Wilmington Rail Improvements

Landside Rail Improvements Serving the Port and Moving Trains Safely through the Community

September 6, 2017

North Carolina Department of Transportation

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This report would not have been possible without the guidance, collaboration, critical analysis and encouragement provided by the management and staff of the North Carolina Department of Transportation, the North Carolina State Ports Authority, the City of Wilmington and the Wilmington Metropolitan Planning Organization.

Finally, CSX Transportation staff, as well as the staff of the Wilmington Terminal Railroad, a subsidiary of the Genesee & Wyoming Inc., both provided important input to the team’s understanding of local railroad operations.

Successful implementation, operation, and achievement of the goals described in this report can only be achieved through an engaged and sustained public private partnership.

Contents

Executive Summary

The economic benefits of the North Carolina State Ports Authority (NCSPA) and the Port of Wilmington (Port) reach well beyond New Hanover County and Southeast North Carolina. Leveraging the adjacent rail network, the Port offers its customers safe, cost-effective, and environmentally sustainable connections to the state's largest metropolitan areas as well as the national transportation system while providing new economic development and job creation opportunities in North Carolina.

A recent economic impact study by NC State University's Institute for Transportation Research and Education found that goods moving through North Carolina ports annually contribute approximately $14 B to the state's economy ($12.9 B attributed to the Port of Wilmington and $1.1 B attributed to the Port of Morehead City). The ports directly and indirectly support over 76,700 jobs across North Carolina; thus, deepwater port shipping is clearly a substantial economic factor for the state.

In order to compete in a dynamic regional and international economy, the Port requires first-rate multimodal transportation connectivity to both the national highway and railroad systems. The rail connection over the CSX Transportation (CSXT) "SE Line" from the Port to their National Gateway corridor follows Interstate 95 to the Northeast US and extends south to Miami. The NCSPA is owner of an 18-mile long terminal railroad that provides service on the Port as well as direction connections west and south of the Third Street railroad highway crossing to industries and sites in the immediate area. The NCSPA rail property is operated and maintained by the Wilmington Terminal Railway (WTRY), a unit of Genesee and Wyoming Corporation.

In July 2017, after a 30-year absence, intermodal rail service returned to the Port through the Queen City Express (QCE), which connects to CSXT intermodal's facility in Charlotte. In addition, with the construction and opening of the Carolina Connector (CCX) intermodal terminal in Rocky Mount in 2019, new intermodal service will be introduced to feed into what will be an East Coast rail hub for CSXT.

Recent operational changes at CSXT have resulted in increased train lengths from 3,000 feet to in excess of 10,000 feet that will require relatively more space at the Port for storage and train handling. Arrival of larger quantities of commodities also will result in peaking of port operations to accommodate the cargos. In addition, CSXT system-wide operations changes are now calling for trains to be operated that combine general merchandise with intermodal container transport.

Based on NCSPA's most recent demand forecast, together with the new rail service flexibility and CSXT operating requirements, an evaluation of rail infrastructure was made that considers track capacity and condition on both the Port property as well as the CSXT Wilmington Beltline (Beltline), and the track from Davis Yard to Third Street.

Demand Forecast

The NCSPA overall demand forecast was used to develop a model incorporating ship calls, commodities, and container volumes by shipper to predict transport by rail and highway modes. The model is a forecasting tool for NCSPA staff to adjust as these inputs change. The results of the demand model provide insight into infrastructure needs to compete for market share. The demand model findings are:

- The existing rail infrastructure of the Beltline and at the Port will not sustain anticipated traffic volumes.
  - Both the Beltline and the Port rail lines require additional capital investment to increase velocity and capacity to mitigate roadway congestion (traffic backups) occurring when trains pass highway-rail at-grade intersections.
  - Rail infrastructure improvements are necessary to accommodate incremental rail volume increases defined over time for near-term, mid-term, and long-term needed improvements.
  - The demand forecast for increased freight, includes meeting NCSPA's goals of 25% transported by rail and a 79% increase in rail intermodal shipping (holding truck growth to 21%) by 2025. This growth will require strengthening and additions to existing railroad and port facilities and infrastructure.
- Shifting to short haul intermodal (Wilmington to Charlotte) from highway trucks will result in cost savings of approximately $10M-$15M annually for shippers.

On-Terminal Port Improvements

Sufficient land is available at the Port to achieve 750,000+ TEU capacity by expanding rail and intermodal handling capacity, however building and gate re-configurations would be required to meet that goal. To meet this level of container volume, improvements and additions to the existing infrastructure and operations must be made, including:

- Rehabilitation of ballast, ties and rail on Container 1 and Container 2 tracks
  - Estimated Costs: $1.2M
  - Schedule: Construction Fall 2017
- Construct an intermodal container handling rail yard utilizing reach stacker equipment and procure additional reach stacker equipment.
  - Estimated Costs: $18.8M
  - Schedule: Construction Fall 2019
    - Container Yard capital costs do not include utility upgrades required for site lighting and security booths.

Rail Access Improvements

Interpretation of the demand model results indicate the need for rail access to the Port to have improved mobility, increased velocity and capacity, and reliability enhancements to maintain healthy competition with trucking options. These rail improvements are needed to facilitate fluidity along the Beltline and improved service from the Port owned assets, and are more specifically described as follows:

- Strategic Transportation Investments (STI) Project – Beltline Speed and Safety Improvements

  - Enhanced highway-rail at-grade crossing warning devices and closures though the implementation of the Wilmington Traffic Separation Study (TSS), track improvements, curve realignments, and operational changes to increase safety, velocity, and capacity, and reduced Beltline travel time over some 26 road crossings.
  - Estimated Cost: $30.0M
  - Schedule: Submitted in STI 5.0 September 2017 for funding SFY2020
- Port and Access Line
  - Track upgrades, siding extensions, new side tracks, and expanded yard facilities to provided increased capacity to accommodate the growth in volume and lengths of trains serving the intermodal traffic while providing capacity and timely access for other port rail bulk/breakbulk customers.
  - Estimated Cost: $22.8M
  - Schedule: Phase 2 Construction Spring 2018 through Spring 2019;
    Phase 3 Construction Summer 2019 through 2025

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1 Introduction

Completion of the 48-mile-long Panama Canal expansion in 2016 doubled the Canal's capacity and ushered in a new Post-Panamax era in shipping, predicated on larger ships, increased throughput of tonnage, and changed the landscape of international maritime trade for decades to come.

The Port of Wilmington (Port) will benefit from the effects of increased tonnage and larger ships, as the Port expects to record increased freight volumes across all types of shipments (bulk, breakbulk, and container traffic). In addition to accommodating larger ships carrying more containers, the Canal project has heightened competition among North American Atlantic ports, as they rush to improve infrastructure, dredge channels, and add capacity to handle the increased freight.

The Queen City Express (QCE) is a direct rail service into and out of the Greater Charlotte region from a port in the Southeast U.S. This intermodal daily rail service, inaugurated July 28, 2017, is a double stacked train service to/from the Port to the Charlotte Intermodal Terminal (CIT), owned by the North Carolina State Port Authority (NCSPA). Daily container rail service via the QCE with next-day delivery to Charlotte from the Port will give Wilmington a competitive advantage in the market share contest among ports.

A second rail intermodal service will begin operation in late 2019 between the Port and CSXT's new Carolina Connector intermodal facility (CCX) in Rocky Mount. This critical infrastructure project will serve as a key transportation hub in the Southeast for containerized freight.

The QCE and CCX intermodal services are the first regularly scheduled intermodal rail services at the Port in nearly 30 years. Given current and forecasted demand for bulk and breakbulk shipments, the QCE and CCX intermodal services will significantly increase inbound-outbound rail shipments at the Port, adding stress to the existing transportation and intermodal infrastructure, and providing more opportunities for modal conflicts at highway-railroad at-grade crossings, and impacting safety and community mobility in Wilmington. Overall, the QCE and CCX rail services will lower transportation costs for businesses while taking trucks off the road, thus reducing emissions, improving road safety, and minimizing wear and tear on the State's highways.

To improve the efficiency of freight transport and to minimize the impact of projected volume increases on roadways, NCSPA has established a strategic goal to increase container traffic by rail to 25% of total freight shipped through the port by the year 2025.

The NCSPA and the North Carolina Department of Transportation (NCDOT) have initiated this study to review projected freight increases and potential infrastructure improvements needed to accommodate the expected growth. The goal of this report is to improve upon the Port's operational efficiencies, keep cargo moving, and minimize congestion and train conflicts within the City of Wilmington.

While there has been extensive discussion regarding long range rail improvements within the City of Wilmington, including the removal of at-grade crossings and a new rail bridge across the Cape Fear River, this report will focus on near term incremental improvements that can be accomplished for a growing freight market, and initiation of the QCE and CCX services.

For the State of North Carolina and the Port, it is critical to invest in freight infrastructure and optimize logistical assets to retain and grow transportation options for the State's current and future industries and growing population. Such a program of investments will help sustain and build North Carolina's economy.

1.1 Overview

As requested by the NCDOT, this study evaluated potential near-term rail and port infrastructure improvements that would (1) improve rail access to the Port from CSXT's Davis Yard encompassing existing rail infrastructure traversing the City of Wilmington and (2) improve rail conditions and operations on the Port property. This report summarizes the findings and recommendations on three primary topics:

- Assessment of the demand for freight rail services at the Port, including the transport of bulk, breakbulk and intermodal container commodities,
- Review of existing rail facilities at the Port and make recommendations for accommodating the projected growth in freight rail traffic, and
- Review of CSXT's Wilmington Beltline, including the Davis Yard facility in Leland, together with implementing recommendations for enhancing safety at the numerous highway-railroad at-grade crossings, and make recommendations for upgrading the infrastructure needed to sustain the increased freight volumes and raise train operating speeds.

The report also identifies potential public funding options and includes preliminary Benefit-Cost Analyses for the two recommended programs of projects.

This report focuses on achievable transportation improvement projects that will create near term benefits to NCSPA, the Port, and the City of Wilmington. In that regard, the NCSPA along with support from the Wilmington Metropolitan Planning Organization (WMPO) and NCDOT have prepared project proposals and budgets for Federal Congestion Mitigation and Air Quality (CMAQ) and State Strategic Transportation Investments (STI) funding. The proposal for CMAQ funding will support the QCE operations to address truck congestion on Wilmington area streets aiming to reduce air quality emissions. Additionally, the NCSPA through the WMPO has requested STI funding for a program of projects on the CSXT Beltline. These proposals were submitted in accordance with the regional and statewide transportation planning processes and are currently under consideration for funding.

The Port and NCSPA are challenged with competing effectively in today's global marketplace, which includes offering reliable and frequent Port access for loading and unloading of cargo as well as quick access to inland transportation networks and population centers. In so doing, the Port will create unique value over other ports in the Southeast.

In partnership with NCDOT, the NCSPA has developed a list of priority near term projects to improve the onboarding and offloading capability via rail at the Port. This report details those recommendations. Development of high capacity intermodal rail operations and enhancement of the existing railroad network within the City of Wilmington will strongly position the Port to capture additional maritime trade opportunities.

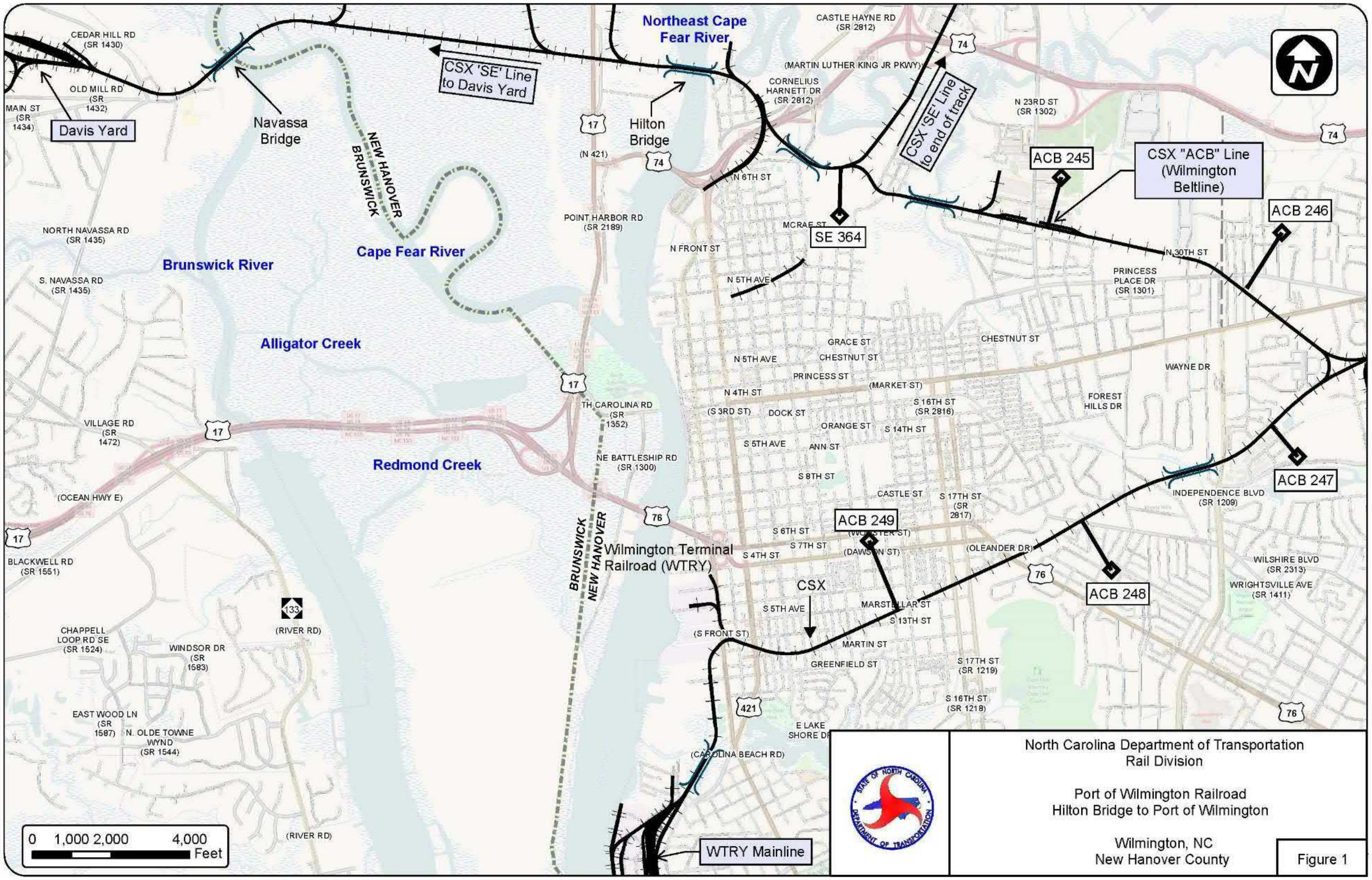
1.2 Study Area/Existing Conditions

1.2.1 Description

This study focused on the current Port property boundaries and the connecting rail lines to/from the Port, in New Hanover County and the City of Wilmington to Davis Yard, northwest across the Cape Fear River into Brunswick County. From the northwest, the CSXT rail line enters New Hanover County, crossing first the Cape Fear River and then the Northeast Cape Fear River and into the City of Wilmington. The rail line continues eastward through the City then turns southwest – back toward the river and the Port. As the rail line traverses the City, there are 26 at-grade crossings, necessitating stoppage of highway traffic and slow orders for trains to ensure the safety of pedestrians, trains, and highway traffic.

This report summarizes the Mott MacDonald team's findings and recommendations in two parts: the CSXT properties connecting Davis Yard via the Beltline to the Third Street crossing, and from the Third Street highway railroad at-grade crossing to the WTRY operated and maintained rail facilities of the Port and South to Southern Yard.

