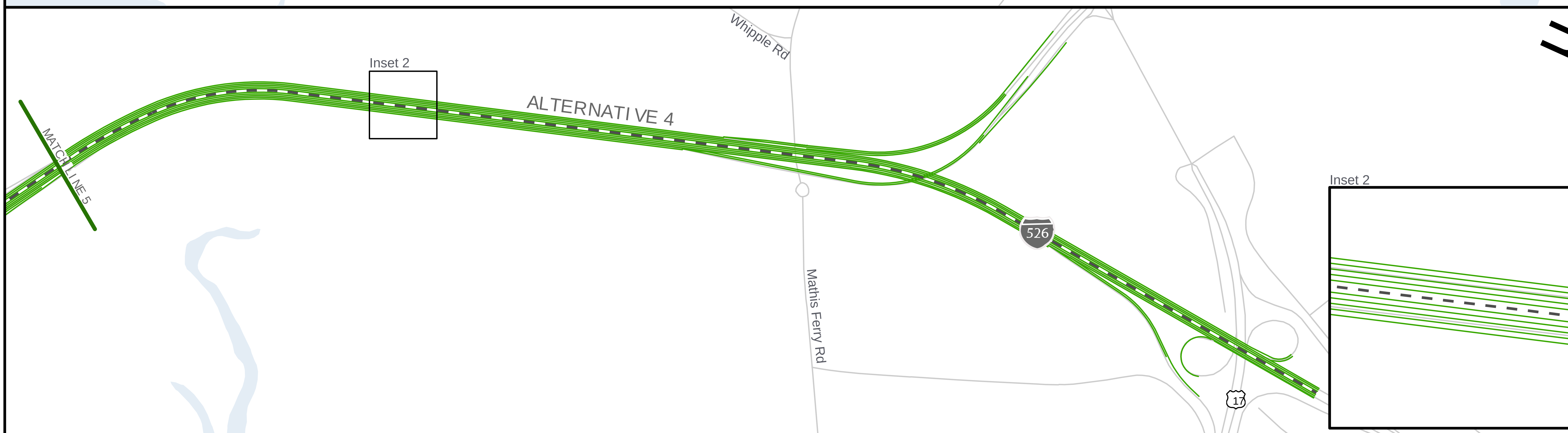
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 4

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 4

Date: 4/12/2021





526 EAST
LOWCOUNTRY CORRIDOR

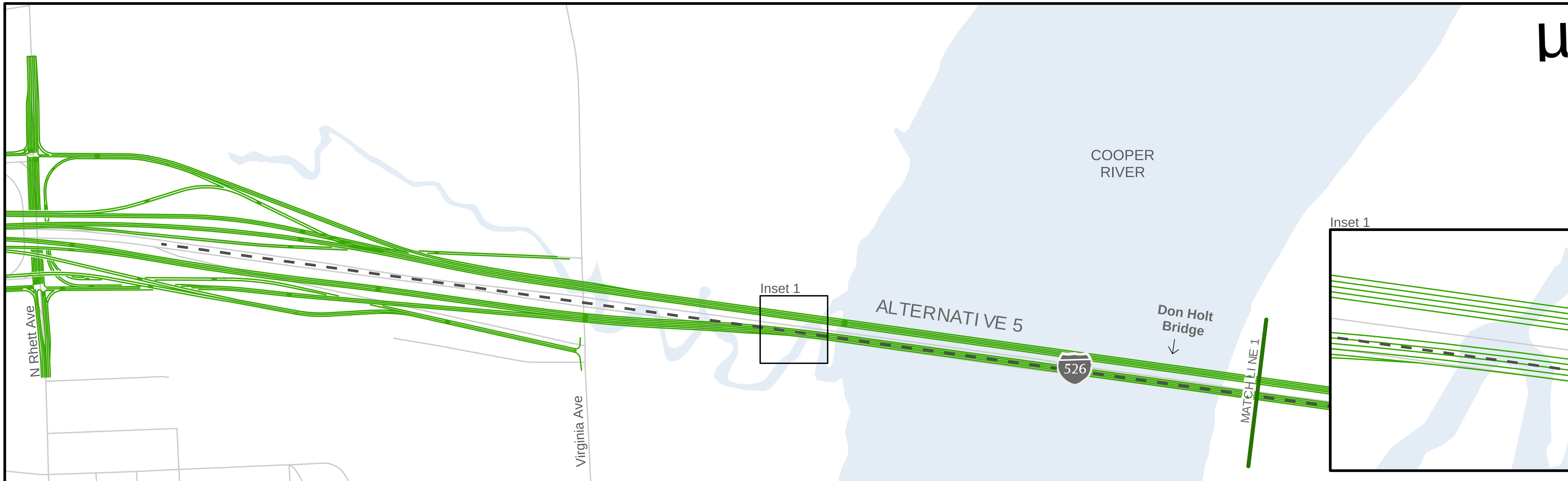
Conceptual Alternatives

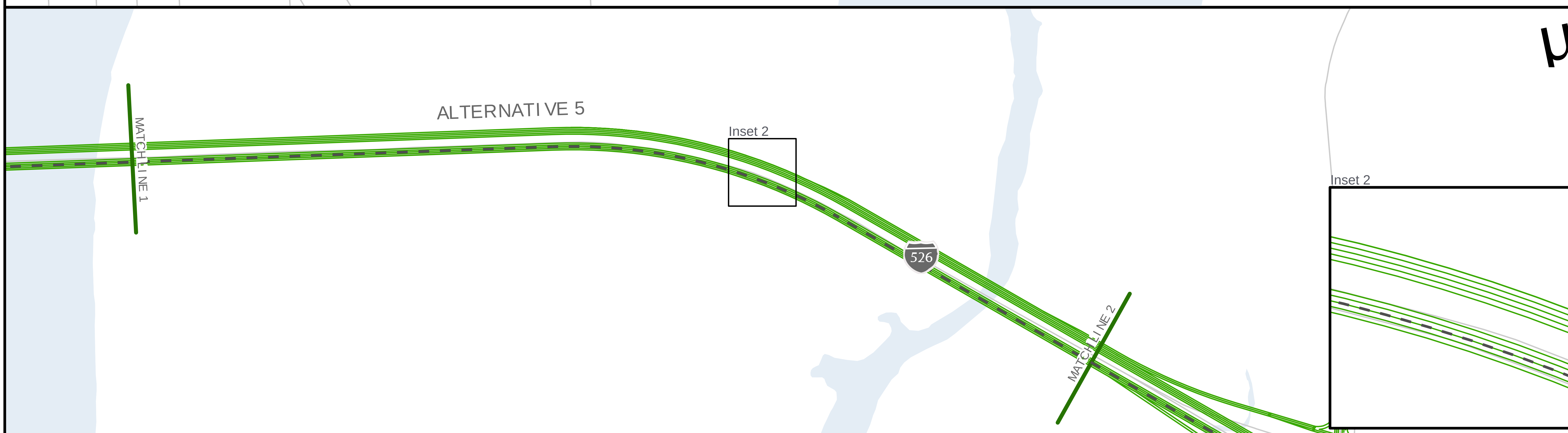
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 4