Figure 1: Vicinity Map



1.3 Purpose and Scope

Figure 2: Example Grade Crossing Issue

Note: Wilmington Beltline Grade Crossing at Martin Street

A longstanding gap in the State's freight transportation capability has been the absence of port-rail intermodal capability. In 2016, a public private project to address this facet of transportation was announced. "North Carolina Ports and CSX today announced the arrival of the QCE. This intermodal rail service will traverse the existing CSX Class I network between the Port and CSX's intermodal terminal in Charlotte, N.C."[1] Beginning July 28, 2017, the QCE returned regular rail intermodal service between the Port and Charlotte, NC. This double stacked train marks the official return of intermodal rail to North Carolina Ports.

Both the QCE and the CCX were announced on the same day, and quoting from the same news report, "The Carolina Connector (CCX) was announced this morning in Rocky Mount, N.C. This critical infrastructure project will serve as a key transportation hub in the Southeast for containerized freight. CCX along with the QCE will lower transportation costs for businesses while taking trucks off the road, thus reducing emissions, improving road safety, and minimizing wear and tear on the State's highways. North Carolina's Ports are direct beneficiaries of both rail announcements and represent its commitment to improve upon its operational efficiencies, to keep cargo moving and to remain congestion free."[2]

The new QCE and CCX intermodal services, when combined with the existing and projected growth in bulk and breakbulk rail shipments, will significantly increase rail shipments into and out of the Port. Near term freight increases will add stress to the existing transportation and intermodal infrastructure, and provide more opportunity for modal conflicts at highway-railroad at-grade crossings.

The total volume of bulk and intermodal freight volumes shipped by rail to and from the Port are the product of both organic growth in demand and the goal to increase the rail share of the modal split between trucks and rail. The number and length of trains operated are a result of both those needed to meet service demands and at the operating discretion of the railroads. For example, during this analysis CSXT underwent a change in leadership, and is now implementing a new operating philosophy. With the goal of enhancing operational efficiency, CSXT has advised that they no longer will operate short unit trains (trains of less than 10,000 feet in length

[1] North Carolina Ports, CSX Announce Queen City Express, American Journal of Transportation, July 19, 2016
[2] ibid

which transport a single commodity) and henceforth will operate longer trains comprised of blocks of mixed merchandise together with intermodal containers.

While the number of trains would be reduced under the new CSXT policy, the length of the trains operated would be increased from a typical 3,000 feet length to up to 10,000 feet. This will require more space at the port for storage and train handling. Arrival of larger quantities of mixed commodities also will result in peaking of port operations to accommodate the cargos.

Through the strategic planning process, and in collaboration with state and local transportation agencies, the NCSPA has established a goal to grow intermodal volume so that 25% of total container freight, in addition to breakbulk and bulk goods, shipped through the port from trucks to rail by the year 2025.

Achievement of this goal will result in a relative lessening in the growth of truck moves at the Port and across the highway network. Currently, 40% of bulk and breakbulk freight at the port travels via rail, the remainder by truck.

This modal shift will be more efficiently accommodated by rail and holds the relative increase in port-generated truck traffic to 21% growth through 2025, with rail transport growing 79% over the same period.

Rail infrastructure stresses to accommodate current and future freight volumes will increase until infrastructure improvements are constructed that will modernize and more efficiently accommodate the additional rail freight into and out of the port. Additionally, the increased frequency of rail and highway traffic across the 26 at-grade crossings between the CSXT bridge over the Northeast Cape Fear River and the Third Street highway railroad crossing also will increase the overall volume of modal conflicts and impact safety and community mobility.

The Wilmington Traffic Separation Study (TSS) was completed in February 2017 by NCDOT and local government partners. The TSS conducted an analysis of all 26 at-grade crossings within the City of Wilmington. That study identified a variety of mid- and long-term improvements regarding the at-grade crossings, including enhanced safety features, crossing improvements and road closures to reduce the potential for rail highway conflicts. This study did not repeat that effort but built upon it by proposing system-wide rail enhancements within the City and train maneuvers on Port property to enhance the efficiency of train traffic and reduce dwell time on the CSXT Beltline.

Centrally located along the Eastern seaboard, North Carolina is a critical link in the United States supply chain; enhancing the State's transportation infrastructure across all modes should be a priority especially for the infrastructure to and from North Carolina Ports. Peer ports in Virginia, South Carolina, Georgia and Florida have not only undertaken port improvement projects to increase volume but also made investments in landside transportation improvements, particularly rail.[3]

[3] Work Commences at Virginia International Gateway Heralding Start of Three Year Expansion Plan, February 14, 2017, http://www.portofvirginia.com/work-commences-virginia-international-gateway-heralding-start-three-year-expansion-plan/; NIT

NCDOT, the City of Wilmington, and the WMPO have been studying transportation improvements within the study area extensively. This report will not repeat those previous studies completed or currently underway, but will offer additional perspectives for integrated rail and port improvements that will improve the safety, capacity, and efficiency of the rail system within the City and on Port property in the near term to meet increased freight and shipping demands.

1.4 Stakeholders/Consulting Agencies

The study was conceived, sponsored and overseen by the staff of the NCDOT Rail Division and the NCSPA. Additional stakeholders included the City of Wilmington, the WMPO, the Wilmington Terminal Railway, Inc. (WTRY) and CSXT.

Optimization Project, http://www.portofvirginia.com/facilities/norfolk-international-terminals-nit/the-nit-optimization-project/; SCPA Announces Improved Rail Service between Port of Charleston and Charlotte, NC, March 10, 2016, http://www.scspa.com/news/scpa-announces-improved-rail-service-between-port-of-charleston-and-charlotte-nc/ ; Six Percent Container Growth, $248M in Capital Expenditures Projected for SC Ports Authority, June 15, 2016, http://www.scspa.com/news/six-percent-container-growth-248-million-in-capital-expenditures-projected-for-sc-ports/ ; Georgia Ports Authority Fiscal Year 2016 Annual Report, http://www.gaports.com/About/AnnualReport.aspx ; Port plan to reduce Garden City train crossings, March 1, 2017, http://www.gaports.com/Media/PressReleases/TabId/379/ArtMID/3569/ArticleID/109/Port-plan-to-reduce-Garden-City-train-crossings.aspx ; GPA awarded $44M transportation grant Rail expansion to improve capacity, traffic, July 6, 2016, http://www.gaports.com/Media/PressReleases/TabId/379/ArtMID/3569/ArticleID/72/GPA-awarded-44M-transportation-grant.aspx

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2 Port of Wilmington Demand Forecast

2.1 Demand Overview

A demand forecast was developed to estimate the number and frequency of trains serving the Port. Building upon data provided by NCSPA and NCDOT, the demand forecast was consolidated into a model that includes all commodities and includes both highway and rail modes.

The purpose of this analysis is to forecast possible outcomes for newly contracted rail intermodal traffic combined with existing and forecasted rail-based bulk and breakbulk traffic to determine probable rail transportation activity in terms of carloads of traffic and trains, for the following purposes:

- Planning train operations given significant increases in activity and track space required, including tracks connecting the Port to the CSXT;
- Identifying capital needs for rehabilitation of existing rail facilities and for expanded or reconfigured facilities;
- Assessing community impacts and planning for mitigation; and
- Determining the benefit-to-cost relationship, given the generally favorable environmental and other “quality-of-life” outcomes of substituting rail trains for truck traffic.

Separate forecasts identify future flows of container traffic and other freight (merchandise), as well as the number of trains implied by carload forecasts. These results are predicated on the Port securing new container service volumes. This growth case scenario assumes an 8.0% rail share for 2018 container traffic, growing in two-percentage point annual increments until 2025, when it reaches the NCSPA goal of 25% of intermodal traffic.

The NCSPA uses the 20-foot transportation equivalent unit (TEU) to count each time a container is moved; these data were translated into number of trains and total feet of trains to determine capacity needs. Approximately 1 million tons or 40% of the Port’s bulk and breakbulk freight traffic is currently moved by rail. Organic growth at historic rates was applied for bulk and breakbulk trains, plus established projections for volumes forecasted for growth in wood pellets. Finally, the forecast adds the new volumes of intermodal container movements forecasted for the QCE and CCX rail intermodal services.

For container movements, the 2017 rail share was initially derived by assigning anticipated rail market share to various ocean carrier services formerly conducted solely by truck.[4] The truck share of total container movements has been calculated as a fraction (78%)[5] of the total movements and then container movements assumed

[4] To the extent possible rail share expectations were correlated to the carrier’s inland markets and whether they might be serviced via Charlotte initially and CCX eventually.

[5] At the present time, with no rail offering, approximately 78% of container movements are leaving or entering the Port by truck. The balance of the container moves are within the Port.

diverted to rail were subtracted. Container moves by rail and truck shown in Table 1 reflect a subset of all containers handled at the Port, the remainder being movements within the Port.

Table 1: Combined Traffic Forecast: Base Case, Fixed Share, and Growth

Fiscal year ending June 30:	2018	2019	2020	2021	2022	2023	2024	2025
Total Movements Based on Berth Plan	247,960	281,632	321,672	331,708	341,952	352,560	363,428	374,712
Total Movements Forecast by POW	247,960	298,390	347,590	354,542	361,633	368,865	376,243	383,767
Container Moves								
Rail	12,376	14,092	16,692	17,264	17,784	18,356	18,928	19,552
Single Move Trucks	58,796	66,778	76,123	78,485	80,912	83,417	85,987	88,648
Dual Move Trucks	124,941	141,903	161,761	166,781	171,939	177,262	182,723	188,377
Combined Container Moves	**196,113**	**222,773**	**254,576**	**262,530**	**270,635**	**279,035**	**287,638**	**296,577**
Breakbulk/Bulk								
Railcar Movements	24,515	29,035	29,560	35,560	35,560	40,560	40,560	40,560
Sub-Total	**24,515**	**29,035**	**29,560**	**35,560**	**35,560**	**40,560**	**40,560**	**40,560**
Truck								
Breakbulk Movements	21,875	27,875	28,300	28,300	28,300	28,300	28,300	28,300
Bulk Movements	143,100	176,250	183,700	208,700	208,700	233,700	233,700	233,700
Sub-Total	**164,975**	**204,125**	**212,000**	**237,000**	**237,000**	**262,000**	**262,000**	**262,000**
Combined Bulk & Breakbulk Moves	**189,490**	**233,160**	**241,560**	**272,560**	**272,560**	**302,560**	**302,560**	**302,560**

The Port marketing strategy considers the cost advantages of rail transport and growth of rail's share of container movements at other southeast ports so that by 2025 the Port's rail share approximately equals the rail share for peer ports. Table 2 summarizes the impact of this rail market-share assumption. Assumptions for breakbulk and bulk were not altered by the container share growth assumptions; the assumed truck-rail modal split of breakbulk and bulk tonnages remains constant by commodity.

Table 2: Combined Traffic Forecast: Share Attains South Atlantic Peer Rail Share

Fiscal year ending June 30:	2018	2019	2020	2021	2022	2023	2024	2025
Total Movements Derived from Berth Plan	247,960	281,632	321,672	331,708	341,952	352,560	363,428	374,712
Total Movements Forecast. By POW	247,960	298,390	347,590	354,542	361,633	368,865	376,243	383,767
Estimated Ship Calls per Week (1)	8	9	10	10+	10+	10+	10+	10+
Estimated Containers Handled per Call	596	602	619	638	658	678	699	721
Container Moves								
Rail	19,864	29,276	41,184	50,336	60,112	70,564	81,432	93,756
Single Move Trucks (2)	56,927	62,988	70,010	70,230	70,347	70,386	70,386	70,127
Dual Move Trucks (3)	120,969	133,850	148,771	149,240	149,488	149,571	149,571	149,019

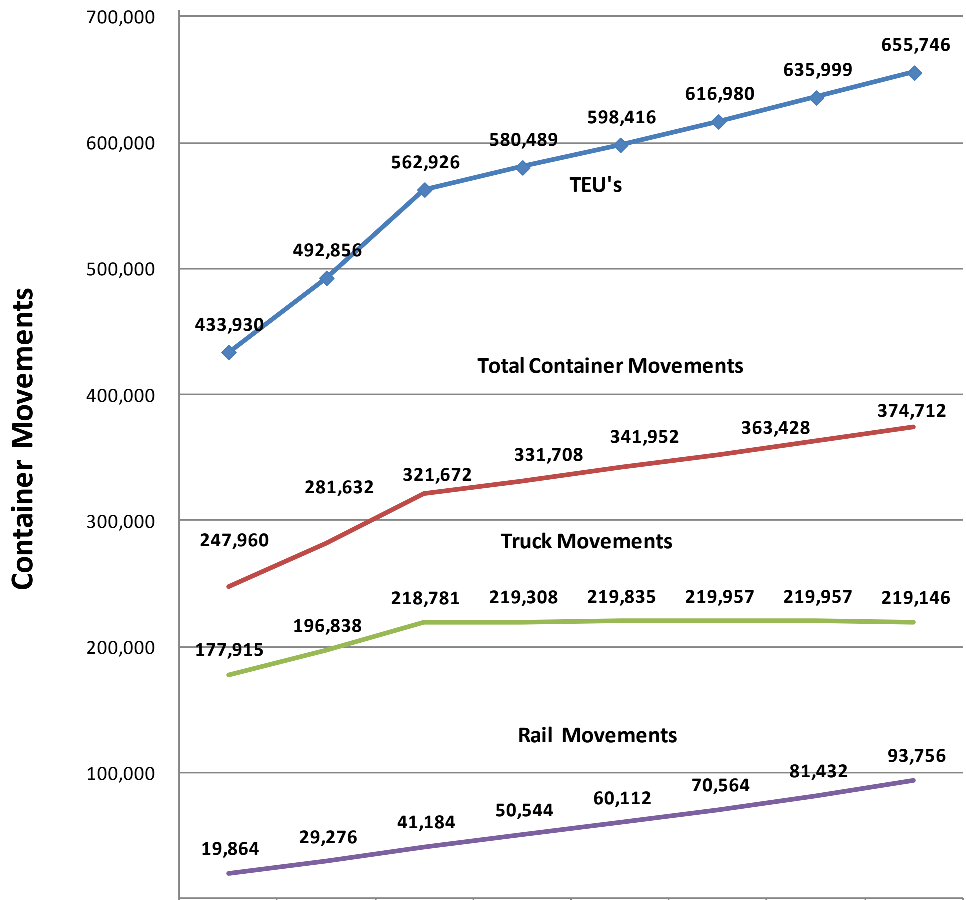
Fiscal year ending June 30:	2018	2019	2020	2021	2022	2023	2024	2025
Combined Container Moves	**197,760**	**226,114**	**259,965**	**269,806**	**279,947**	**290,521**	**301,389**	**312,902**
Breakbulk/Bulk								
Rail								
Railcar Movements	24,515	29,035	29,560	35,560	35,560	40,560	40,560	40,560
Sub-Total	**24,515**	**29,035**	**29,560**	**35,560**	**35,560**	**40,560**	**40,560**	**40,560**
Truck								
Breakbulk Movements	21,875	27,875	28,300	28,300	28,300	28,300	28,300	28,300
Bulk Movements	143,100	176,250	183,700	208,700	208,700	233,700	233,700	233,700
Sub-Total	**164,975**	**204,125**	**212,000**	**237,000**	**237,000**	**262,000**	**262,000**	**262,000**
Combined Breakbulk & Bulk Movements	**189,490**	**233,160**	**241,560**	**272,560**	**272,560**	**302,560**	**302,560**	**302,560**

Notes: 1. 10+ Signifies larger ship size hence more rail participation as experienced by neighboring Ports of Charleston and Savannah. 2. Single Move Trucks drop and leave or pick up and leave. 3. Dual Move Trucks drop and pick up containers in the same trip

2.2 Core Findings: Container Volumes

Over the projection period the principal growth driver is increased container movements, based on NCSPA's growth strategy. Figure 3 illustrates the impact of realizing the Port's goal for the rail mode's capturing 25% of container movements by 2025. Trucks are expected to continue receiving their share of bulk and breakbulk traffic and dominating container movements for the first several years as they do today, and growing 21% from 2018 to 2021. In subsequent years, rail largely absorbs expected growth in container freight traffic and trucks' share of containers remains flat.