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 4

Date: 4/12/2021





526 EAST LOWCOUNTRY CORRIDOR

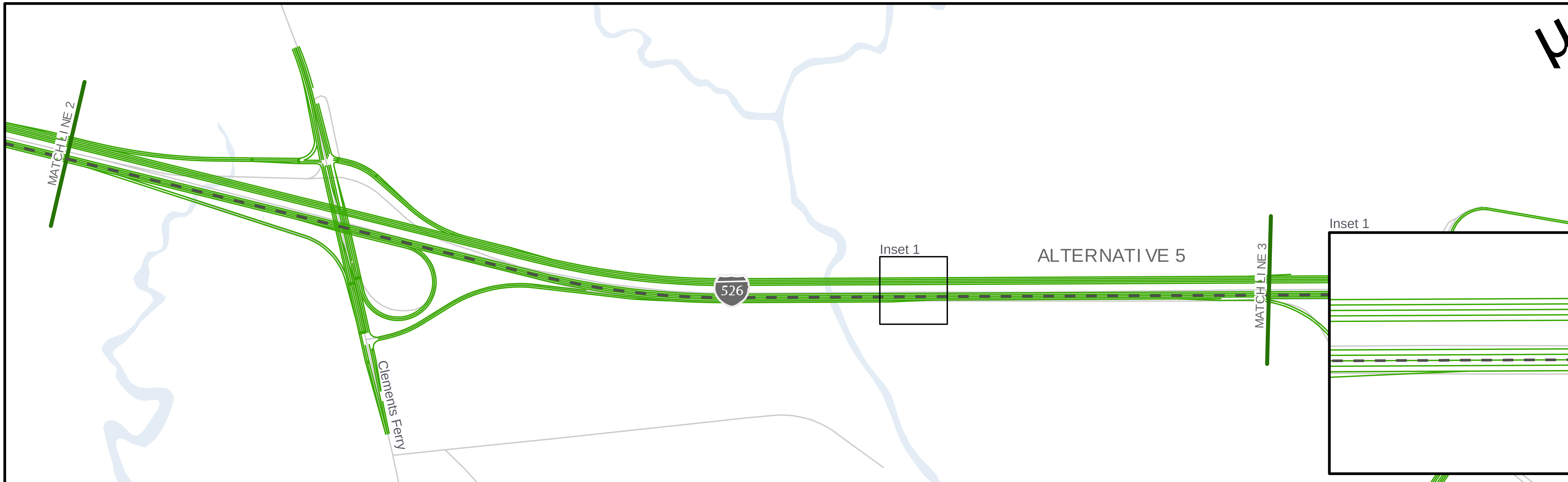
Conceptual Alternatives

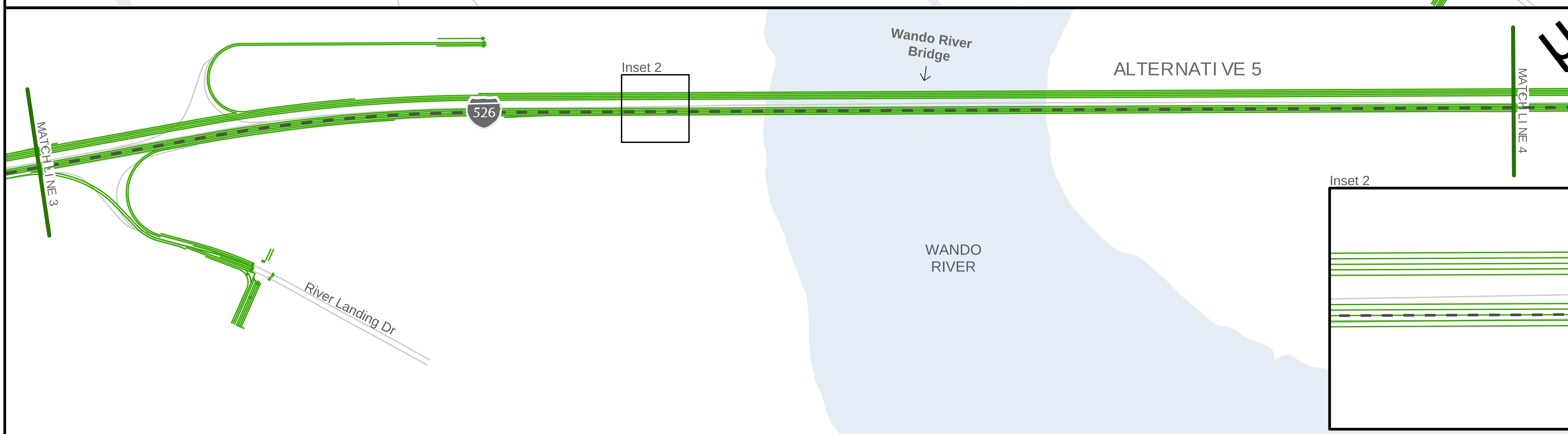
LEGEND
ALTERNATIVE DESIGNS
- - EXISTING I-526 CENTER LINE
— ALTERNATIVE 5

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 5

Date: 4/12/2021





526 EAST LOWCOUNTRY CORRIDOR

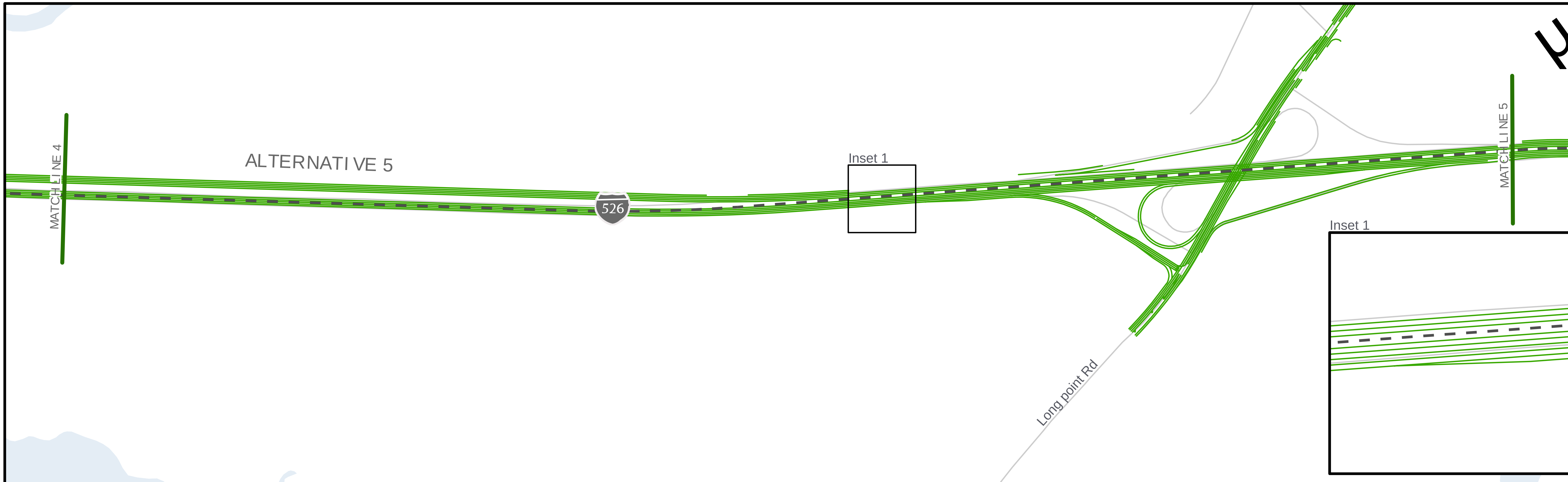
Conceptual Alternatives

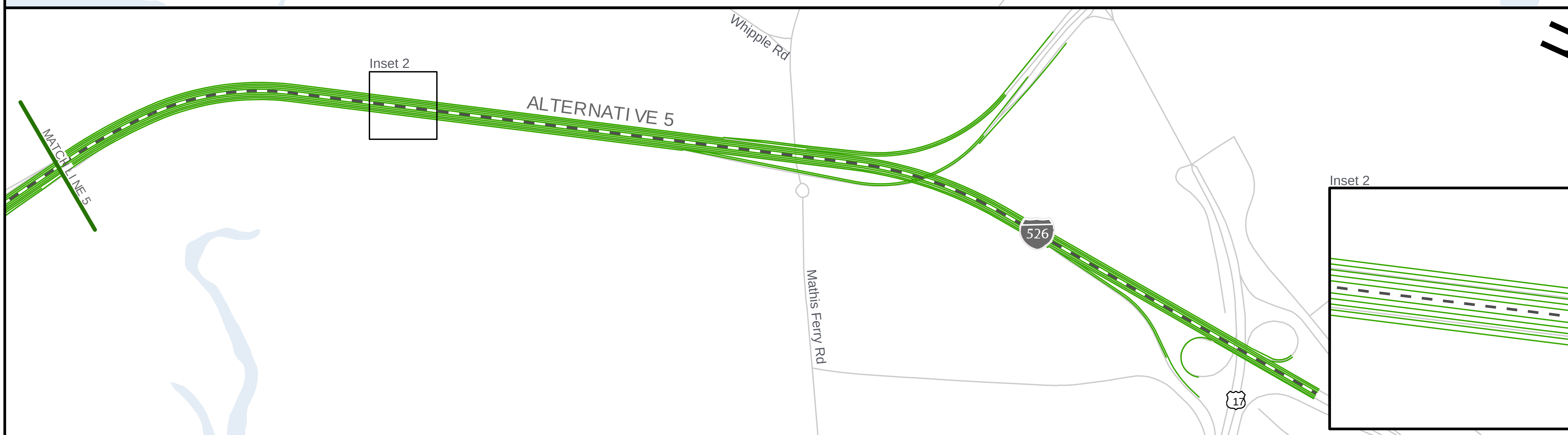
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 5

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 5

Date: 4/12/2021





LOWCOUNTRY CORRIDOR

Conceptual Alternatives

LEGEND
ALTERNATIVE DESIGNS
- - EXISTING I-526 CENTER LINE
— ALTERNATIVE 5

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 5

Date: 4/12/2021

526 EAST
LOWCOUNTRY
CORRIDOR

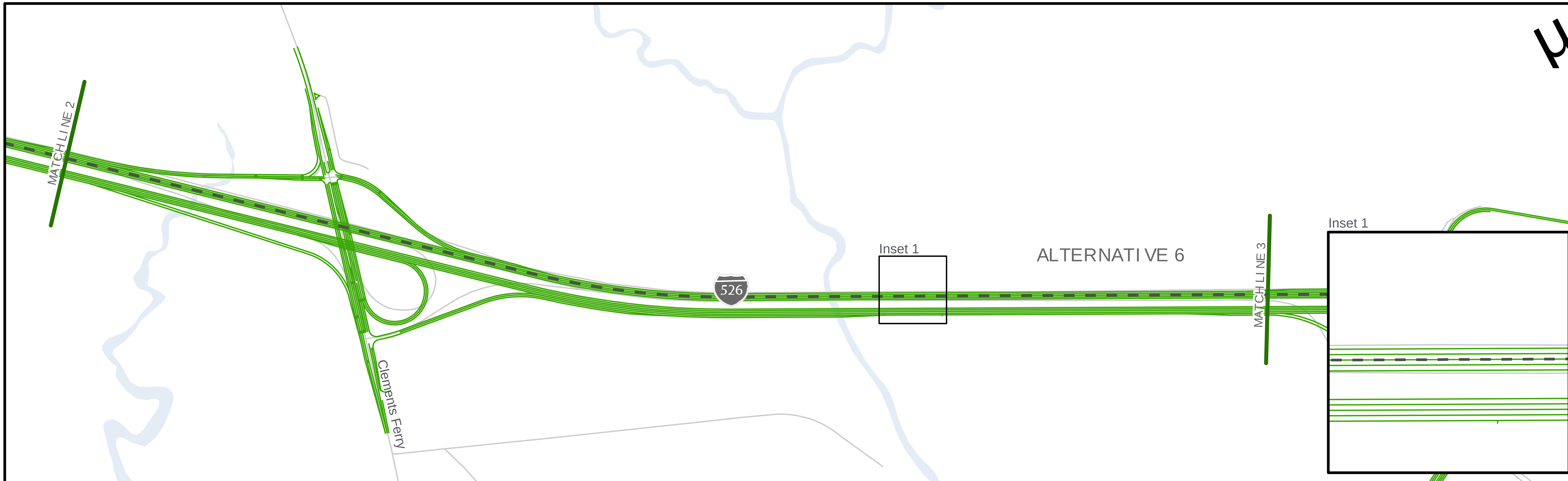
Conceptual Alternatives

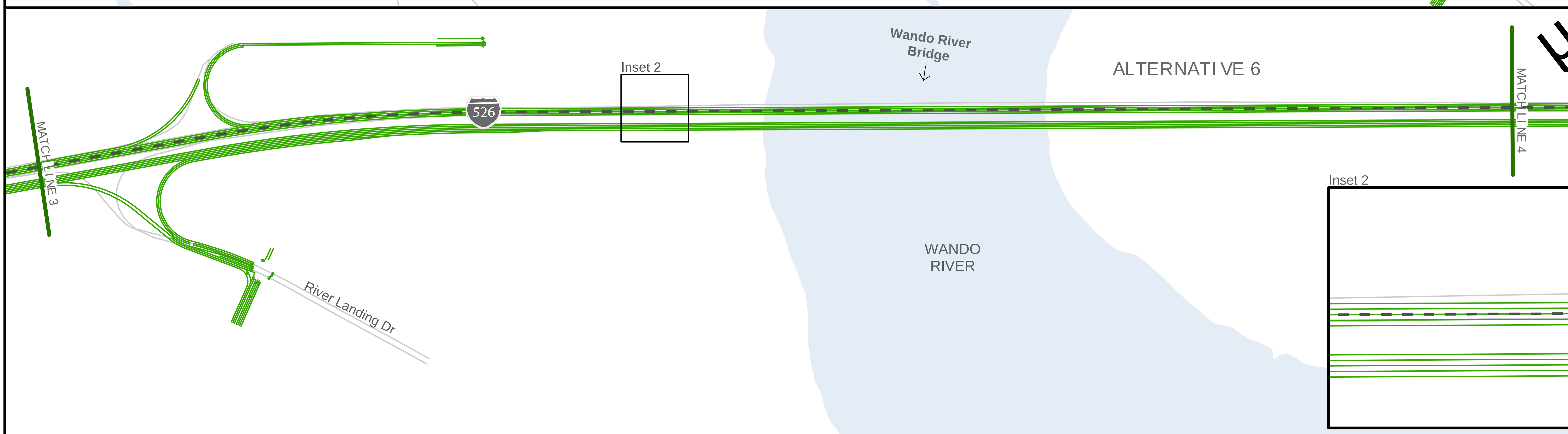
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 6

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 6

Date: 4/12/2021





LOWCOUNTRY CORRIDOR

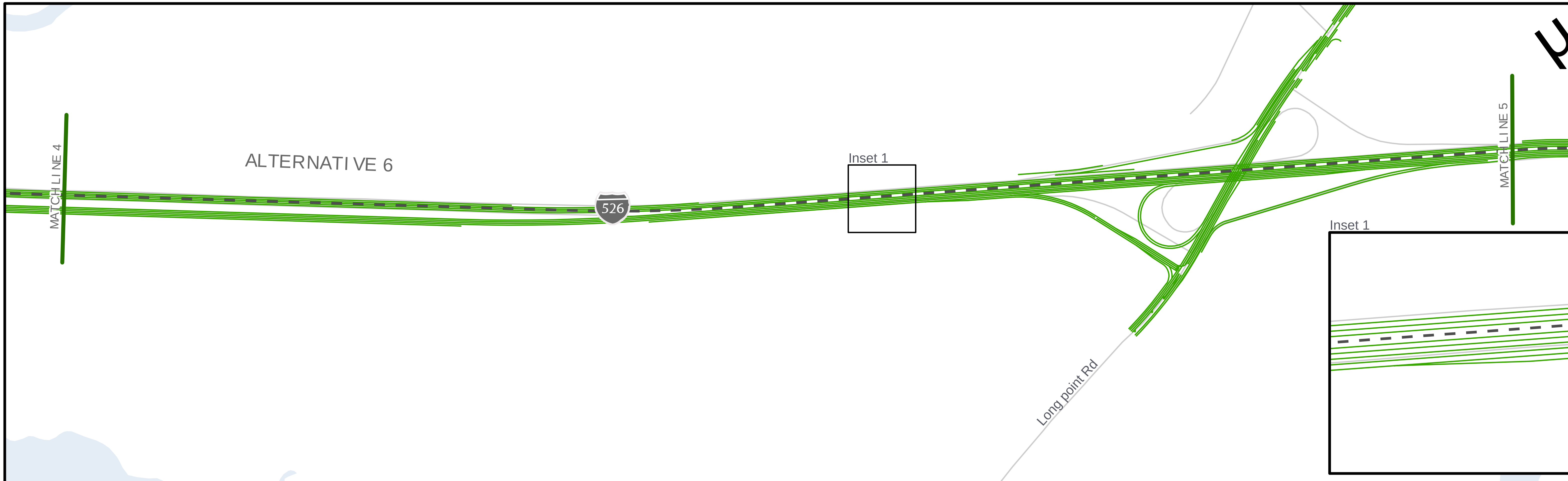
Conceptual Alternatives

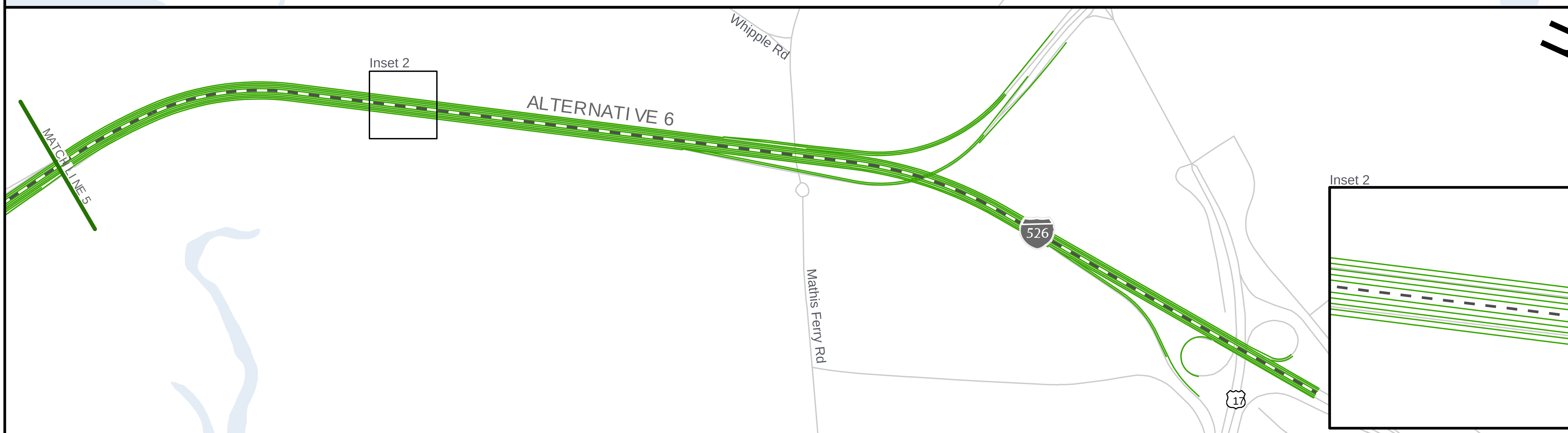
LEGEND
ALTERNATIVE DESIGNS
- - EXISTING I-526 CENTER LINE
— ALTERNATIVE 6

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 6

Date: 4/12/2021





LOWCOUNTRY CORRIDOR

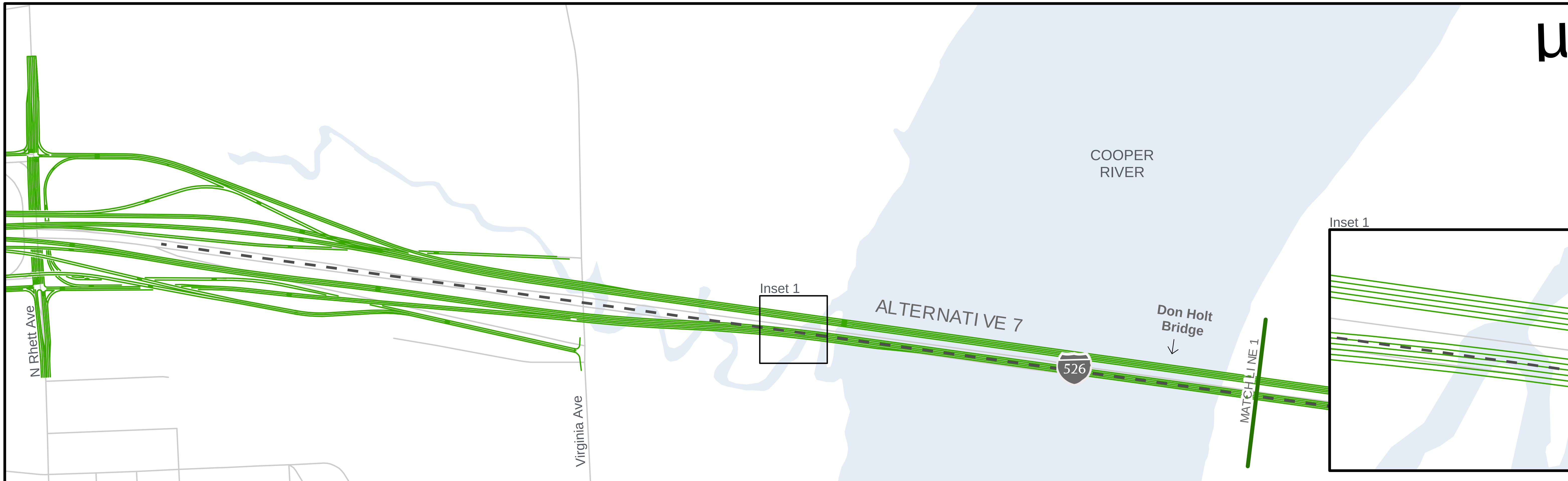
Conceptual Alternatives

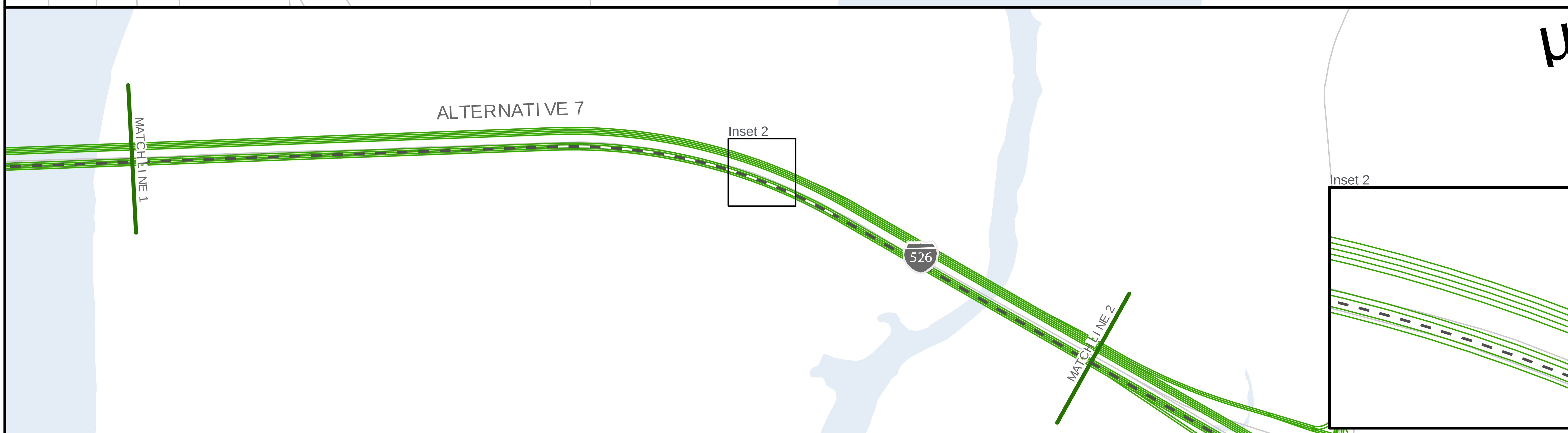
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 6