Figure 3: Forecast Modal Share of Port of Wilmington Container Traffic



	2018	2019	2020	2021	2022	2023	2024	2025
Total Containers Moved by Port	247,960	281,632	321,672	331,708	341,952	352,560	363,428	374,712
Forecast Rail Containers	19,864	29,276	41,184	50,544	60,112	70,564	81,432	93,756
TEU Equivalents	433,930	492,856	562,926	580,489	598,416	616,980	635,999	655,746
Forecast Truck Containers	177,915	196,838	218,781	219,308	219,835	219,957	219,957	219,146

Source: Vanness Company

2.3 Merchandise Traffic on Rail

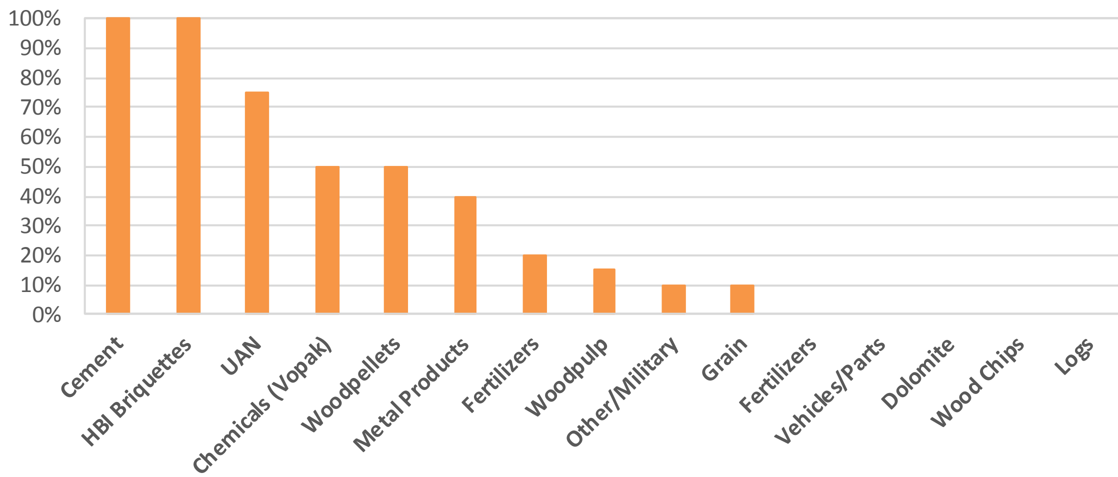
For merchandise traffic (traffic other than intermodal) a different forecast procedure was adopted. Base year and forecast rail traffic for bulk and breakbulk activity, in short tons and by commodity, was provided by NCSPA. These data indicate a projected total of approximately 1 million short tons of various commodities hauled by rail in other-than-intermodal cars to or from the Port in 2017.

The Port forecasts such traffic to increase more than 93.1% between 2017 and 2025, with a compound annual growth rate (CAGR) of 8.6%. Most of that growth is expected to come from new wood pellet facilities. The Port forecasts tonnage for this commodity to quadruple between 2017 and 2025, estimating in a 23.9% CAGR. During the same period, the wood pellets share of total merchandise traffic to/from the Port is expected to increase from 15.4% in 2017 to 44.2% in 2025. Other elements of the merchandise market will also increase. The Port forecasts all other freight (not carried in containers) to increase 27.3% between 2017 and 2025, an overall 3.1% CAGR for merchandise.

2.3.1 Merchandise Train Requirements

Annual forecasts of total bulk and breakbulk tonnage are made by commodity and shipper and assigned to rail by a series of estimated percentages traveling by rail. These assumptions are displayed in Figure 4. Tonnage figures are translated to carloads, by assuming 100 short tons of commodity per loaded car.

Figure 4: Rail Share of Bulk and Breakbulk



Source: Vanness Company

One empty railcar move was assumed for each loaded move. An additional 1,000 annual empty railcar movements were assumed to accommodate repositioning to storage, car-repair shops, and other purposes.

Annual carloads for all merchandise traffic were divided by 52 to generate a weekly carload requirement. Railroad operator CSXT indicates it will operate up to 10,000-foot merchandise trains in this corridor and that wood pellet unit trains would hereafter be combined with merchandise trains. Assuming 60 feet per railcar, this translates into 167-car trains. Dividing weekly cars—both loaded and empty—by 167 yields the number of weekly train pairs required.

Table 3 details forecast results for bulk and breakbulk trains. On an "average day", current volumes fill out 27% of a 10,000-foot train with both loads and empties. But as new wood pellet facilities are implemented and traffic increases, forecast demand implies a demand for 47% of a 10,000-foot train, on average, by 2023. In practice, however, daily loaded, and empty activity would not be uniform and consistent. For example, wood pellet cars are expected to arrive in blocks of 30 to 50 cars as will urea (UAN) trains. In principle, it will be necessary to concede train space to higher priority, time sensitive intermodal containers or to run dedicated trains for them once all the space on merchandise trains is taken.

Table 3: Bulk and Breakbulk Rail Projection

Fiscal year ending June 30		2016 Actual	2017 Projected	2018	2019	2020	2021	2022	2023	2024	2025
Est. of Movements Short Tons	% by Rail										
Breakbulk	25	76,174	96,900	73,500	79,250	80,000	80,000	80,000	80,000	80,000	80,000
Bulk	44	669,407	862,168	1,073,000	1,322,500	1,348,000	1,648,000	1,648,000	1,898,000	1,898,000	1,898,000
Break Bulk and Bulk Combined Total			959,068	1,146,500	1,401,750	1,428,000	1,728,000	1,728,000	1,978,000	1,978,000	1,978,000
Loaded Cars at Capacity / Rail Car	100	Short Tons	9,591	11,465	14,018	14,280	17,280	17,280	19,780	19,780	19,780
Returning Empty Cars	n.a.	n.a.	9,591	11,465	14,018	14,280	17,280	17,280	19,780	19,780	19,780
Cars to / from Other + Storage	n.a.	n.a.	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total Car Movements			20,181	23,930	29,035	29,560	35,560	35,560	40,560	40,560	40,560
Cars per Week	52	weeks/year	388	460	558	568	684	684	780	780	780
Avg. Cars per Operating Day Each Way	5	days/week	39	46	56	57	68	68	78	78	78
Cars per Max. 10,000-foot train	167	10,000/60 feet	167	167	167	167	167	167	167	167	167
Variance + = Vacancy			128	121	111	110	99	99	89	89	89
Daily Merchandise Train Pairs Required			1	1	1	1	1	1	1	1	1

Source: Vaness and Co.

Notes: Rail Forecast Assumptions: Rail share percentages were estimated from historical participation.
CSXT Railroad has indicated it desires to combine freight cars (other than intermodal) into 10,000-foot trains.
First woodpellet plant will have initial production capacity of 500,000 tons.
Second woodpellet plant will come online September 2016 with additional production capacity of 500,000 tons.
Third woodpellet plant will come online July 2021 with additional production capacity of 500,000 tons.
Fourth woodpellet plant will come online July 2023 with additional production capacity of 500,000 tons.

2.4 Train Lengths Influence Design

During this analysis, the proposed length of trains has evolved and required adjustment multiple times. Initially, 3,000-foot-long trains cumulating to 9,000 feet per day were used for purposes of estimating CSXT Beltline train volumes in the TSS. Following discussions with CSXT about capacity constraints at the Charlotte Intermodal Terminal, they advised the Port facilities would need to accommodate trains up to 6,000 feet in length. Then, following discussion with NCSPA staff, train lengths again were increased up to 9,000 feet as CSXT began to implement their new operating plans.

For each scenario, for dedicated trains, the required number of trains was computed by averaging two equipment scenarios, predicated on the initial 6,000-foot train length constraint imposed by CSXT and after the expected inauguration of CCX, a longer 9,000-foot intermodal train length in keeping with the new operating plans.

Table 4 portrays the range of equipment capacities. Many combinations could occur, depending on how and where the QCE trains are assembled. For example, if the trains are assembled from equipment arriving at Charlotte, there would be a preponderance of Universal 53-foot container capacity cars used mainly in domestic transport. The more conservative scenario would deploy a Universal 53-foot, two-container-capacity double-stack car, whereas, an optimized configuration was a five-unit articulated double-stack car, which hauls 39.2% more containers per unit of length.

Table 4: Comparative Capacity of Various Container Hauling Rail Cars within 1,000 Feet of Train Length

	Maxi I	Maxi Z40	HS40-70	HS40-100	Maxi Z 53	HS53 70	HS 53 100	Universal
Car Length	265.28	191.71	64.21	64.71	230.98	76.73	77.23	75.75
Train Length	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
TEU/Car	20	12	4	4	12	4	4	4
Cars/Train	3.8	5.2	15.6	15.5	4.3	13.0	12.9	13.2
TEU/Train	75	63	62	62	52	52	52	53
Containers/Train	**37**	**31**	**31**	**30**	**25**	**26**	**25**	**26**
TEU Index	142.3%	119.2%	119.2%	115.4%	96.2%	100.0%	96.2%	100.0%

Source: Greenbriar, Inc.

Now under the new operating plan, CSXT has advised that they plan to configure intermodal containers with mixed merchandise loadings to operate trains with lengths of up to 10,000 feet. A recent article summarizing rail infrastructure projects serving American ports illustrates how facilities capable of accommodating trains of up to 10,000 feet are becoming the competitive norm.[6]

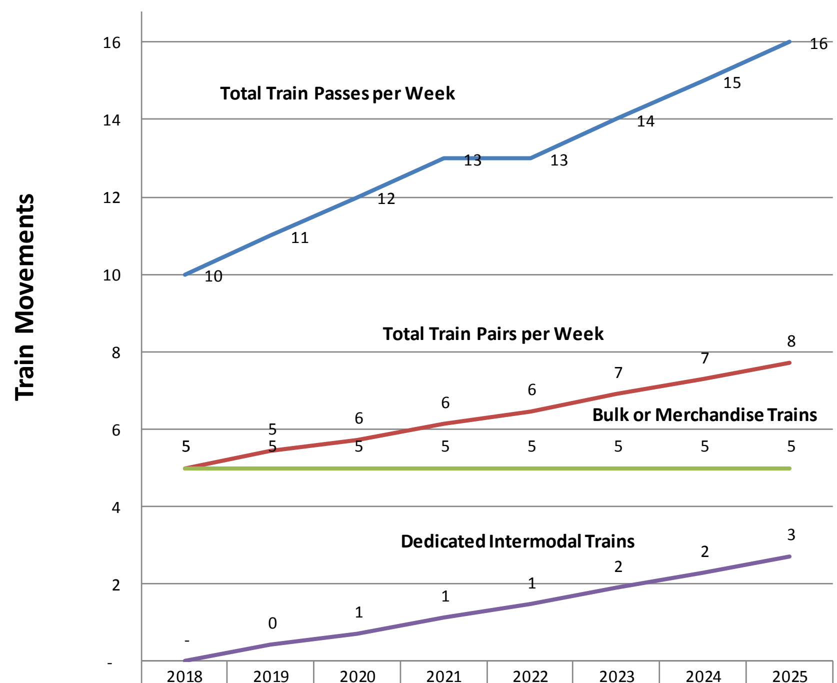
For purposes of this analysis and subsequent recommendations for improving rail infrastructure at the Port up to 10,000 feet maximum for train lengths were used. The

[6] Port Projects Offer Mutual Opportunity For Growth, Railway Track & Structures, June 2017, https://issuu.com/railwaytrackstructures/docs/digital_edition_rts_june_2017/16

effect minimizes the number of trains operating over the CSXT Beltline to serve freight needs. It also defines the operating peaks for which NCSPA must plan their operations.

Moreover, adding intermodal train cars first to the existing five[7] weekly merchandise trains results in between five and seven regular train services per week, each of which is a “round trip” or train pair, entering the Port once and leaving the Port once. As demonstrated in Figure 5, during the ramp up period of 2018 to 2021, it is possible to accommodate the forecast containers on the existing merchandise trains without adding dedicated intermodal trains. Ultimately, in year 2025, forecasted container movements generate seven intermodal trains plus the merchandise train, eight train pairs per week or 16 movements over streets and highways comprising the Beltline between the Port and CSXT’s Davis Yard near Leland, NC. The required trains calculations are explained in the following section.

Figure 5: Trains Assuming Containers Move on Merchandise Trains First, Then in Dedicated Trains



	2018	2019	2020	2021	2022	2023	2024	2025
Passes To and From Port per Week	10	11	12	13	13	14	15	16
Average Total Train Pairs per Week	5	5	6	6	6	7	7	8
Average Mdse. Train Pairs per Week	5	5	5	5	5	5	5	5
Average Dedicated IM Train Pairs per Week	-	0	1	1	1	2	2	3

Source: Vanness Company

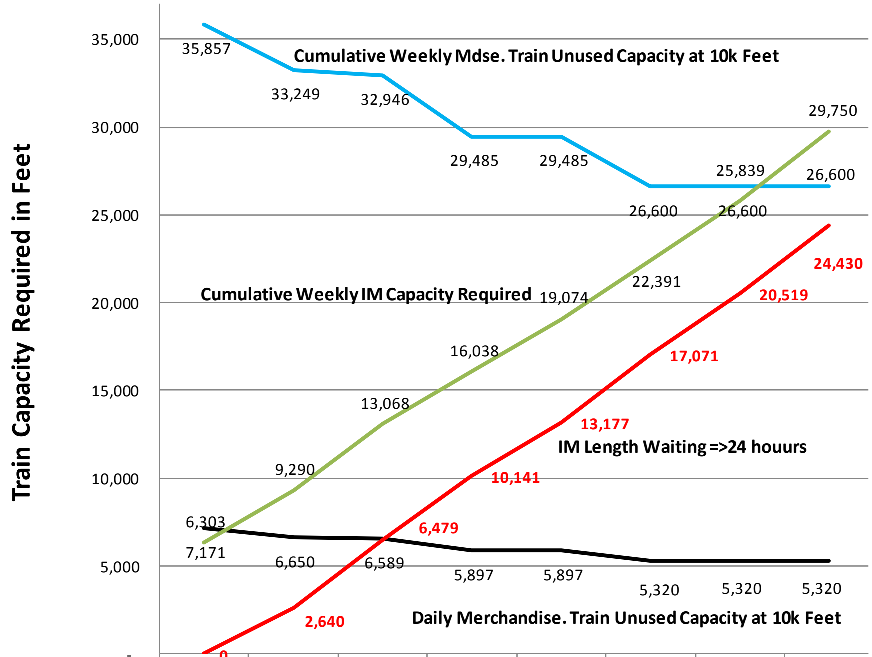
2.4.1 Forecasting the Ability to Accommodate Intermodal

Port data and CSXT operating plans indicate that there is capacity on the daily merchandise trains to accommodate the forecasted intermodal traffic volumes. In Figure 6, the blue line indicates cumulative weekly unused feet of capacity on merchandise trains – assuming no containers were hauled – and the green line

[7] Merchandise trains Q477 and Q478 operate seven days from the CSX yard, but generally only five days to the Port.

indicates cumulative weekly feet of container capacity required for intermodal trains. Weekly unused capacity for merchandise trains is forecast to exceed the weekly requirement for intermodal capacity until 2024.

Figure 6: Required Train Capacity in Feet



	2018	2019	2020	2021	2022	2023	2024	2025
Daily Avg. Vacancy vs. 10,000 Foot Mdse. Train	7,171	6,650	6,589	5,897	5,897	5,320	5,320	5,320
Cum. Weekly Avg. Vacancy on Mdse. Trains	35,857	33,249	32,946	29,485	29,485	26,600	26,600	26,600
Average IM Feet per Week w. Avg. Equipment	6,303	9,290	13,068	16,038	19,074	22,391	25,839	29,750
IM Length waiting => 24 hours for Mdse. Vacancy	0	2,640	6,479	10,141	13,177	17,071	20,519	24,430

Source: Vanness Company

Combining intermodal traffic with merchandise trains can result in operational savings for CSXT and daily frequencies for intermodal trains but may not yield positive results due to intermodal and merchandise handling incompatibility. Characteristics of intermodal traffic limit its compatibility with merchandise traffic:

- Intermodal shipments cannot be delayed more than 24 hours
- Intermodal shipments are not fungible; commitments to ocean carriers require specific performance; and
- Intermodal shipments will arrive in a flood with the arrival and departure of ships not car-by-car as does most of the Port's merchandise traffic.