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 6

Date: 4/12/2021





526 EAST
LOWCOUNTRY CORRIDOR

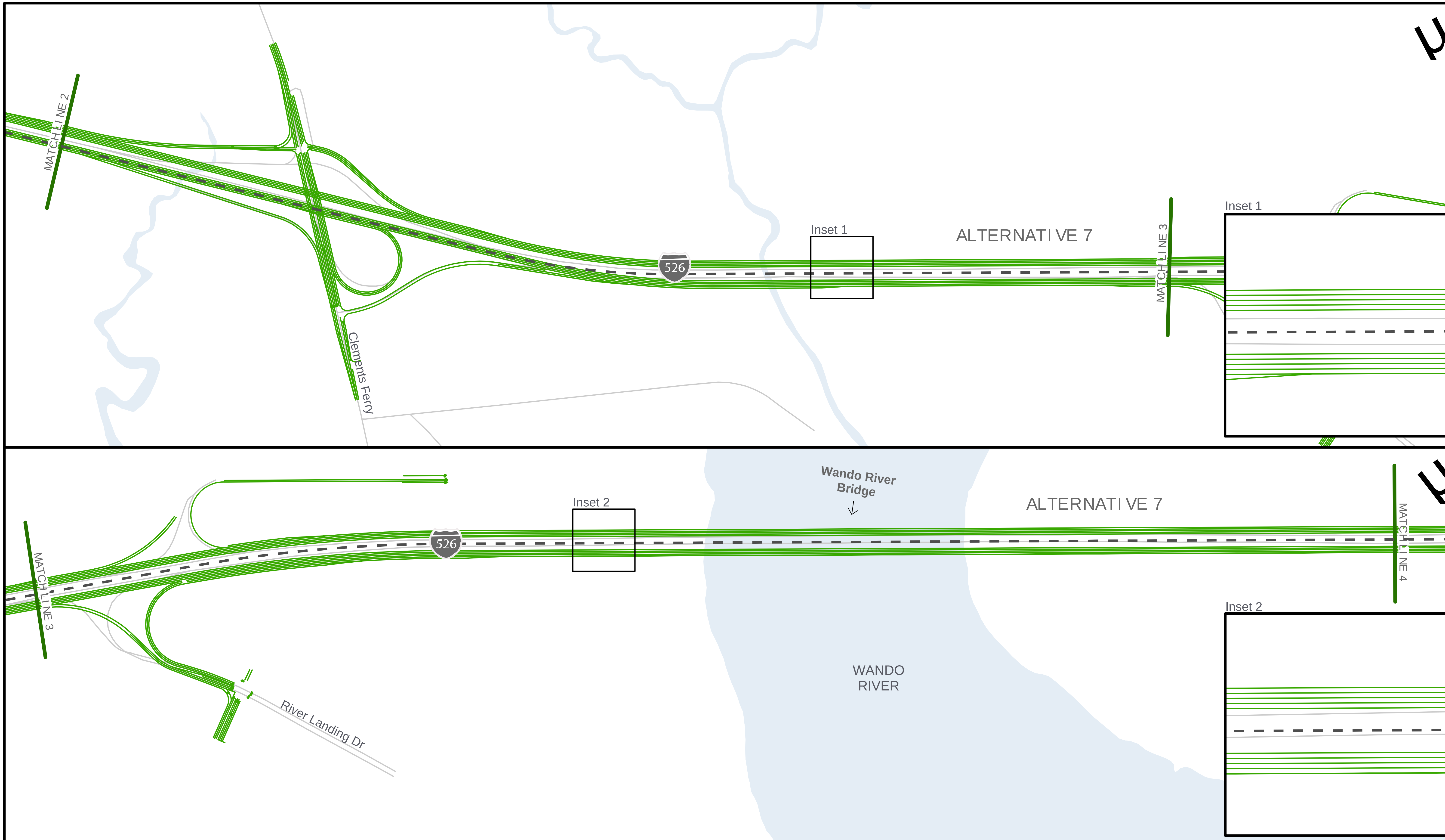
Conceptual Alternatives

LEGEND
ALTERNATIVE DESIGNS
- - EXISTING I-526 CENTER LINE
— ALTERNATIVE 7

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 7

Date: 4/12/2021



526 EAST LOWCOUNTRY CORRIDOR

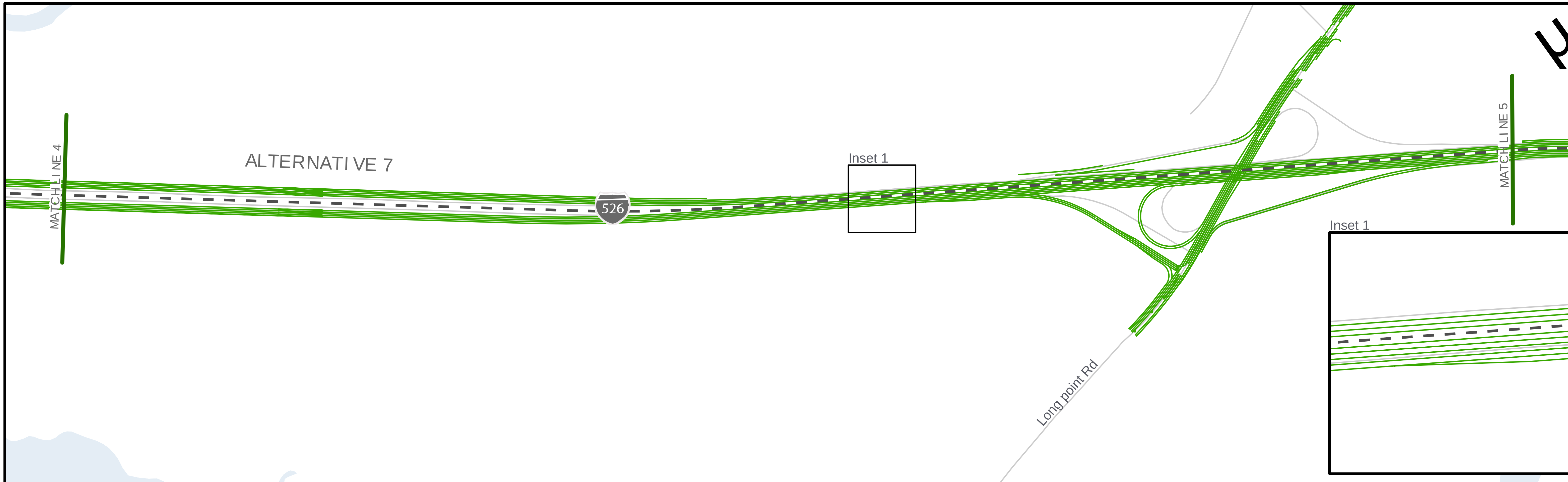
Conceptual Alternatives

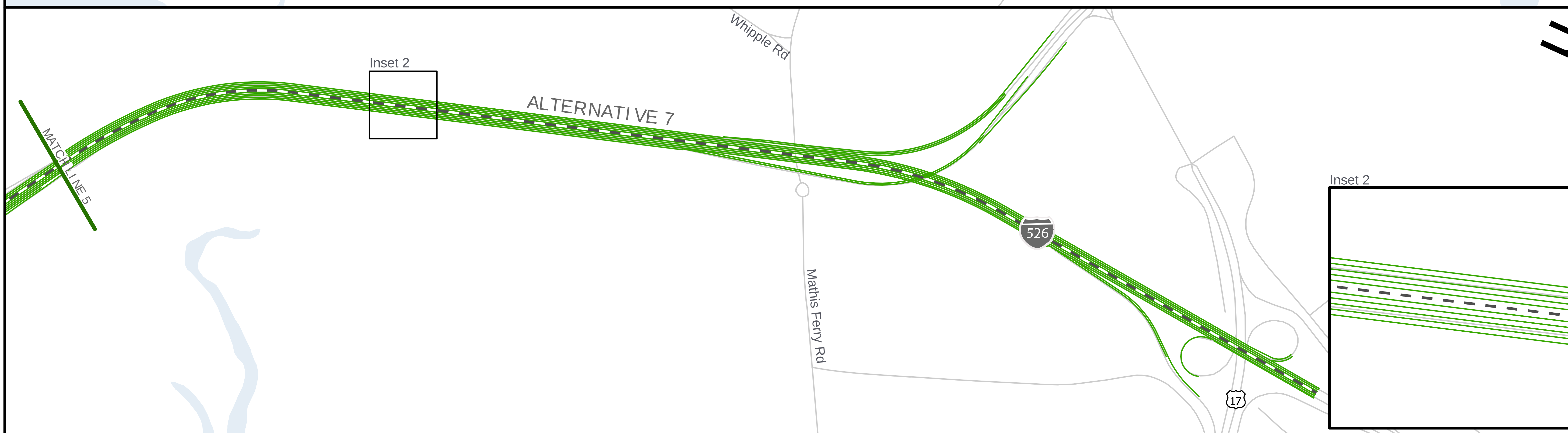
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTER LINE
ALTERNATIVE 7

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 7

Date: 4/12/2021





526 EAST LOWCOUNTRY CORRIDOR

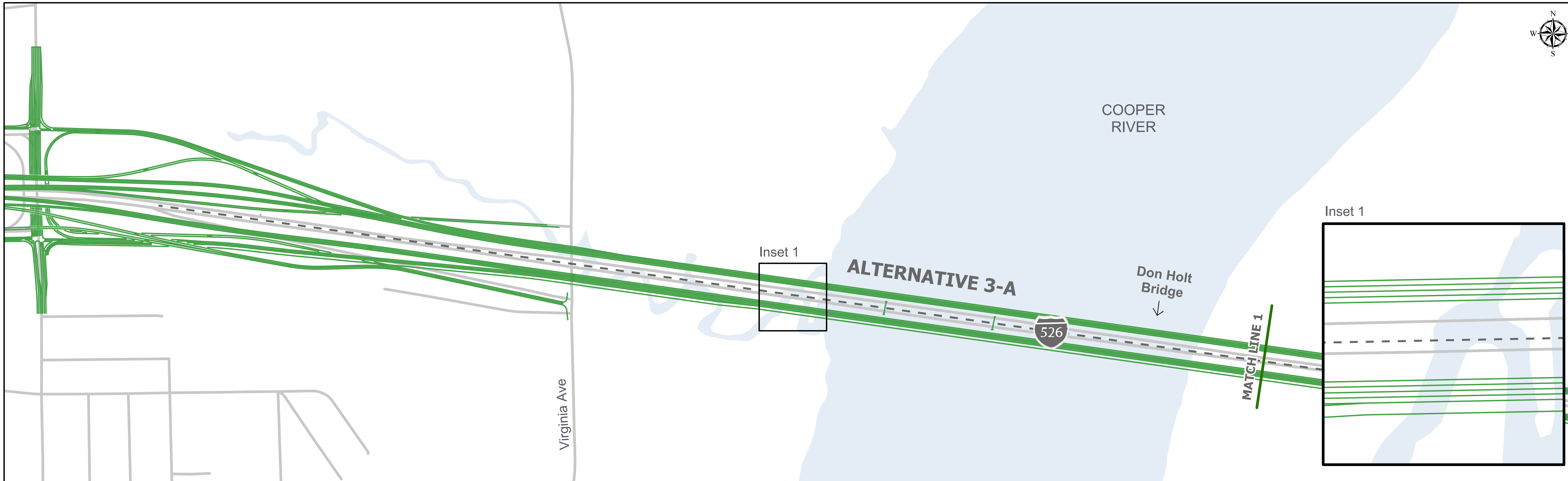
Conceptual Alternatives

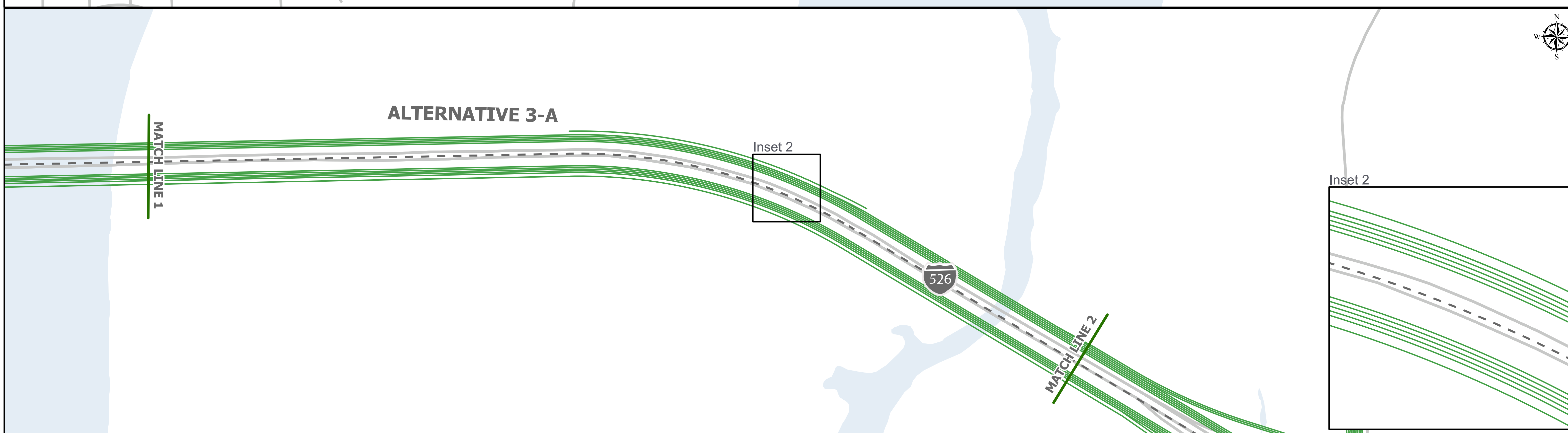
LEGEND
ALTERNATIVE DESIGNS
- - EXISTING I-526 CENTER LINE
— ALTERNATIVE 7

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 7

Date: 4/12/2021





526 EAST
LOWCOUNTRY
CORRIDOR

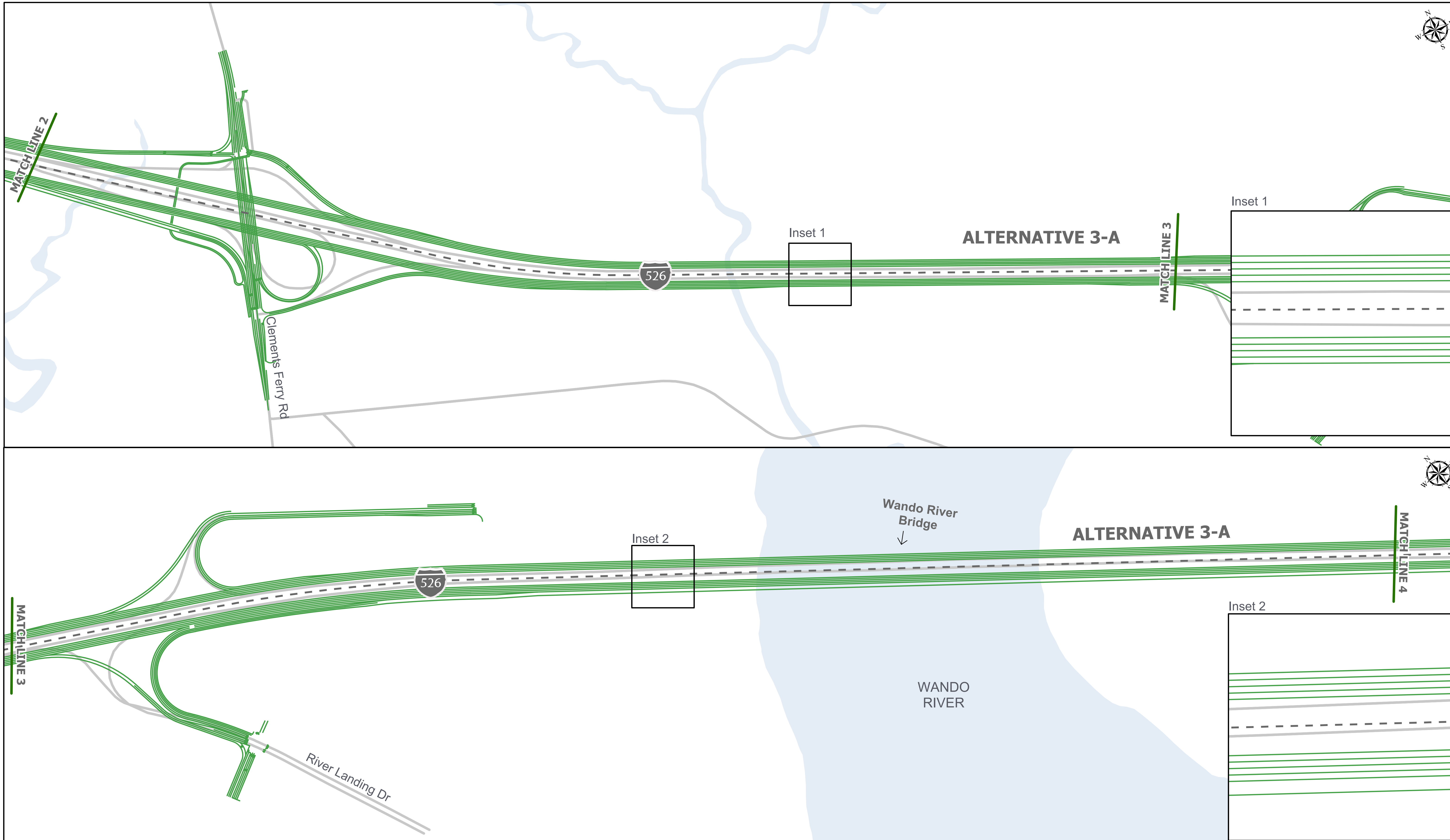
Conceptual Alternatives

LEGEND
ALTERNATIVE DESIGNS
- - - EXISTING I-526 CENTERLINE
—— ALTERNATIVE 3-A

0 500 1,000 1,500 2,000 Feet

ALTERNATIVE 3-A

Date: 4/12/2022



526 EAST
LOWCOUNTRY CORRIDOR