The urgent nature of intermodal shipments minimizes the ability to wait for capacity to cumulate on merchandise trains. To hold wait times to 24 hours, maximum, the weekly intermodal requirement should be correlated with daily unused capacity for merchandise trains. The black line in Figure 6 shows daily unused capacity on merchandise trains of 10,000 feet. The red line shows the amount of intermodal traffic that would have to wait more than 24 hours to be absorbed into the merchandise train capacity, if no other capacity were available.

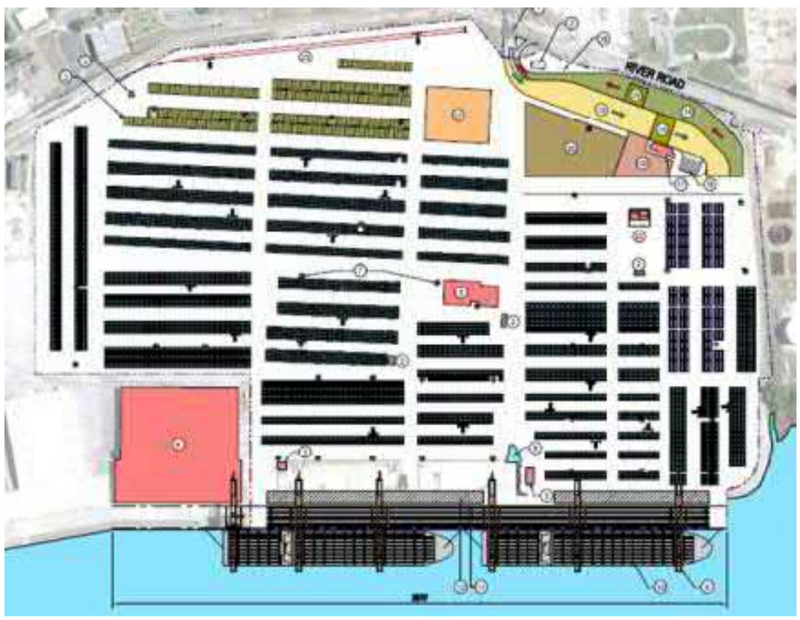
The assumption is that no capacity issues would arise in 2018 and in 2019, as it is probable that 2,640 feet of otherwise unmet intermodal capacity need could be accommodated by shifting the schedules of wood pellet or urea cars or other freight without serious consequences. By 2020 however, it is probable that 6,479 feet of unmet capacity could not be easily accommodated with informal substitutions and a dedicated intermodal train of that length could be justified. The next year, 2021, the indicated unmet intermodal requirement is for 10,141 feet, more than meeting the new criteria for a dedicated intermodal train.

3 Freight and Port Operations

The 2015 Strategic Plan of the NCSPA has a goal to increase the container business to more than 530,000 TEU per year and expand the business of general cargo by 4 million tons. NCSPA's goal for container throughput has since been increased to 750,000 TEU. The existing terminal capacity is approximately 460,000 TEU and will increase to over 550,000 TEU with the introduction of an intermodal rail yard.

Capital improvements completed and underway by NCSPA are positioning the Port for increased overall freight throughput. The new "At Port" cold storage distribution center has been built and is in service. Additionally, the turning basin was expanded in 2017 and additional channel improvement studies are underway with the United States Army Corps of Engineers (USACE) and NCSPA.

Figure 7: Reach Stacker Layout



Source: 2012 North Carolina Maritime Strategy Report

Review of the North Carolina Maritime Strategy Report, prepared in 2012, provides some very useful information on the existing and future potential capacity of the container terminal at the Port. Specifically, in the Future Port Infrastructure Report that is part of the 2012 Strategy Report, consideration of six potential deep water port locations was analyzed. This included expansion of the existing Port under the following scenarios:

- Existing operations at one berth with a 42-foot channel depth and reach stacker operations;
- Expanding to two berths with a 42-foot channel and reach stacker operations;
- Expanding to two berths with a 45-foot channel and rubber tire gantry (RTG) operations;

- Expanding to two berths with a 47-foot channel and RTG operations;
- Expanding to two berths with a 51-foot channel and RTG operations.

Examples taken from the 2012 Strategy report are provided in Figures 7 and 8.

Berth capacity analysis of these scenarios indicates the following results:

Figure 8: RTG Layout

2012 North Carolina Maritime Strategy Report

Table 5: Berth Capacity

Existing 1 Berth 42' Channel	2 Berth 42' Channel	2 Berth 45' Channel	2 Berth 47' Channel	2 Berth 51' Channel
530,000 TEU	1,240,000 TEU	1,420,000 TEU	1,460,000 TEU	1,640,000 TEU

Source: 2012 North Carolina Maritime Strategy Report

The report also analyzed the container yard capacity with reach stacker and RTG operations, given various dwell times, with a 7-day dwell time being the existing condition (100% Dwell). Reduction of dwell time is dependent on the development of an intermodal facility at the port. Results of the container yard capacity under these scenarios indicates the following:

Table 6: Container Yard Capacity

RS Existing Configuration	RS 2 Berth Configuration	RS 2 Berth Configuration	RTG 2 Berth Configuration	RTG 2 Berth Configuration	RTG 2 Berth Configuration
100% Dwell	100% Dwell	80% Dwell	100% Dwell	80% Dwell	65% Dwell
540,000 TEU	750,000 TEU	940,000 TEU	1,070,000 TEU	1,330,000 TEU	1,660,000 TEU

Source: 2012 North Carolina Maritime Strategy Report

The important point to take away from this analysis considering the goal to reach 750,000 TEU, is that it may be possible to reach the projected throughput with a reach stacker operation. To achieve this, the terminal is expanded to two berths, and the south gate is reconfigured to provide for 8,300 ground slots. Dredge depth is maintained at 42 feet.

The report also provided capital costs for the reach stacker and RTG expansions. The capital costs for the reach stacker operation with expanding the berth and yard ranged from $78M to $94M, and the RTG expansion ranged from $145M to $175M, in 2012 dollars. Considering 2.5 % inflation over the past five years, the expansion costs would range from $88M to $106M for the reach stacker operation and $164M to $198M for the RTG operation today. These costs do not include rail improvements which were estimated to be $15M, or $17M in 2017 and is not clear from the 2012 report what the rail improvements entailed.

3.1 Current System Capacity

The CSXT Beltline, from Davis Yard near Leland, NC through the City of Wilmington to the Third Street highway-railroad crossing, is essentially a single-track railroad. The line is operated under 'CSXT Yard Limit Rules' which constrains the speeds of operations, and requires that trains can stop within one-half the range of the engineer's vision, and with a system of manually operated switches which also may require a train to come to a full stop to line the switch for the desired route. In addition, there are no sidings which can accommodate long trains to pass one another.

The above factors, together with the design and condition of the rail infrastructure, require 1.25 to 1.75 hours for a train to traverse the 10 miles from the Hilton Bridge crossing of the Northeast Cape Fear River to the Port. Trains of 10,000 feet in length operating over the CSXT Beltline may require 10 to 15 minutes or more to pass a given point or pass over a highway crossing. The proposed program of projects will increase velocity and reduce train travel times within the study area.

The CSXT Beltline can accommodate the number of trains forecast through 2025, but it will require additional capacity investments, in partnership with reductions in train handling turnaround times at the port, to accommodate additional train frequencies.

The estimated capacity of a port is measured by tons cleared within a 24-hour window. Rail capacity is expressed as the number of trains which can be planned to move in both directions over a specified section of track within a 24-hour period. The absolute capacity of the rail and port network derives from many factors including infrastructure, personnel resources, and operations practices. Network capacity also is viewed in both static—a length of track will hold a finite number of rail cars—and dynamic—the amount of time required to off-load, on-load and ready for transport terms.

Based on the North Carolina Maritime Strategy (2015) report, the existing container capacity at the Port is estimated to be 530,000 TEU. More recently, the NCSPA staff estimate that the current configuration of the Port facilities can accommodate a capacity of 750,000 TEUs annually. This estimate is based on the experience and practice of historic and existing operations and the current expansion of the berth facility.

Based upon the demand model and with implementation of the rail and terminal infrastructure recommendations in this report, the port can accommodate the increased container volumes with train lengths of 10,000 feet through 2025.

3.2 Future System Requirements

Based on the analyses of the existing and potential future capacity of the Port, the ability to achieve 750,000 TEU appears reasonable. Thereafter, with an extension to the existing rail layout, including relocation of the South Gate and a further extension of the tracks, that the Port can accommodate additional growth. To reach this capacity, it will be required to expand to two berths (berth expansion is underway), add additional cranes (two additional cranes are scheduled for arrival in 2018), expand the number of ground slots in the terminal yard, and develop an intermodal yard at the Port. Channel improvements would depend on the aspirations of shipping companies visiting the port, which may necessitate dredging to accommodate larger vessels regardless of capacity.

4 Rail Inventory and Operations

4.1 Rail Inventory on Terminal

The tracks on the Port are generally in aged, but good condition meeting the Federal Railroad Administration (FRA) Class 1 industrial track requirements. Construction is generally of 100 pound or lighter rail, wood ties, with tie plates. The rail is fastened with cut spikes.

The ballast in the body of the tracks is mostly covered by sand, but appeared to be comprised of mainly slag or crushed rock. Subballast, if any, was not inspected to ascertain its condition and turnouts are generally 100 pound rail on wood timbers.

Figure 9: Port of Wilmington Existing Track Configuration[8]

The switch points are in good condition (not chipped or worn excessively) fitting the stock rails as designed. Frogs were generally solid cast of the self-guarding style with guardrails also installed. Gage rods have been applied in the past to assure proper gage at several locations, mainly in curves. Track maintenance (to FRA Class 1 – 10 mph condition) is assigned by contract to the WTRY. The February 9, 2017 Rail Defect inspection conducted by Sperry Rail Service indicated 12 defective rails, with 8 that had to be changed and 4 that required monitoring.

Containers are unloaded using typical reach stackers that can service double-stacked containers on well-cars. On May 11, 2017, the 9,000 feet long empty return container train took 7 hours to unload and re-set the empty well-car train to return to CSXT. Unloading was accomplished by utilizing Container Track 1 and Container Track 2 which held about 4,200 feet of cars for unloading. With 4,800 feet or cars remaining on the Main Track, rail cars required to be switched two more times (for a total of 3 switching moves) to unload the entire train. The Port's yard can hold about 560 cars (one well-car can accommodate two containers) on tracks that are generally

[8] The graphics used in this report are for illustration purposes only, larger versions are included in the appendices.

unassigned. This would include track 0, Wood Siding and Classification tracks 2, 3, 4, 5, 6, 10, 11, 12, 13, 14, 15 and 18A.

4.2 Rail Inventory off Terminal

4.2.1 CSXT Beltline

CSXT operates and maintains the trackage from Davis Yard to the Third Street Crossing in Wilmington. The key portions of CSXT's track are from mile post (MP) SE 356.8 (East Brook Crossing) to MP SE 364.1 (near Old Smith Creek Yard) which is also MP ACB 243.9 to ACB 249.7 (Third Street Crossing) for a total of 13.1 miles. The track from East Brook Crossing to the Smith Creek Yard switch is operated at FRA Class 2 and is constructed of mainly 100 pound rail (and one short stretch of 115 pound rail) with some of the curves laid with 115 pound or 132 pound rail on the high side of the curves. The track from Smith Creek Yard to Third Street Crossing is operated at FRA Class 1 and is constructed of 100 pound rail with two short stretches with 132 pound on the high side of the curves. Wood ties, tie plates and cut spikes are the general support for the rail.

Table 7: Rail Track Inventory

Track Number	Length (ft.)	50' Car Lengths	Notes
0	5,310	106	
Main	18,450	369	WTRY Yard Limit to End of Line
Maritime	5,950	119	
Wood Siding	1,351	27	
P	1,165	23	
P2	560	11	
1	14,460	289	Including dockside track, not including Container 1 Track
Container 1	2,530	51	
2	1,300	26	Ladder
2	6,730	135	Dockside
3	1,140	23	Ladder
3	1,025	21	
4	960	19	Ladder
4	4,020	80	Loop
4a	725	15	
5	800	16	Ladder
5	1,260	25	Loop
6	1,530	31	Including Ladder
9	460	9	
10	1,595	32	
10a	1,460	29	
11	1,605	32	
11a	500	10	
12	1,435	29	
13	5,070	101	
14	590	12	
15	2,520	50	
15a	670	13	
17	3,615	72	
18 Container 2	995	20	
18a	1,645	33	
18b	1,635	33	Enviva Wood Pellet Storage
19	285	6	
20	705	14	
Total Track	**94,051**	**1,881**	

4.2.2 Wilmington Terminal Railway, Inc.

WTRY operates and maintains the track owned by the Port. This includes approximately 18 miles of track between MP ACB 249.7 at Third Street and MP ACB 253.3, the endpoint of the 3 tracks at Cape Fear Bonded Warehouse. This includes the Main track, the tracks in the yard and the siding tracks owned by the Port. The track from Third Street crossing southerly to the end of track is operated at FRA Class 1 and is constructed of 100 pound rail with heavier rail in some of the road crossings. Wood ties, tie plates and cut spikes are the general support for the rail.

4.2.3 Davis Yard

The CSXT "SE line" serves Wilmington and provides sole access from the national rail system to the Port with points to the west and south. CSXT's Davis Yard near Leland, NC serves as the base for CSXT's switching operations. With a car capacity of 2,250, the facility is three miles long and has 28 separate tracks. Piggyback service (trailer on railcar) is also provided by highway loading and unloading facilities. This rail yard offers long and short-haul truck service and has a transloading ability for dry and liquid bulk products, warehouses for lumber, paper and packaged products, steel centers for ferrous and non-ferrous materials.

Davis Yard trackage consists of five tracks each about 7,500 feet long with the capacity to hold 150-160 cars plus 23 classification tracks, each about 2,500 feet long and can hold 50 cars, of which only 18 currently are in service.

4.3 Rail Operations

4.3.1 CSXT

CSXT operates from Davis Yard to the Port under Yard Limit Rules at Restricted Speed, (15 miles per hour maximum, prepared to stop within ½ the range of vision short of train, obstruction, switch improperly lined, or derail) between Davis Yard and Third Street in Wilmington. The Navassa Bridge over the Cape Fear River is manned continuously. Trains must approach the track derail device, which protects the bridge, prepared to stop, and stop unless granted permission by the bridge tender.

The Hilton drawbridge over Northeast Cape Fear River is remotely operated from the Navassa drawbridge located to the East at SE 360.8. Trains approach stop signs, located approximately 100 feet from the end of the approach structures, prepared to stop, and will stop before reaching the stop sign, unless granted permission from the Navassa bridge tender.

4.3.2 WTRY

WTRY operates under the CSXT Yard Limit Rules at Restricted Speed between Third Street in Wilmington and Mile Post (MP) SE 253.3 the endpoint of the three tracks at Cape Fear Bonded Warehouse.

4.3.3 Davis Yard

Davis Yard operates under CSXT Yard Limit Rules at Restricted Speed, from MP SE 356.8 (East Brook Crossing) for the length of the yard.

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5 Rail Infrastructure Improvements

5.1 CSXT Beltline Speed and Safety Improvement Program of Projects

Freight capacity and safety improvements to Class I freight rail corridors are eligible for funding under NC General Statute 136-189.10 (4)(h) of North Carolina's Strategic Transportation Investments (STI) formula funding program. "Passed in 2013, the Strategic Transportation Investments law allows NCDOT to use its funding more efficiently and effectively to enhance the state's infrastructure, while supporting economic growth, job creation and a higher quality of life. This process encourages thinking from a statewide and regional perspective while also providing flexibility to address local needs.

STI also establishes the Strategic Mobility Formula, which allocates available revenues based on data-driven scoring and local input. It is used to develop NCDOT's State Transportation Improvement Program (STIP), which identifies the transportation projects that will receive funding during a specified 10-year period."[9]

The STIP, required by Federal law, is a two-year process broken down into three phases: Prioritization, Programming and Scheduling, and Review and Approval. Currently, NCDOT is in the Prioritization phase of the 2020-2029 STIP, Prioritization 5.0 (P5.0). The STIP update process began June 2017 and will conclude with an update of the STIP projects.

The purpose of the CSXT Beltline Speed and Safety Improvements is to improve the safety of the travelling public and train operations, reduce the duration of at-grade modal conflicts and improve freight capacity by increasing the operating speeds over the CSXT Beltline (from Davis Yard across the Cape Fear River bascule drawbridge and the Northeast Cape Fear River bascule drawbridge to Third Street in Wilmington).

The safety improvements come from the installation of enhanced at-grade crossing warning devices and proposed closures, as well as the reduced time the trains traveling to and from Davis Yard and the Port will be traversing the 26 road crossings. The reduced time that the crossings will be blocked will lessen driver anxiety, fatigue and frustration that are products of delays while driving to and from locations, thus increasing the level of the highway traveler's safety.

The improved safety to the train operation is coupled with the increase in train speed from 10 mph to a 25 mph maximum. To increase the speed between Davis Yard and Third Street a program of tie and rail rehabilitation will be undertaken to bring the line of railroad from Class 1 to Class 2 FRA track safety designation. Along with the rail and tie installation will come improvements to the highway grade crossing surfaces, and curve re-alignments.

[9] For more information about the STI Program and the Prioritization Process please see: https://www.ncdot.gov/strategictransportationinvestments/

Prior to the change in train speeds, all 26 crossings will be modified to handle the increased train speeds. The increased operating speeds will require modifications to the flashers and gate start times at each crossing from both directions; and warning sign placement at cross buck protected crossings advising highway travelers of the increased train speeds at the crossing.

Additional safety improvements were recommended in the Wilmington Traffic Separation Study (TSS). The study included installation of new crossing signals and gates, upgrading the existing signals and gates, and constructing new roadways to close and combine crossings. This procedure of consolidating crossings will occur at multiple locations.

The proposed CSXT Beltline Speed and Safety Improvements Program of Projects has six elements which should be implemented as soon as funding and construction will allow:

1. **Change the train operation from Yard Limits to Manual Block operation.**

   Under the current Yard Limits operation, each train must proceed at Restricted Speed. This is a speed of 15 mph or less and includes the requirement that the engineer must be able to stop his train within one-half of the distance of his vision, short of another train or switch improperly lined. The CSXT Wilmington Beltline Program of Projects is intended as a basis to change the rules under which trains operate from CSXT Yard Limits rules to Manual Block rules. This change in operating rules must be negotiated with CSXT prior to undertaking the program of projects and will have to be implemented by CSXT following completion.

   Costs: No Capital or Construction Costs - CSXT's change in operations only

2. **Curve improvement at Fernside Junction to raise track speed to a minimum of 20 mph**

   This element includes some minor grading to widen the existing roadbed of the West leg of the wye at Fernside Junction to permit the realignment of the existing track. The switches at either end of the West leg of the Wye will also be replaced. This work will permit trains to achieve 20 mph operation on an 11-degree curve.

   Costs: $3M

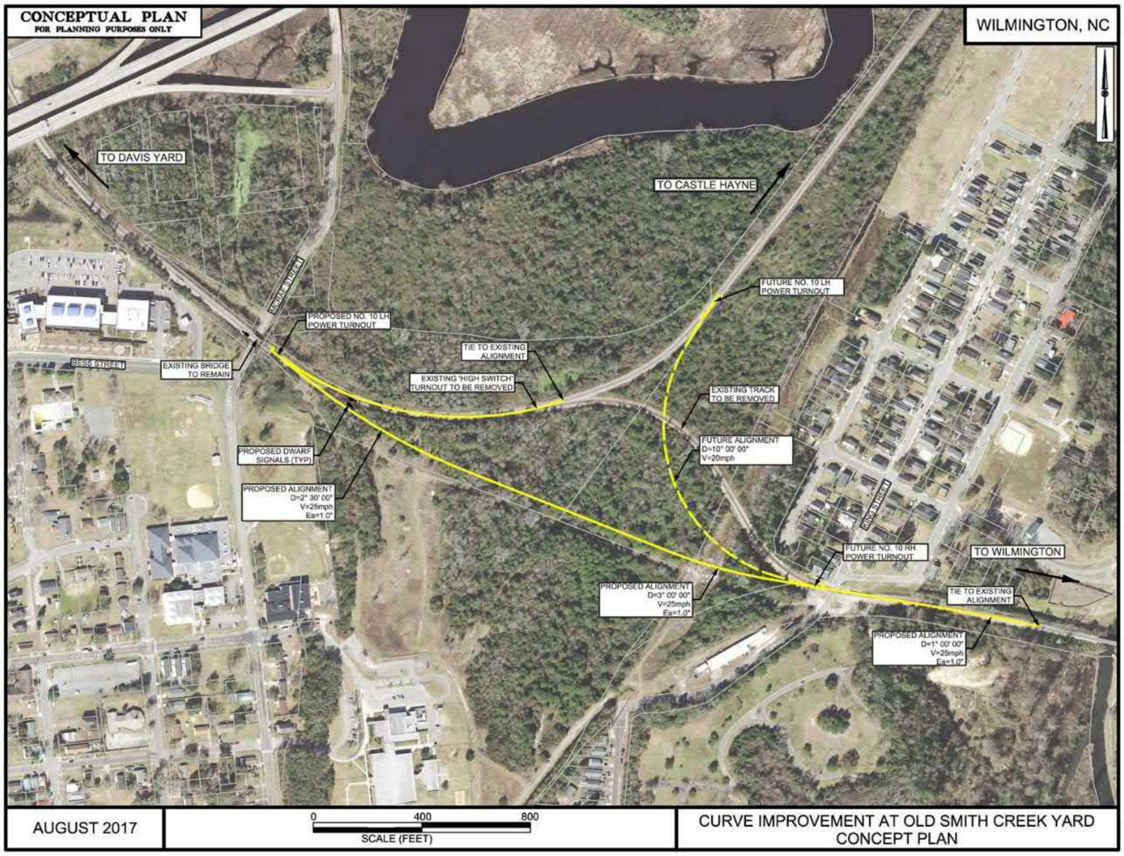
Figure 10: Fernside Junction Improvements

3. Curve Improvement at the Old Smith Creek Yard

This element involves construction of roadbed and new track near the former Smith Creek Yard near the switch toward Castle Hayne. The existing track has three curves of reverse direction which vary in degree of curvature, with the maximum being 11 degrees 30 minutes. These sharp curves accelerate rail wear and gage widening which requires increased maintenance and leads to restriction of speed on the track to adhere to the Federal Railroad Administration's Track Safety Standards. Trains are required to operate at a speed of less than 10 mph to safely accommodate the sharp curvature. The new track will have curves of 3 degrees or less which will permit trains to operate at FRA Class 2 speed of 25 mph. This increased train speed reduces the amount of delays motorists experience from trains traversing highway crossings at-grade.

Costs: $3M

Figure 11: Curve Improvement at Old Smith Creek Yard



4. Tie and rail replacement and surfacing

This element comprises rehabilitation of the rail and tie structure of the approximately 10 miles of track between Davis Yard and the Port. Rehabilitation of the line will be accomplished by installing new crossties, applying new track ballast, and surfacing the track. Crossties would be installed to meet FRA Class 2 standards. The track would be raised and tamped to bring it to uniform profile, line, and surface. At this point, new or fit branch line rail of 132-pound or greater would be laid to eliminate the existing light weight (100-pound) rail. This work, coupled with the revisions of the CSXT operating rules, will permit trains to operate up to 25 mph which is within FRA Track Safety Class 2.

Costs: $6M

5. Bridge modifications, including modifications to the movable bridges for 20-25 mph speed

This element must be coordinated and more detail provided by CSXT. Coordination of this element began May 2017 between CSXT and NCDOT Rail Division, but to date, no additional information has been received. The cost estimate is based on the information readily available and is subject to change after continued coordination and definition.

Costs: Anticipated $6M

6. Implementation of Wilmington Traffic Separation Study

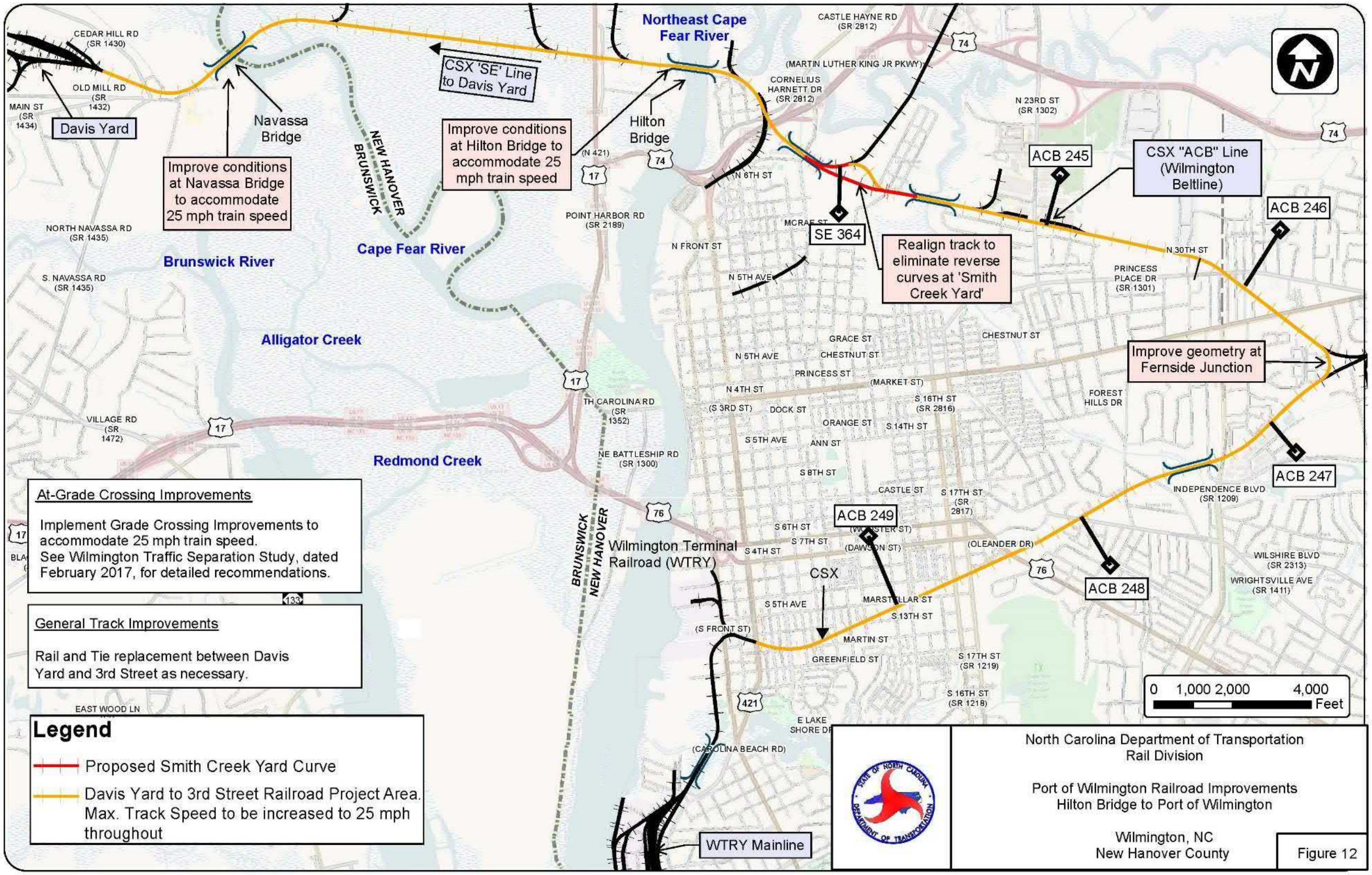
Details of this element are included in Appendix C.

Costs: $12M

Table 8: Summary of Beltline Speed and Safety Improvements Cost Estimates

Project	Estimated Cost ($M)
Change Yard Limits to Manual Block Operation	$0.0
Fernside Curve Realignment	$3.0
Realign Curves Smith Creek Yard	$3.0
Tie and Surfacing	$6.0
Rehabilitate Bridges	$6.0
Wilmington Traffic Separation Study	$12.0
Total	$30.0

Figure 12: CSXT Beltline Speed and Safety Improvements



5.2 WTRY Track Upgrades Program of Projects

The WTRY track, both on and off the Port terminal, will need to be upgraded to handle the anticipated increase in intermodal business. To that end, several track construction and or rehabilitation projects are listed below to meet this need. Phase 1 is recommended in the near term in order to accommodate QCE and CCX 10,000-foot train. Phase 2 is recommended to accommodate increased service frequencies. Phase 3 is recommended to be included in the STIP, Project U-5734. See Appendix E for detailed maps of the WTRY Track Upgrades Program of Projects.

Figure 13: Overview of Improvements Third Street to Port

5.2.1 Rehabilitate Track 1, Container 1 – Phase 1

This intermodal loading track will be rehabilitated by replacing 100% of the wood ties with new, adding crushed stone ballast and surfacing the track. It will be followed by renewing the existing 90 pound and 85 pound rail with Fit Yard Continuously Welded Rail (CWR) and re-surfacing the track.

Costs: $600k Schedule: Fall 2017

5.2.2 Rehabilitate Track 18, Container 2 – Phase 1

This Intermodal loading track will be rehabilitated by replacing 50% of the wood ties with new, adding crushed stone ballast and surfacing the track. It will be followed by renewing the existing 90 pound and 85 pound rail with Fit Yard CWR and re-surfacing the track.

Costs: $600k Schedule: Fall 2017

5.2.3 Rehabilitate the Main Track from Third Street through the Port Lead Switch – Phase 2

Includes renewing 50% of the ties and surfacing the track, along with replacing the rail with Branch Line relay CWR on the Main track. This rail should have no more than ½" horizontal nor more than 3/8" vertical wear and can carry loads based on 100 ton cars. The curve between Third Street and Wood Siding should be laid with New "Curvemaster" or head hardened welded rail due to the severe curvature of the track. A final surfacing completes rehabilitation of the track.

Also, there are three highway-rail at-grade crossings included in this work, namely Third Street (which is beyond the scope of the NCDOT TSS) South Front Street, and Greenfield Street.

There are four pound10 Turnouts to be renewed (Front Street Spur, N. Wood Siding., S. Wood Siding, Port Lead), included in this work.

Costs: $2.4M Schedule: Spring 2018

5.2.4 Rehabilitate the Main Track from the Port Lead Switch through Shipyard Boulevard – Phase 2

Rehabilitation of this section of the Main includes renewing 50% of the ties and surfacing the track, along with replacing the rail with Branch Line relay CWR. You will notice that this work jogs near the former Central Boulevard crossing. This is due to the realignment of the Main as part of an ongoing project.

There are three at-grade crossings in this project, Myers, Woodbine, and Shipyard Boulevard, and two pound10 Turnouts to be renewed, the North and South 0-Track switches.

Costs: $2.7M Schedule: Fall 2018

5.2.5 Rehabilitate the Maritime Siding from the Main Turnout to near the former Central Avenue Crossing - Phase 2

Rehabilitation of this section of the Maritime Siding includes renewing 50% of the ties and surfacing the track, along with replacing the rail with Branch Line relay CWR. This section of the Maritime Siding was formerly the Main track. The track was realigned as part of the ongoing project. There are no at-grade crossings and no turnouts to be renewed in this project.

Costs: $1.0M Schedule: Winter 2018

5.2.6 Rehabilitate the 0-Track from near the former Central Avenue Crossing to the South Turnout to the Main – Phase 2

This work includes renewing 50% of the ties and surfacing the track, along with replacing the rail with Branch Line relay CWR on the 0-Track.