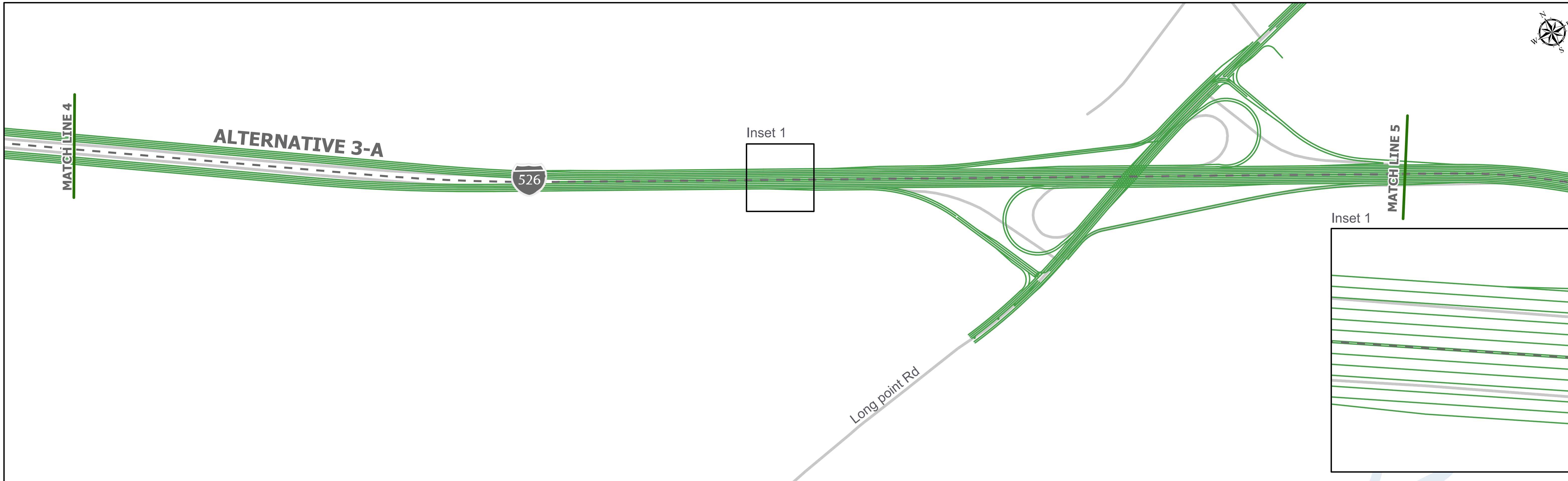
Conceptual Alternatives

LEGEND
ALTERNATIVE DESIGNS
- - - EXISTING I-526 CENTERLINE
— ALTERNATIVE 3-A

0 510 1,000 1,500 2,000 Feet

ALTERNATIVE 3-A

Date: 4/12/2022



526 EAST
LOWCOUNTRY
CORRIDOR

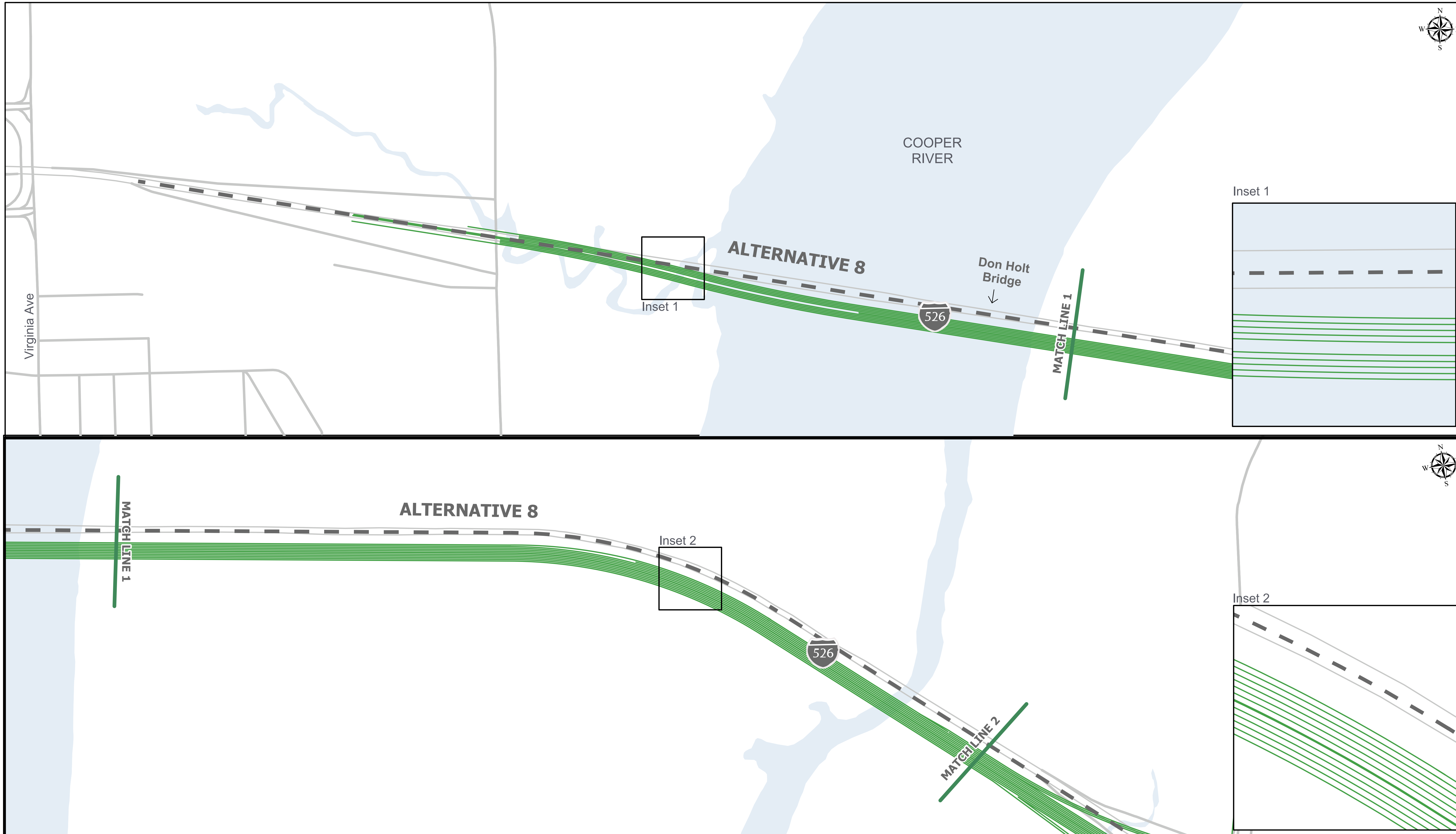
Conceptual Alternatives

LEGEND
ALTERNATIVE DESIGNS
- - - EXISTING I-526 CENTERLINE
— ALTERNATIVE 3-A

0 490 980 1,500 2,000 Feet

ALTERNATIVE 3-A

Date: 4/12/2022



526 EAST
LOWCOUNTRY
CORRIDOR

Conceptual Alternatives

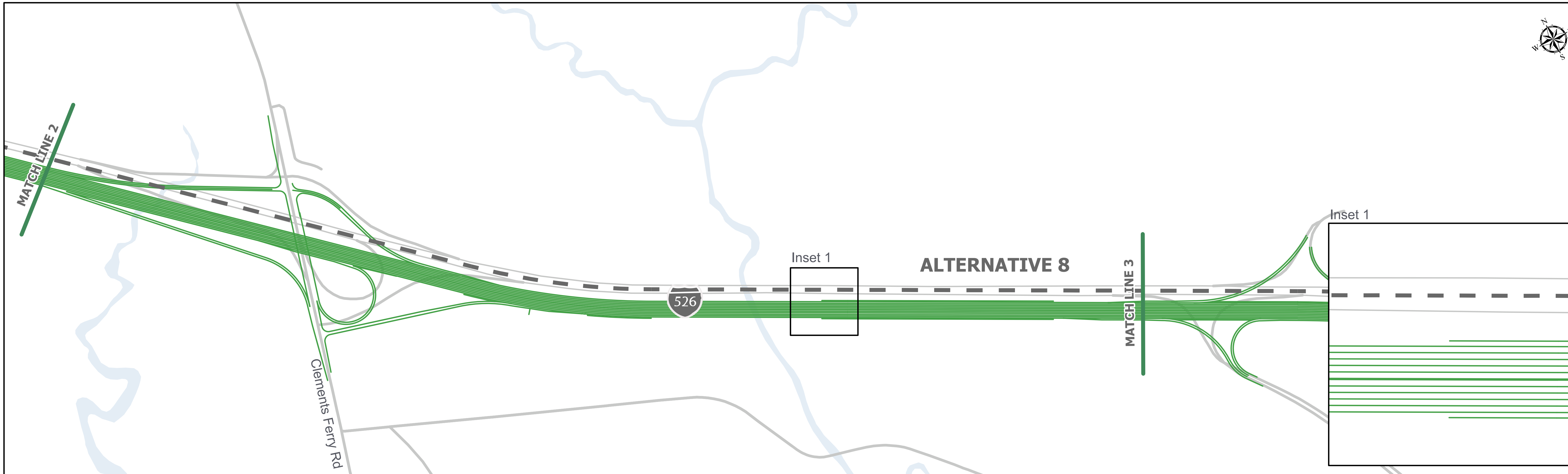
LEGEND
ALTERNATIVE DESIGNS

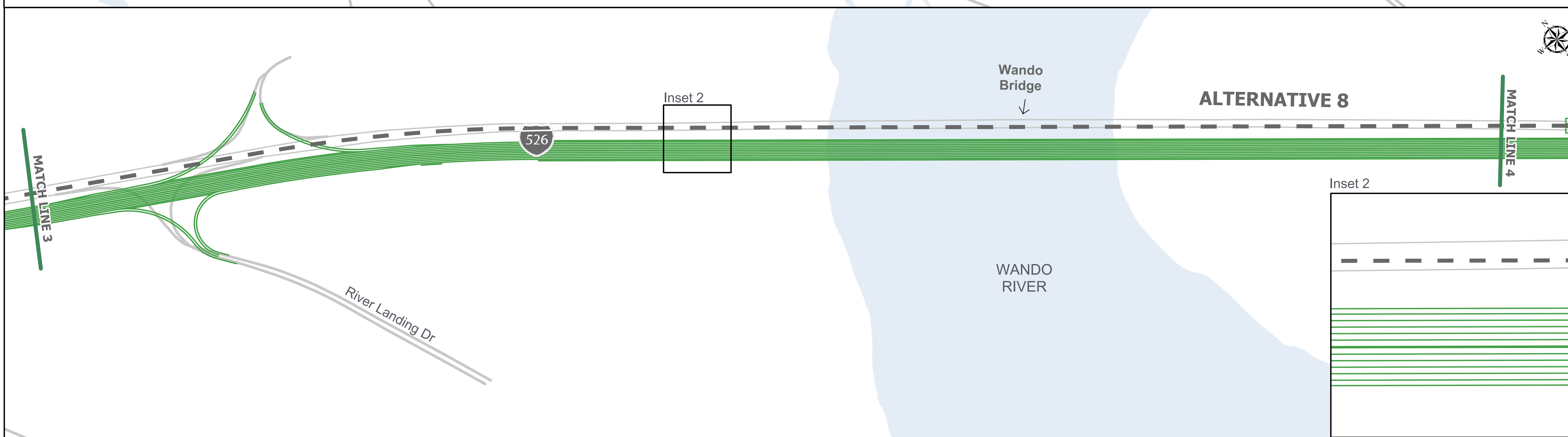
- EXISTING I-526 CENTERLINE
- ALTERNATIVE 8