Costs: $500k Schedule: Spring 2019

5.2.7 Rehabilitate Wood Siding from the North Switch to the South Switch – Phase 2

The rehabilitation of Wood Siding includes renewing 50% of the ties and surfacing the track, along with replacing the rail with Branch Line relay CWR. The work includes the renewal of the Greenfield Street at-grade crossing.

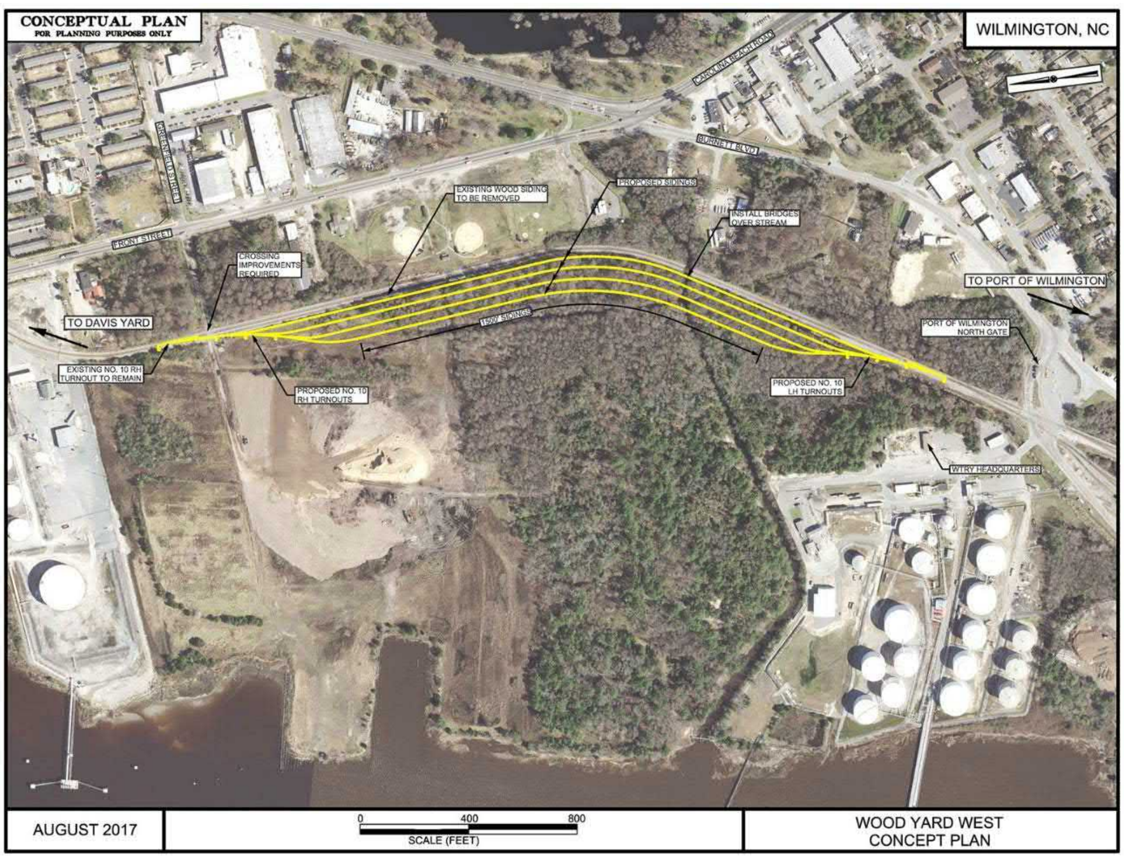
Costs: $400K Schedule: Spring 2019

5.2.8 Wood Yard West - Additional Yard Tracks – Phase 3

As needed to increase the car capacity of the Port, add four tracks parallel to the existing Main on the West Side. These four tracks would provide additional classification capability and add about 6,000 feet of storage space. They would be constructed of Fit Yard CWR which should have no more than 5/8" Horizontal nor more than ½" Vertical wear and can carry the loads based on 100-ton cars. The use of wood, steel ties, or concrete should be based on the bids submitted by qualified track contractors. The work will include an additional at-grade crossing at Greenfield Street and 4 standard concrete trestles over Greenfield Creek.

Costs: $6.6M Schedule: TBD

Figure 14: Improvements at North Gate (Wood Yard West)

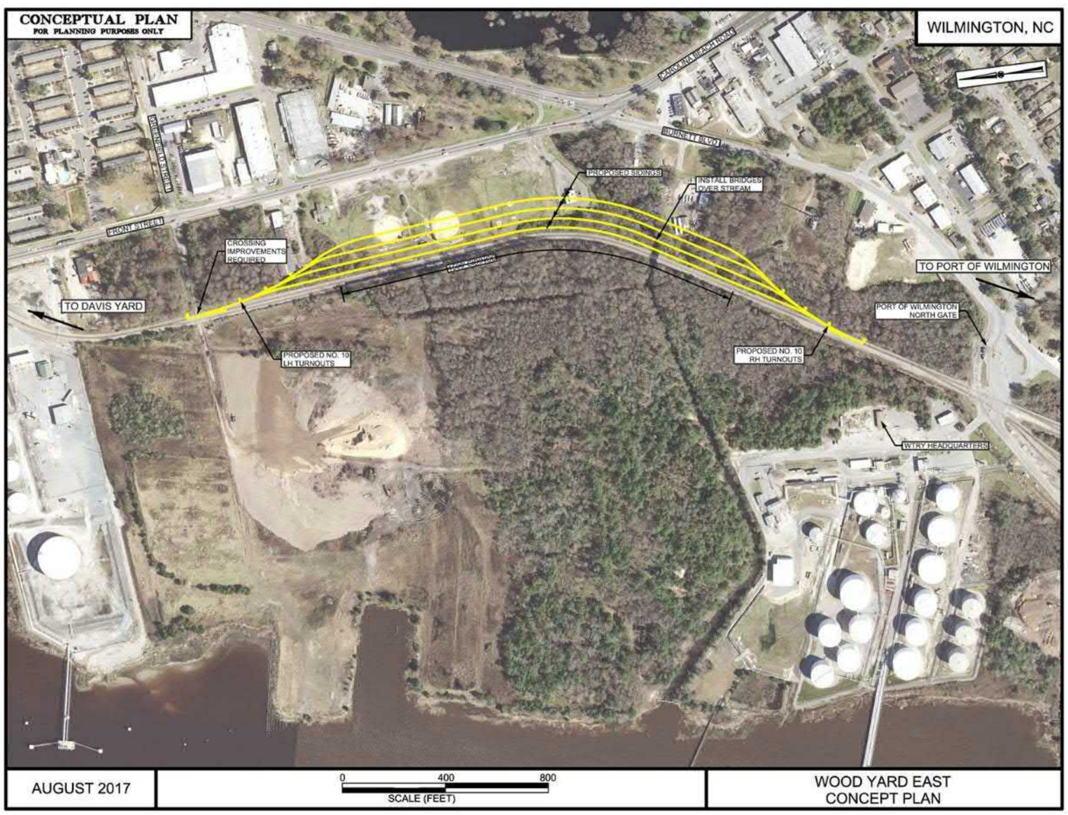


5.2.9 Wood Yard East - Additional Yard Tracks – Phase 3

As needed to increase the car capacity of the Port, add four tracks parallel to the existing Main on the East Side. These four tracks would provide additional classification capability and add about 6,000 feet of storage space. They would be constructed of Fit Yard CWR which would should have no more than 5/8" horizontal nor more than ½" vertical wear and can carry the loads based on 100-ton cars. The use of wood, steel, or concrete ties should be based on the bids submitted by qualified track contractors. The work will include an additional at-grade crossing at Greenfield Street and 4 standard concrete trestles over Greenfield Creek.

Costs: $6.6M Schedule: TBD

Figure 15: Improvements at North Gate (Wood Yard East)

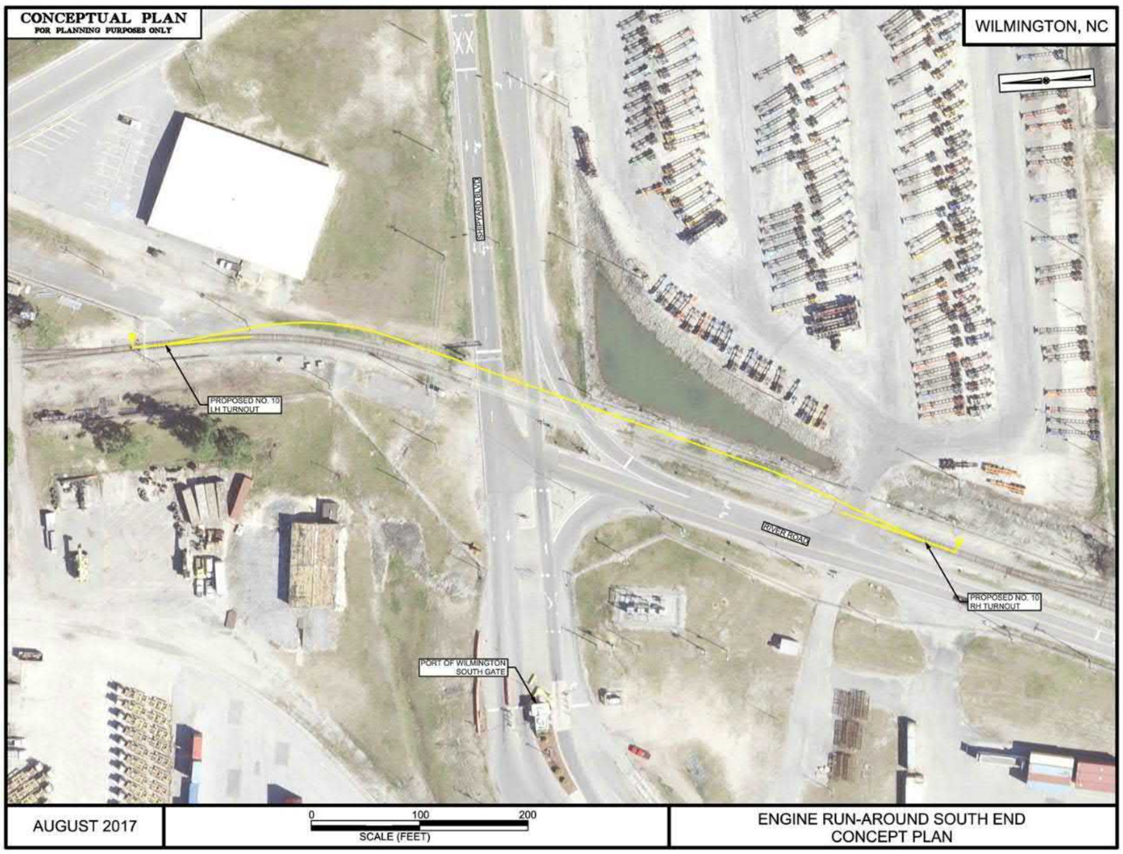


5.2.10 Engine Run-Around Track – Phase 3

An engine run-around track is a location to 'park' engines while permitting the use of the Main for other train moves. It would be a location to hold CSXT engines waiting to be re-crewed to make-up a 10,000-foot train. It would consist of two No. 10 turnouts at either end of a 600-foot siding that would be a second track through the Shipyard Boulevard / River Road grade crossing. It would be constructed with wood ties and Branch Line relay CWR.

Costs: $2.7M **Schedule: TBD**

Figure 16: Improvements at South Gate (Engine Run-Around Track)



5.2.11 Re-align the curve and Front Street Spur switch location – with U-5734

This project adds a step to the rehabilitation work. It will permit the reduction in the degree of curvature of the track between Third Street and Front Street. It is proposed to remove the existing switch to the Front Street Spur after installing a new No. 10 Right Hand turnout on the West side of Front Street to access the Front Street Spur. The turnout side of the switch will have the same curvature as the Main track at that location, while the straight side track of the turnout will diverge to the left and across Front Street near the existing crossing. It will tie into the existing Front Street spur near the point where the existing track enters the roadway of Front Street.

Project U-5734, funded in the NCDOT STIP is in the planning process. One alternative being evaluated will revise the track alignments in this area. It is recommended that the Port, Division of Highways Division 3, and Rail Division continue to coordinate regarding this project and rail impacts.

Costs: $1.4M Schedule: As Part of U-5734

Figure 17: Front Street Improvements

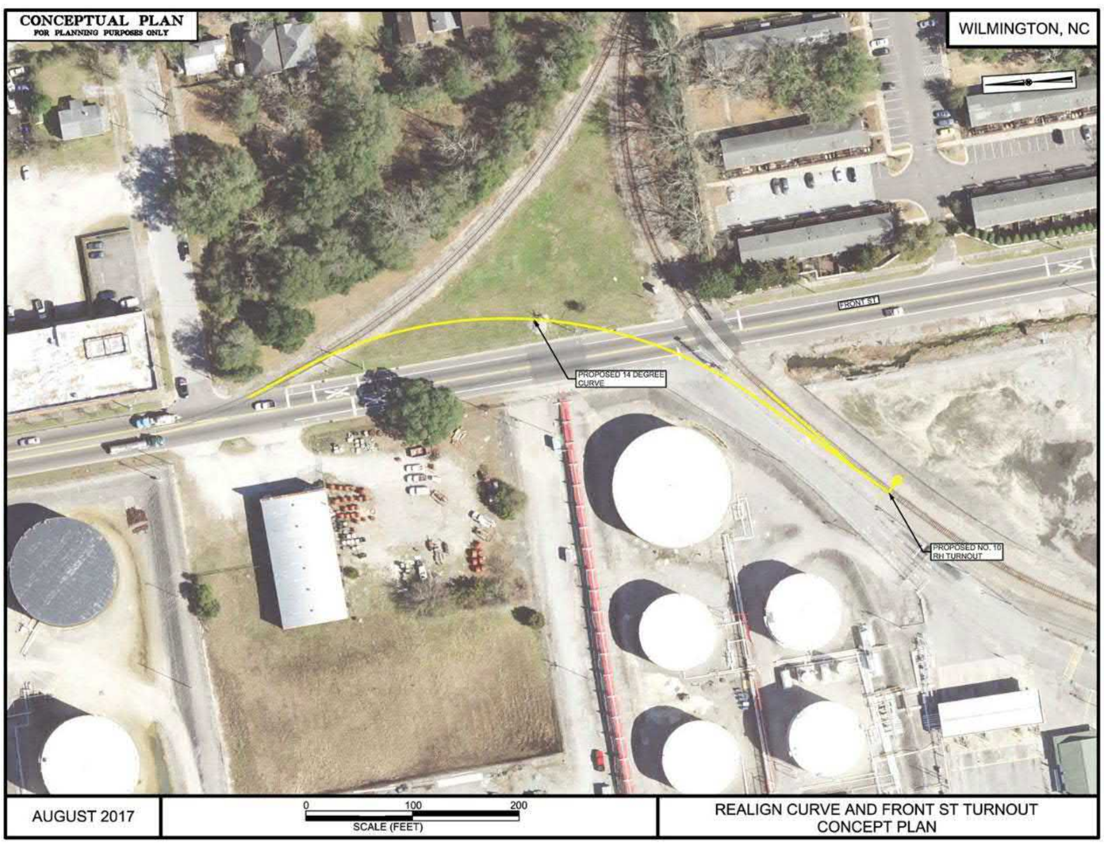


Table 9: Third Street to Port Cost Estimates

Project	Description of Work	Estimated Cost ($M)	Construction – Phase / Schedule
5.2.1 Track 1, Container 1	Rehabilitate Track	$0.6	1 - Fall 2017
5.2.2 Track 18, Container 2	Rehabilitate Track	$0.6	1 - Fall 2017
5.2.3 Main – Third Street to Port Lead Switch	Rehabilitate Track	$2.4	2 - Spring 2018
5.2.4 Main – Port Lead Switch to Shipyard Blvd.	Rehabilitate Track	$2.5	2 - Fall 2018
5.2.5 Maritime Siding – P.L. Sw.to Central Blvd.	Rehabilitate Track	$1.0	2 - Winter 2018
5.2.6 0-Track – Central Blvd. to Main South T.O.	Rehabilitate Track	$0.5	2 - Spring 2019
5.2.7 Wood Siding	Rehabilitate Track	$0.4	2 - Spring 2019
5.2.8 West Yard – Additional Tracks	4 New Tracks Wood West Yard	$6.6	3 - TBD
5.2.9 East Yard – Additional Tracks	4 New Tracks Wood East Yard	$6.6	3 - TBD
5.2.10 Engine Run-Around South End	Construct Run-Around Track	$1.4	3 - TBD
5.2.11 Realign Curve and Front Street Turnout	Install T/O to Front Street Spur	$1.4	As Part of U-5734
Total		**$24.0**	

5.2.12 Additional Operational Improvements

These operational improvement proposals should be investigated only in accordance with the rules and practices of WTRY as per its agreement with the NCSPA. These improvements would increase efficiency and productivity and are used in similar operations elsewhere.

Install a Yard Air System

This project facilitates the process of pre-charging strings of cars to be interchanged with CSXT. It will permit the charging of the air brake system of the railcars prior to their pick-up by CSXT and eliminate the need for the CSXT engines to spend 40 minutes to an hour to charge each string of cars. If a 10,000 foot train is broken into two 5,000-foot sections this results in potentially up to a 2 hour delay before a train departs. Installing a yard air system would reduce the delay for charging the cars' air brakes by 25%, resulting in 15-30 minutes of time savings per train departure.

Figure 18: Remote Yard Switch

Source: Vossloh

To optimize the assembling of a 10,000-foot train requires that the CSXT power couples to one track with 5,000 feet of railcars that has the air brake system of each car fully charged with air from the Yard Air System, then pull that 5,000-foot section North until the end of the first section is North of the second track of cars that will make up the 10,000-foot train. CSXT will then shove back and couple to the second string of cars. After testing that the brake system is functioning for the 10,000-foot length of the train, CSXT can depart for Davis Yard and beyond. North Gate and Greenfield Street crossings will be blocked during this time.

Remote Control of Yard Switches

This project will install switch operating mechanisms that can be remotely controlled by means of a railroad radio with a dual-tone multi-frequency signaling (DTMF) tone pad system. There are several companies that provide hydraulic remotely controlled switch machines. Further research into these systems will be conducted if NCSPA interest warrants.

Locomotive Remote Control

Remote control of locomotives is currently being used at Davis Yard. There are several companies that provide systems to remotely control locomotives. Two brochures from Control Chief Wireless Solutions are included in the Appendices. Further research into these systems will be conducted if POW interest warrants.

Figure 19: Locomotive Remote Control Receiver

Source: Control Chief

Figure 20: Locomotive Remote Control

Source: Control Chief

6 Port Infrastructure Improvements

Projected growth in intermodal freight volumes necessitates the need for future port infrastructure and space needed at the terminal to accommodate each targeted market in the near term. This planning level assessment of the facilities within the current terminal property limits and near-term improvements to efficiently operate with the forecasted tonnage and container movements.

6.1 Intermodal Yard Development

To service 10,000-foot trains at the Port, various intermodal facility options were considered. These include intermodal yards serviced by rail mounted gantry cranes (RMG) and yards serviced by existing reach stacker operations. RMG options have been developed to allow a complete 10,000-foot train to be brought into the working tracks, which is possible due to the ability of the RMGs to service multiple tightly spaced tracks. Development of the intermodal yard will also increase yard capacity at the Port of Wilmington by reducing dwell time.

6.1.1 RMG Capacity

There are several capacity factors that exist for the rail yard operation such as:

- RMG handling capacity
- Train capacity factoring the turnaround and well car positioning and train make-up times
- Capacity of inter-terminal transfer of containers to and from the container yard to the rail yard– factoring in tractor trailer numbers, cycle times, peaking factors, and the like.

With the train capacity and terminal transfer factors being relatively constant between options, we have analyzed the RMG capacity and the ability to turn a single 10,000-foot train in one day.

Figure 21: Typical Rail Mounted Gantry Crane

Source: Kone Cranes

RMG Crane Handling Capacity = 54,600 TEUs/annum

Assuming the following:

- 20 boxes per hour average handling rate per RMG
- One RMG
- One 6 hour RMG shift per day (as advised by the port)
- 5 days per week intermodal yard working
- TEU ratio of 1.75

Train Cargo Capacity = 199,900 TEUs/annum

Assuming the following:

- 10,000 feet total length per train
- 52-foot long well-cars
- Double stacked well-cars (2 FEU per well-car)
- 1 train per day working 5 days per week
- TEU ratio of 1.75

We can see that if a train was to be loaded daily, multiple RMGs will be required to turn the trains around in sufficient time. To summarize, Table 10 presents RMG numbers required to load a single 10,000-foot train based on a single 6-hour shift and two 6-hour shifts per working day.

Table 10: RMG Option Capacity

Number of RMGs	Time to load 10,000ft train (No. of days based on 1 x 6hr shift)	Time to load 10,000ft train (No. of days based on 2 x 6hr shifts)
1	22 hours (3.7 days)	22 hours (1.8 days)
2	11 hours (1.8 days)	11 hours (0.9 days)
3	7.3 hours (1.2 days)	7.3 hours (0.6 days)
4	5.5 hours (0.9 days)	5.5 hours (0.5 days)

Considering the assumptions in Table 10, 4 RMG's will be required to turn around one 10,000-foot train per day based on one 6 hour RMG shift per day. Two RMG's would be required if two 6 hour RMG shifts per day were feasible.

6.1.2 Reach Stacker Capacity

Reach stacker options are developed to service half of the 10,000-foot trains, while the other half of the train is stored on available storage tracks outside of the intermodal yard. This is due to the limitation of the reach stackers to load and unload trains on more than two adjacent tracks. All options were developed to locate the intermodal yard East of the container yard to maximize the efficiency of existing and future container yard operations. One reach stacker option was looked at to service a

Figure 22: Reach Stacker Loading Operation at the Port

Source: Mott MacDonald

complete 10,000-foot train in the working tracks, but was rejected due to extending into the existing container yard operations.

All reach stacker options have sufficient track length to handle the 10,000-foot trains in two sections. The number of reach stackers required to turn the unit trains in one day have been analyzed with the assumptions listed in Table 11.

Table 11: Reach Stacker Yard Capacity

Assumptions	
Reach stacker moves per hour	12 moves per hour
Train length	10,000 foot trains
Well Car length	53-foot well cars
Number of Well Cars	189
Double Stacked	2 FEUs per well car
TEU ratio	1.75
Train inter-arrival time	24 hours
Working hours	8 hours
Number of Tracks	4
Average length per track	2,544 feet
Total TEUs	755
Total boxes	432
Number of reach stackers required	5

Five reach stackers will be required to load/unload a 10,000-foot in a single 8-hour shift.

All options will require relocation of the chassis maintenance area adjacent to the east side of tracks 18 A. Additionally, it is anticipated that a security gate for Customs and Border Patrol (CBP) screening would be required for all configurations of the intermodal yard. The options are presented in Appendix D.

6.2 Intermodal Yard Options

There were seven configuration options studied, each with pros and cons along with an associated cost. Details of all seven including design sketches are in Appendix D. The recommended option (Option 7 Reach Stacker) as described below:

Option 7 Reach Stacker

This option provides 5,000 feet of working track on 4 sidings. Transfer areas are located on both the east and west side of the intermodal yard. Reach stackers will work both sides of the intermodal yard with separate staging areas on each side of the yard. Tractors will be required to deliver containers to the appropriate staging area.

Pros:

- Allows for all working tracks to be occupied during operations.
- Reduces potential congestion in the transfer area.
- Allows for conversion to RMG operations in the future.
- Allows for future expansion south of the yard, provided the south gate access road is realigned.
- Minimizes unused space between the east side of the intermodal yard and the east boundary of the terminal.

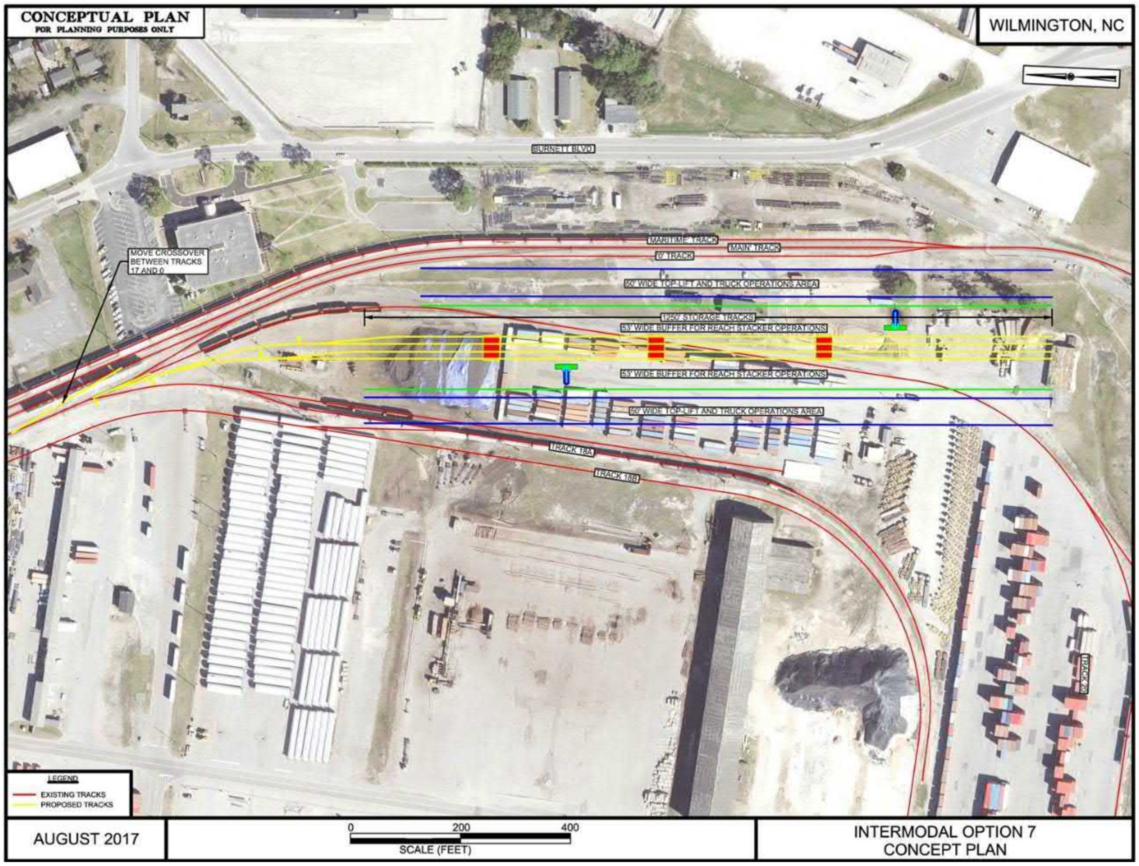
Cons:

- Required to move the Ports America and 1st Seaman's buildings.
- Slightly less efficient use of space with two separate transfer areas.

- West transfer area slightly restricted at North end by ongoing use of tracks 18A/B if needed in the short term.

Costs: $18.8M

Figure 23: Option 7 Reach Stacker



6.3 Summary and Recommendations

Based on the lower capital costs of the reach stacker operations while still achieving the ability to service 10,000-foot trains daily, it is recommended to select one of the reach stacker options. This has the added benefit of operating with familiar equipment and providing reliability in equipment availability. Should a RMG breakdown, there is no redundancy to handle the cargo while repairs are carried out. Whereas a reach stacker operation can deploy an additional piece of equipment should a breakdown occur. Depending on the capabilities of the reach stackers presently used at the Port, specialized reach stackers with the outreach capability to service two tracks may need to be procured. Cost estimates for the reach stacker options include procurement of 6 reach stackers. Five to service the train and one in reserve.

Table 10: Summary of Options Cost Estimates

Supporting Exhibit	Description of Work	Estimated Capital Cost ($M)
Option 1	3 RMGs and 8 tracks	$53.9
Option 2	3 RMGs and 8 tracks (improved switching)	$44.5
Option 3	3 RMGs and 8 tracks (10K track length)	$43.1
Option 4	3 RMGs and 7 tracks (10K track length)	$38.4
Option 5	5 Reach Stackers, 4 adjacent tracks, and transfer yard west	$16.5
Option 6	5 Reach Stackers, transfer yard between 2 sets of tracks	$17.7
Option 7	5 Reach Stackers, 4 adjacent tracks, loading from both sides	$18.8

Capital costs do not include potential power upgrades required for the RMGs or site lighting and security booths. These are considered consistent for each option and should not impact the comparison of relative costs. All estimates are order of magnitude and include, equipment costs, engineering costs, and a 30% contingency.

Of the reach stacker options, Intermodal Yard Option 7 is recommended. While this option has the highest cost, it also has the greatest flexibility for future expansion. Should additional capacity be required, the tracks could be extended to the south, with a reconfiguration of the South Gate. Additionally, this configuration could be converted into an RMG yard. This option effectively uses space to the east of the intermodal yard between the yard and terminal boundary. Negative items such as the conflict at the north end of the yard with Tracks 18A and 18B can be worked out in design. The slight inefficiency in having two transfer areas is minor compared to some of the negative items identified in other options.

In order for the reach stacker option to work, a potential 10,000-foot train would need to be split as it was interchanged to WTRY. CSXT would pull South far enough on the Main to permit WTRY's engines to pull the rear half of the train back and shove it into the Intermodal yard. The WTRY engines would then pull the second half of the train from the CSXT engines and place it on 0 Track. This would permit the CSXT engines to return to Davis yard. The process would then be reversed to prepare the train for CSXT engines to pick-up and return to Davis Yard.

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7 Human and Natural Environment Constraints

7.1 Environmental Resources

This environmental resource screening provides an initial review of the proposed Wilmington Port Rail Improvement Projects. The project areas are located along the rail mainline from the Hilton Bridge to the Port in Wilmington, North Carolina. The environmental screening focused on areas that would have potential construction impacts. Operational changes, or projects that do not require earth moving, were not reviewed during this environmental screening. Depending upon the chosen recommendations and project funding source, a categorical exclusion or State environmental checklist may need to be conducted.

For this screening, the following project areas were reviewed, see Appendix F for the detailed environmental screening:

- Curve Improvement at Old Smith Creek Yard (Figures 1.A and 1.B)
- Fernside Junction Improvement (Figures 2.A and 2.B)
- Front Street Improvements (Figures 3.A and 3.B)
- Rail Improvements from Third Street through the Port (Figures 4.A and 4.B)

The environmental resource screening is the initial step in the planning and design process for these projects and is not the product of exhaustive environmental or design investigations. The information obtained for the environmental screening is from readily available sources. No survey work was performed for this screening. The environmental screening is not a substitute for the project planning or environmental documentation process. The purpose of environmental screening is to identify potential environmental constraints to assist in the development of design concepts and to identify potential concerns that may require consideration in the future planning and design phases. For the purpose of this screening, environmental constraints were identified within and adjacent to the railroad right of way in the project areas.

7.2 State and Federal Permitting Requirements

The proposed projects may result in several activities requiring environmental regulatory permits from State and Federal agencies. A list of potential required coordination or permitting is provided below. Additional coordination or permits not included below may be necessary.

7.2.1 United States Army Corp of Engineers (USACE)

Under Section 404 of the Clean Water Act, a permit from the USACE is required for any activity in water or wetlands which would discharge dredged or fill materials into Waters of the United States and adjacent wetlands. Under Section 10 of the Rivers and Harbors Act of 1899, a permit from the USACE is required for any activity that results in the alteration or obstruction of navigable Waters of the United States. Impacts to the wetlands and a determination of USACE permitting requirements would occur during project planning and environmental documentation.

7.2.2 United States Coast Guard (USCG)

The project areas are located within the Tidally Influenced Zone on the USCG Coordination map, published by NCDOT. The Cape Fear River and other streams located within the project areas are also classified as Tidally Influenced Waters. Any improvements to sites that cross tidal waters would require coordination with the USCG. The level of coordination or permitting effort required is outlined under NCDOT's Procedures Addressing Coast Guard Needs for Federally Funded Projects.