0 490 980 1,500 2,000 Feet

ALTERNATIVE 8

Date: 5/27/2022





526 EAST
LOWCOUNTRY CORRIDOR

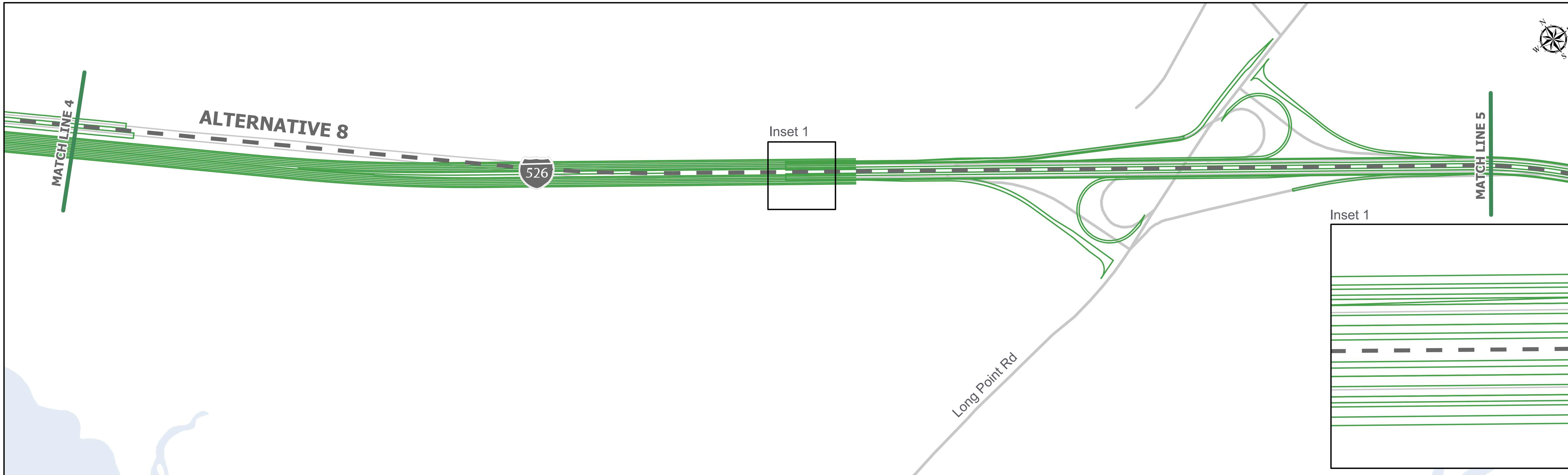
Conceptual Alternatives

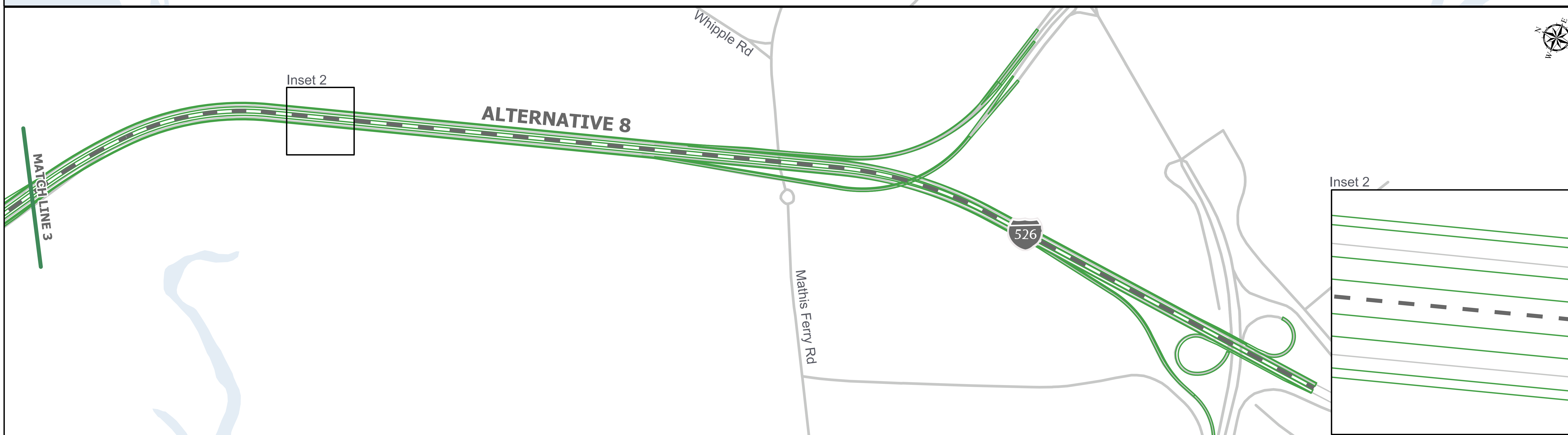
LEGEND
ALTERNATIVE DESIGNS
EXISTING I-526 CENTERLINE
ALTERNATIVE 8

0 490 980 1,500 2,000 Feet

ALTERNATIVE 8

Date: 5/27/2022





526 EAST
LOWCOUNTRY CORRIDOR

Conceptual Alternatives

LEGEND
ALTERNATIVE DESIGNS
- EXISTING I-526 CENTERLINE
- ALTERNATIVE 8

0 490 980 1,500 2,000 Feet

ALTERNATIVE 8

Date: 5/27/2022

APPENDIX B

LEVEL 2 AND 3 SCREENING SCORES

Appendix B:

Level 2 and 3 Screening Scores

Level 2 Screening Scores

Segment 1 Results

Options	Capacity Option	P&N: LOS TOTAL	Engineering: Constructablity TOTAL	Engineering: Design TOTAL	Natural Resources: Aquatic Features TOTAL	Community: Relocations TOTAL	Community: Parks -4(f) TOTAL	Overall Score Total
1-A	Retain/Symmetrical	LOS F	3.8	3.3	1.0	3.0	1.0	12.1
1-B	Retain/Symmetrical	LOS F	1.4	2.9	4.0	4.0	1.0	13.3
1-C	Retain/North	LOS E	3.0	3.5	3.0	1.0	1.0	11.5
1-D	Retain/South	LOS E	3.0	3.5	2.0	4.0	1.0	13.5
1-E	Replace/Symmetrical	LOS E	3.4	2.1	5.0	4.0	1.0	15.5
1-F	Replace/North	LOS E	5.0	2.6	2.0	1.0	1.0	11.6
1-G	Replace/South	LOS E	5.0	2.6	1.0	5.0	1.0	14.6
1-H	Replace/North (Staged Construction)	LOS E	3.0	3.5	3.0	1.0	1.0	11.5
1-I	Replace/South (Staged Construction)	LOS E	3.0	2.9	2.0	4.0	1.0	12.9

Segment 2 Results

Options	Capacity Option	P&N: LOS TOTAL	Engineering: Constructablity TOTAL	Engineering: Design TOTAL	Natural Resources: Aquatic Features TOTAL	Community: Relocations TOTAL	Community: Parks -4(f) TOTAL	Overall Score Total
2-A	Retain/Symmetrical	LOS F	1.8	2.9	4.0	1.0	2.0	11.7
2-B	Retain/Symmetrical	LOS F	1.8	2.9	4.0	1.0	2.0	11.7
2-C	Retain/North	LOS F	3.0	3.0	5.0	1.0	2.0	14.0
2-D	Retain/South	LOS F	3.0	3.0	4.0	2.0	2.0	14.0
2-E	Replace/Symmetrical	LOS E	2.2	1.5	5.0	4.0	2.0	14.7
2-F	Replace/North	LOS E	1.8	2.7	3.0	4.0	1.0	12.5
2-G	Replace/South	LOS E	1.8	2.7	1.0	5.0	1.0	11.5
2-H	Replace/North (Staged Construction)	LOS E	3.0	3.0	5.0	1.0	2.0	14.0
2-I	Replace/South (Staged Construction)	LOS E	3.0	2.3	4.0	2.0	2.0	13.3
2-J	Replace/Symmetrical (Staged Construction)	LOS E	3.0	1.7	4.0	1.0	2.0	11.7

Segment 3 Results

Options	Capacity Option	P&N: LOS TOTAL	Engineering: Constructablity TOTAL	Engineering: Design TOTAL	Natural Resources: Aquatic Features TOTAL	Community: Relocations TOTAL	Community: Parks -4(f) TOTAL	Overall Score Total
3-A	Widen inside/outside (smaller footprint)	LOS D	3.0	2.3	1.0	1.0	0.0	7.3
3-B	Widen outside (larger footprint)	LOS D	1.8	2.7	2.0	5.0	0.0	11.5

Segment 1 A						
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)	Compatability with adjoining projects - High (5) Medium (3) Low (1)	Contribution to Increased Resiliency - High (5) Medium (3) Low (1)	Total
Roadway Eng	3		3	1	5	
Roadway Eng	3		3	1	5	
Roadway Designer	3		3	1	5	
Bridge Engineer	5		5	1	5	
Construction Engineer	5		5	1	5	
		3.8	3.8	1.0	5.0	3.3

Segment 1 B						
	Constructability		Design			
			Ports & Transit Access	Compatibility	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)	Compatibility with adjoining projects - High (5) Medium (3) Low (1)	Contribution to Increased Resiliency - High (5) Medium (3) Low (1)	Total
Roadway Eng	1		3	1	3	
Roadway Eng	1		3	3	3	
Roadway Designer	3		5	3	3	
Bridge Engineer	1		5	1	3	
Construction Engineer	1		5	3	3	
		1.4	3.6	2.2	3.0	2.9

Segment 1 C						
	Constructability		Design			
			Ports & Transit Access	Compatibility	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)	Compatibility with adjoining projects - High (5) Medium (3) Low (1)	Contribution to Increased Resiliency - High (5) Medium (3) Low (1)	Total
Roadway Eng	3		3	5	3	
Roadway Eng	3		3	3	3	
Roadway Designer	3		5	3	3	
Bridge Engineer	3		5	3	3	
Construction Engineer	3		5	3	3	
		3.0	4.2	3.4	3.0	3.5

Segment 1 D						
	Constructability		Design			
			Ports & Transit Access	Compatibility	Seismic	
	Disruption to traffic , construction techniques/type, staginging issues during construction - High (5) Medium (3) Low (1)	Total	Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)	Compatability with adjoining projects - High (5) Medium (3) Low (1)	Contribution to Increased Resiliency - High (5) Medium (3) Low (1)	Total
Roadway Eng	3		3	5	3	
Roadway Eng	3		3	3	3	
Roadway Designer	3		5	3	3	
Bridge Engineer	3		5	3	3	
Construction Engineer	3		5	3	3	
		3.0	4.2	3.4	3.0	3.5

Segment 1 E						
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)	Compatability with adjoining projects - High (5) Medium (3) Low (1)	Contribution to Increased Resiliency - High (5) Medium (3) Low (1)	Total
Roadway Eng	3		1	1	1	
Roadway Eng	3		5	3	1	
Roadway Designer	5		1	5	1	
Bridge Engineer	3		3	1	1	
Construction Engineer	3		3	3	1	
		3.4	2.6	2.6	1.0	2.1

Segment 1 F						
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)	Compatability with adjoining projects - High (5) Medium (3) Low (1)	Contribution to Increased Resiliency - High (5) Medium (3) Low (1)	Total
Roadway Eng	5		1	5	1	
Roadway Eng	5		1	5	1	
Roadway Designer	5		1	5	1	
Bridge Engineer	5		3	5	1	
Construction Engineer	5		3	5	1	
		5.0	1.8	5.0	1.0	2.6

	Segment 1 G					
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	5		1	5	1	
Roadway Eng	5		1	5	1	
Roadway Designer	5		1	5	1	
Bridge Engineer	5		3	5	1	
Construction Engineer	*5*		*3*	*5*	*1*	
		5.0	1.8	5.0	1.0	2.6

	Segment 1 H					
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	3		3	5	3	
Roadway Eng	3		3	3	3	
Roadway Designer	3		5	3	3	
Bridge Engineer	3		5	3	3	
Construction Engineer	*3*		*5*	*3*	*3*	
		3.0	4.2	3.4	3.0	3.5

	Segment 1 I					
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	3		3	5	1	
Roadway Eng	3		3	3	1	
Roadway Designer	3		5	3	1	
Bridge Engineer	3		5	3	1	
Construction Engineer	*3*		*5*	*3*	*1*	
		3.0	4.2	3.4	1.0	2.9

	Segment 2 A					
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	1		3	1	3	
Roadway Eng	3		3	3	3	
Roadway Designer	3		5	3	3	
Bridge Engineer	1		3	1	3	
Construction Engineer	*1*		*3*	*3*	*3*	
		1.8	*3.4*	*2.2*	*3.0*	2.9

	Segment 2 B					
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	1		3	1	3	
Roadway Eng	3		3	3	3	
Roadway Designer	3		5	3	3	
Bridge Engineer	1		3	1	3	
Construction Engineer	*1*		*3*	*3*	*3*	
		1.8	*3.4*	*2.2*	*3.0*	2.9

	Segment 2 C					
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	3		3	3	3	
Roadway Eng	3		3	3	3	
Roadway Designer	3		5	3	3	
Bridge Engineer	3		1	3	3	
Construction Engineer	*3*		*3*	*3*	*3*	
		3.0	*3.0*	*3.0*	*3.0*	3.0

Segment 2 D

	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	3		3	3	3	
Roadway Eng	3		3	3	3	
Roadway Designer	3		5	3	3	
Bridge Engineer	3		1	3	3	
Construction Engineer	*3*		*3*	*3*	*3*	
		3.0	*3.0*	*3.0*	*3.0*	**3.0**

Segment 2 G

	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	3		3	5	1	
Roadway Eng	3		3	5	1	
Roadway Designer	1		1	5	1	
Bridge Engineer	1		1	5	1	
Construction Engineer	*1*		*3*	*5*	*1*	
		1.8	*2.2*	*5.0*	*1.0*	**2.7**

Segment 2 E

	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	1		3	1	1	
Roadway Eng	3		3	3	1	
Roadway Designer	1		1	1	1	
Bridge Engineer	3		1	1	1	
Construction Engineer	*3*		*3*	*1*	*1*	
		2.2	*2.2*	*1.4*	*1.0*	**1.5**

Segment 2 H

	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	3		3	3	3	
Roadway Eng	3		3	3	3	
Roadway Designer	3		5	3	3	
Bridge Engineer	3		1	3	3	
Construction Engineer	*3*		*3*	*3*	*3*	
		3.0	*3.0*	*3.0*	*3.0*	**3.0**

Segment 2 F

	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	3		3	5	1	
Roadway Eng	3		3	5	1	
Roadway Designer	1		1	5	1	
Bridge Engineer	1		1	5	1	
Construction Engineer	*1*		*3*	*5*	*1*	
		1.8	*2.2*	*5.0*	*1.0*	**2.7**

Segment 2 I

	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	3		3	3	1	
Roadway Eng	3		3	3	1	
Roadway Designer	3		5	3	1	
Bridge Engineer	3		1	3	1	
Construction Engineer	*3*		*3*	*3*	*1*	
		3.0	*3.0*	*3.0*	*1.0*	**2.3**

	Segment 2 J					
	Constructability		Design			
			Ports & Transit Access	Compatiblity	Seismic	
	Disruption to traffic during construction - High (5) Medium (3) Low (1)	Total	*Improve access to Ports and Transit facilities- High (5) Medium (3) Low (1)*	*Compatability with adjoining projects - High (5) Medium (3) Low (1)*	*Contribution to Increased Resiliency - High (5) Medium (3) Low (1)*	Total
Roadway Eng	3		3	1	1	
Roadway Eng	3		3	1	1	
Roadway Designer	3		3	1	1	
Bridge Engineer	3		3	1	1	
Construction Engineer	*3*		*3*	*1*	*1*	
		3.0	*3.0*	*1.0*	*1.0*	**1.7**

Segment 1 Natural Resources						
Options	Aquatic Resources		Total	Score (1-5)		
	Freshwater	Tidal		Score	Scale	Score
1-A	13.7	99.3	112.9	**1.0**	108-117	1
1-B	17.8	124.9	142.8	**4.0**	118-126	2
1-C	16.4	111.4	127.8	**3.0**	127-135	3
1-D	17.6	107.9	125.5	**2.0**	136-143	4
1-E	19.6	135.1	154.7	**5.0**	144+	5
1-F	18.0	102.9	120.9	**2.0**		
1-G	16.1	92.3	108.5	**1.0**		
1-H	16.4	111.4	127.8	**3.0**		
1-I	17.6	107.9	125.5	**2.0**		

Segment 2 Natural Resources						
Options	Aquatic Resources		Total	Score (1-5)		
	Freshwater	Tidal		Score	Scale	Score
2-A	15.0	31.1	46.0	**4.0**	37-39	1
2-B	15.2	31.2	46.4	**4.0**	40-42	2
2-C	17.8	31.8	49.6	**5.0**	43-45	3
2-D	16.3	30.8	47.0	**4.0**	46-48	4
2-E	16.2	34.3	50.4	**5.0**	49-50	5
2-F	19.2	26.2	45.4	**3.0**		
2-G	13.2	24.0	37.2	**1.0**		
2-H	17.8	31.8	49.6	**5.0**		
2-I	16.3	30.8	47.0	**4.0**		
2-J	15.1	31.1	46.2	**4.0**		

Segment 2 Natural Resources						
Options	Aquatic Resources		Total	Score (1-5)		
	Freshwater	Tidal		Score	Scale	Score
3-A	7.6	2.0	9.6	1.0		
3-B	8.1	3.2	11.3	2.0		

Segment 1 Community Impacts										
Options	Relocations			Relocations Score (1-5)			Park 4(f)		Parks Score (1)	
	Residential (Units)	Buisnesses	Total	Score	Score	Scale	Park 4(f)	Score	Score	Scale
1-A	4	1	5	3	1 to 2	1	1	1	1	1
1-B	4	2	6	4	3 to 4	2	1	1		
1-C	1	0	1	1	5	3	1	1		
1-D	4	2	6	4	6	4	1	1		
1-E	4	2	6	4	7	5	1	1		
1-F	0	1	1	1			1	1		
1-G	5	2	7	5			1	1		
1-H	1	0	1	1			1	1		
1-I	4	2	6	4			1	1		
		Min	1							
		Max	7							

Segment 2 Environmental Resources Impacts										
Options	Relocations			Score (1-5)			Park 4(f)		Parks Score (1-2)	
	Residential (Units)	Buisnesses	Total	Score	Score	Scale	Park 4(f)	Score	Score	Scale
2-A	39	19	58	1	58-61	1	2	2	1	1
2-B	39	19	58	1	62-65	2	2	2	2	2
2-C	49	9	58	1	66-69	3	2	2		
2-D	36	28	64	2	70-73	4	2	2		
2-E	41	30	71	4	73+	5	2	2		
2-F	66	6	72	4			1	1		
2-G	44	30	74	5			1	1		
2-H	49	9	58	1			2	2		
2-I	36	28	64	2			2	2		
2-J	39	19	58	1			2	2		
		Min	58							
		Max	74							

Segment 3 Environmental Resources Impacts										
Options	Relocations			Score (1-5)			Park 4(f)		Parks Score (0)	
	Residential (Units)	Buisnesses	Total	Score	Score	Scale	Park 4(f)	Score	Score	Scale
3-A	1	1	2	1			0	0		
3-B	7	3	10	5			0	0		

Level 3 Screening Scores

Community Impacts										
Alternatives	Relocations			Relocations Score (1-5)			Park 4(f)		Parks Score (1)	
	Residential (Units)	Businesses	Total	Score	Score	Scale	Park 4(f)	Score	Score	Scale
Alternative 1	48	25	73	4	39 to 48	1	3	3	1	1
Alternative 2	46	27	73	4	49 to 58	2	3	3		
Alternative 3	51	31	82	5	59 to 68	3	3	3		
Alternative 3A*	48	24	72	4	69 to 78	4	2	2		
Alternative 4	68	12	80	4	79 +	5	2	2		
Alternative 5	49	15	64	3			3	3		
Alternative 6	11	28	39	1			3	3		
Alternative 7	46	26	72	4			3	3		
Alternative 8*	50	33	83	5			2	2		

*Developed following the second public information meeting

Natural Resources						
Alternatives	Aquatic Resources			Score (1-5)		
	Freshwater	Tidal	Total	Score	Scale	Score
Alternative 1	30.3	144.5	174.8	1.0	146 to 175	1
Alternative 2	31.8	144.7	176.5	2.0	176 to 186	2
Alternative 3	38.6	176.6	215.2	5.0	187 to 197	3
Alternative 3A*	33.2	170.7	203.9	4.0	198 to 207	4
Alternative 4	35.2	132.0	167.1	1.0	208+	5
Alternative 5	29.5	144.8	174.3	1.0		
Alternative 6	26.7	138.8	165.5	1.0		
Alternative 7	29.9	147.9	177.8	2.0		
Alternative 8*	28.1	118.3	146.4	1.0		

*Developed following the second public information meeting