7.2.3 United States Fish and Wildlife Service (USFWS)

The USFWS provides recommendations to the USACE on how a proposed project could avoid or minimize impacts to existing fish and wildlife resources and their habitats, including wetlands. If SACE Section 404 and Section 10 permits are required for a project, USFWS would review the permits to determine a project's impact on public fish and wildlife resources.

A Section 7 Consultation with USFWS will be required for any project that may impact a threatened or endangered species. A review of the USFWS's Endangered and Threatened Species by County for North Carolina lists fifteen species under federal protection for New Hanover County as of April 2, 2015. These species are listed in Table 12.

Scientific Name	Common Name	Status
Alligator mississippiensis	American Alligator	T (S/A)
Chelonia mydas	Green sea turtle	T
Eretmochelys imbricata	Hawksbill sea turtle	E
Lepidochelys kempii	Kemp's ridley sea turtle	E
Dermochelys coriacea	Leatherback sea turtle	E
Caretta caretta	Loggerhead sea turtle	T
Myotis septentrionalis	Northern long-earred bat	T
Charadrius melodus	Piping plover	T
Picoides borealis	Red-cockaded woodpecker	E
Calidris canutus rufa	Red knot	T
Trichechus manatus	West Indian manatee	E
Thalictrum cooleyi	Cooley's meadowrue	E
Carex lutea	Golden Sedge	E
Lysimachia asperulaefolia	Rough-leaved loosestrife	E
Amaranthus pumilus	Seabeach amaranth	T

Notes: E - Endangered denotes a species in danger of extinction throughout all or a significant portion of its range.

T - Threatened denotes a species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

T(S/A) - Threatened due to similarity of appearance denotes a species that is threatened due to similarity of appearance with another listed species and is listed for its protection. Taxa listed as T(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation.

Source: United States Fish and Wildlife Service, 2015 (Last updated April 2, 2015

The N.C. Natural Heritage Program (NHP) database was queried to determine the presence of protected species within the project areas. Based upon this query, it is recommended that surveys for protected species be conducted during project planning and environmental documentation.

7.2.4 Coastal Area Management Act (CAMA)

The projects are located in New Hanover County, a Coastal Area Management Act (CAMA) county. If the project area is located in an Area of

Environmental Concern, as designated by the Coastal Resources Commission, then a CAMA permit may be required for the project. The project areas should be screened for Areas of Environmental Concern during project planning and environmental documentation.

7.2.5 North Carolina Division of Environmental Quality (NCDEQ)

Any activity which may result in discharge to navigable waters and which requires a Federal permit must obtain a certification that such discharge would be in compliance with applicable State water quality standards. An application for a USACE Section 404 Permit is considered an application for a water quality certification. Impacts to navigable waters and a determination of USACE permitting requirements would occur during project planning and environmental documentation.

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8 Benefit-Cost Analysis

8.1 Benefit-Cost Analyses Overview

Once proposed projects were finalized, conceptual engineering complete, and cost estimates drafted, a Benefit-Cost Analysis (BCA) was conducted for the CSXT Beltline Program of Projects and the Port Improvement Projects. The BCA for the Port Improvement Projects demonstrates that the program of projects will be beneficial with a benefit/cost ratio of almost 14 to 1; the BCA for the CSXT Beltline Projects had a benefit/cost ratio of 7 to 1, proving the projects will be a cost-effective investment to improve regional mobility for people and goods. The BCAs were conducted in accord with US Office of Management and Budget (OMB) Circular No. A-94, Guideline and Discounted Rates for Benefit-Cost Analysis of Federal Programs.[10] Details of both BCAs are summarized below and presented in Appendix B.

Current Status/ Baseline & Problem to be Addressed	Change to Baseline	Type of Impacts	Affected Population	Economic Benefits	Summary of Results
Port Improvements BCA					
Port of Wilmington additional Rail Investment for Queen City Express and CCX intermodal initiatives	Improvements on the Port to facilitate efficient loading, unloading and storage of intermodal container trains	Social Environmental Competitive	Throughout North Carolina	Monetized value of reduced highway congestion costs	Projected investment Cost from $18.8M to $54M with recommended option $18.8M
Creates significant safety and environmental benefits	Reduce adverse impact of additional projected activity at Port on highway system	Accident reductions Fuel consumption savings Social benefits of reduced air emissions	Local and regional community affected by air emissions, accidents, and road degradation	Monetized value of reduced accidents, fuel consumption, and emissions	$260M benefits NPV at 3% discount rate and $159M at 7% discount rate
Creates significant maintenance and competitiveness benefits	Port expects to divert trucks carrying containers to rail at lower cost	Improved traffic flow and reduce delays and maintenance	Drivers realizing fewer traffic delays, higher safety through area	Monetized value of competitive benefits, reduced highway maintenance	Benefit/Cost Ratio of 13.8 at 3% NPV and 8.5 at 7% NPV
CSXT Beltline Improvements BCA					
Numerous railroad crossings and significant grade crossing delay plus secondary effects on traffic at adjacent intersections	Railroad improvements to eliminate need to stop trains along 13 mile path from Hilton Bridge area to the Port of Wilmington	Reduce wait times at intersections	Number of drivers traversing grade crossing and affected by grade crossing preemption and related delays	Monetized value of reduced waiting costs	Travel time savings average 3.5 minutes per car or truck trip

[10] OMB Circular No. A-94 Revised, https://www.whitehouse.gov/omb/circulars_a094

Current Status/ Baseline & Problem to be Addressed	Change to Baseline	Type of Impacts	Affected Population	Economic Benefits	Summary of Results
Quality of life impacts as a result of long "gate down" times due to slow speed and stopping of trains	Reduce total stopped vehicle delay at the 26 grade crossings comprising the CSXT Belt Line, by increasing overall train speeds	Improved traffic flow, reduce delays, and reduced fuel consumption	Number of drivers realizing reduced traffic delays through project area	Monetized value of reduced traffic delay plus monetized value of reduced fuel consumption	The average annual value of travel time savings is $9.4M and $1.4M for passenger and truck, respectively
Social costs of air emissions caused by congestion at the 13 grade crossings and adjacent intersections	Reduce impact of possible additional projected activity at Port	Social and community benefits of reduced air emissions	Local and regional community affected by air emissions	Monetized value of reduced air emissions	Average annual $134,197 in reduced social cost of carbon and $63,254 average annual benefit related to non-carbon emissions

9 Funding

A review of potential State and Federal funding sources was undertaken during this analysis. Recommended study projects were reviewed for funding eligibility, based on the funding authority, and related policies. While there are numerous Federal funding programs related to transportation and freight infrastructure projects, there are only a few that would be eligible for the Wilmington Rail and Port Program of Projects.

9.1 State Funding

Several sources of North Carolina State funds are available for components of the program of projects. For example, Strategic Transportation Investments (STI) funds are only eligible for Class I rail improvements, while Port funds are only eligible for improvements on NCSPA property.

9.1.1 Strategic Transportation Investment Fund (STI)

STI provides Highway Trust Fund monies for non-highway projects through a project scoring formula. STI categorizes projects as statewide mobility, regional impact, or division needs, each with different funding levels and scoring. Intermodal terminal development on a Class I railroad falls into the statewide category, and as such, project selection decisions are based entirely on a data-driven scoring system. The rail project scoring system considers:

- Cost-effectiveness which is a combination of a return on investment index and regional job creation index
- System health which is a combination of a capacity index and accessibility / connectivity index
- Safety and suitability which is based on a safety index
- Project support which is based on a funding leverage index.

Several other rail improvement projects that benefit intermodal systems have been funded through the STI and are programmed in the draft State Transportation Improvement Program (STIP):

- Development of container parking/storage adjacent to the NS Greensboro Intermodal Facility – total cost $1.7M
- 10,000-foot siding extension on the CSXT line in Stouts – total cost of $10.6M

In each case, the State contributed half of the development cost.

9.1.2 NCSPA Funding

The 2018-2019 Appropriations Act, has budgeted $45M each year over the next fiscal biennium for NCSPA projects. NCSPA will consider the recommendations in this report in light of their overall capital needs.

9.1.3 Freight Rail & Crossing Safety Improvement Program (FRRCSI)

Established in 2013 by the General Assembly through Senate Bill 402, FRRCSI utilizes dividends received from the North Carolina Railroad Company and other State appropriations to support projects that improve freight service and the safety of rail-highway crossings in the State.

9.2 Federal Funding Programs

Major freight rail infrastructure projects come at a high dollar cost and rarely is a single funding source able to cover those costs. The high cost of construction and materials for rail and intermodal facilities compounded with limited public funding lead has led to a federal philosophy of leveraging Federal funding to attract other, non-Federal sources of infrastructure investment. Combinations of Federal, state, local and private funding programs are often employed during the planning and construction phases.

9.2.1 Fixing America's Surface Transportation Act (FAST Act)

The FAST Act, signed into law on December 4, 2015, authorized funding the Nation's transportation system for the long term. For freight specifically, the FAST Act establishes both formula and discretionary grant programs to fund critical freight transportation projects, and will for the first time provide a dedicated source of Federal funding for freight projects, including multimodal projects. The Act emphasizes the importance of Federal coordination to focus local governments on the needs of freight transportation providers.

The FAST Act creates a new discretionary freight-focused grant program that will invest $4.5B over 5 years. This new program allows states, Metropolitan Planning Organizations (MPOs), local governments, special purpose districts and public authorities (including port authorities) to apply for funding to complete projects that improve safety and eliminate freight bottlenecks and improve critical freight movements.

9.2.2 Infrastructure for Rebuilding America (INFRA)

The USDOT announced on June 29 the INFRA discretionary grant program through a Notice of Funding Opportunity (NOFO) in the Federal Register. The INFRA program allocates approximately $1.5B available for transportation infrastructure projects directly to state and local governments. Additionally, the INFRA program aims to increase the total investment by state, local, and private partners. The INFRA program replaces the Fostering Advancements In Shipping And Transportation For The Long term Achievement Of National Efficiencies (FASTLANE) grants. Specifically, the INFRA grant program goals are to:

- Support economic vitality at the national and regional level;
- Leverage Federal funding to attract other, non-Federal sources of infrastructure investment, as well as accounting for the life-cycle costs of the project;
- Using innovative approaches to improve safety and expedite project delivery; and
- Holding grant recipients accountable for their performance and achieving specific, measurable outcomes identified by grant applicants.

INFRA grants may not exceed 60% of future eligible project costs. An additional 20% of project costs may be funded with other Federal assistance, bringing total Federal participation in the project to a maximum of 80%.

Grant projects are broken into two categories large (over $100M) and small (less than $100M); For each fiscal year, 10 percent of available funds are reserved for small projects, and 90 percent of funds are reserved for large projects.

Similar to other USDOT competitive grant programs, grants should address program criteria as well as, generate economic, mobility and safety benefits, which must be calculated; be cost effective; be based on preliminary engineering; have dependable sources of funding and financial available for construction, maintenance and operations; factor in contingency costs; mitigate risk, and can begin construction no later than 18 months after obligation of funds.

The FAST Act authorized the $4.5B INFRA program through FY2020, including $850M for FY 2017 and $900M for FY 2018.

9.2.3 Transportation Investment Generating Economic Recovery (TIGER)

In February 2009, Congress passed the American Recovery and Reinvestment Act (ARRA). The act provided $1.5B in multi-modal funding to be distributed through a discretionary grant program, established by USDOT as the TIGER program. These grants have been awarded on a competitive basis for surface transportation projects having a significant economic impact on the Nation, a metropolitan area, or a region.

The highly competitive program supports innovative projects, including multimodal and multi-jurisdictional projects. Grant applicants must detail the benefits of the project for five outcomes: safety, economic competitiveness, state of good repair, quality of life and environmental sustainability. USDOT also evaluates projects on innovation, partnerships, project readiness, benefit-cost analysis, and cost share. TIGER funding is dependent upon Congressional approval of a continuing resolution for funding in FY 2018, but the funding levels remain to be determined.

9.2.4 Congestion Mitigation and Air Quality (CMAQ)

The CMAQ program provides funding for areas that do not meet the National Ambient Air Quality Standards (nonattainment areas) as well as former nonattainment areas that are now in compliance (maintenance areas). The program funds transportation capital and operating projects that contribute to air quality improvements, reduce transportation related emissions, and provide congestion relief. NCDOT has approved a request for CMAQ funding from the NCSPA to underwrite the operating costs to inaugurate the QCE service.

9.2.5 Surface Transportation Block Grant (STBG) Program

The FAST Act converted the long-standing Surface Transportation Program (STP) into the Surface Transportation Block Grant Program acknowledging the program’s administrative flexibility. The STBG provides flexible funding that may be used by States and localities for projects that improve the conditions and performance on any

Federal-aid highway, bridge and tunnel infrastructure, pedestrian and bicycle projects, and transit capital projects. Eligible rail improvements include eliminating crossings, increasing the vertical clearance of bridges, and improving intermodal connections.

As part of the STP program the Direct Apportionment Planning Program (STP-DA) provides additional funds directly to Metropolitan Planning Organizations (MPOs) for long range plans and projects. The reimbursement program funds projects that are within the MPO Long Range Transportation Plan and may be programmed as a supplement project to the MPO annual Unified Planning Work Program, part of an existing TIP project or a stand-alone project in the TIP.

9.2.6 Intelligent Transportation (ITS) Program

The FAST Act continues the FHWA ITS program and provides funding for the research and development of ITS with the goal of solving congestion and safety problems; primary focus continues to be reducing crashes through advanced safety systems for surface transportation vehicles, traffic signals, wireless devices, and automated vehicle systems. FAST Act added a new ITS goal to the program for freight related projects that enhance the national freight system and policy goals. $100M has been authorized each year through 2020.

9.2.7 Advanced Transportation and Congestion Management Technologies Deployment

FAST Act established a new program, the Advanced Transportation and Congestion Management Technologies Deployment program. This new program creates competitive grants for the development and operation of advanced transportation technologies to improve safety, efficiency, and system performance. Eligible projects could include: traveler information systems, transportation management technology, and collision avoidance systems. $60M has been authorized each year through 2020.

9.2.8 Railroad Rehabilitation and Financing (RRIF) Loan Program

The RRIF program, originally established by the Transportation Equity Act for the 21st Century (TEA-21), has been amended multiple times including through the FAST Act. Through this loan program direct loans and loan guarantees of up to $35B are available for railroad infrastructure projects benefiting freight railroads other than Class I carriers. Funding is available for acquisition, improvement or rehabilitation of intermodal equipment or facilities, refinancing of outstanding debt for improvements, development of new intermodal or railroad facilities.

Direct loans can fund up to 100% of a project with repayment periods of up to 35 years and low government interest rates. Eligible borrowers include railroads, state and local governments, government-sponsored authorities and corporations, joint ventures including at least one railroad, and limited option freight shippers intending to construct a new rail connection.

9.2.9 Transportation infrastructure Finance and Innovation Act (TIFIA) Loan Program

The TIFIA program provides credit assistance for projects of regional and national significance; usually large-scale, surface transportation projects - highway, transit, railroad, intermodal freight, and port access.

Eligible applicants include state and local governments, transit agencies, railroad companies, special authorities, special districts, and private entities. The TIFIA program is designed to leverage Federal funds by combining with substantial non-Federal (private or state) investment by providing supplemental capital. TIFIA typically aids large-scale transportation projects that utilize tolls or other innovative revenue sources, such as proceeds from tax increment financing.

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Appendices

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A. Integrated Demand Forecast

Demand model used in the development of this report is submitted electronically in native Excel format under separate cover.

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B. Benefit-Cost Analyses

Port Improvement Projects Benefit-Cost Analysis

Table B-1 Summary

Current Status/ Baseline & Problem to be Addressed	Change to Baseline	Type of Impacts	Affected Population	Economic Benefits	Summary of Results
Port of Wilmington additional Rail Investment for Queen City Express and CCX intermodal initiatives	Improvements on the Port to facilitate efficient loading, unloading and storage of intermodal container trains.	Social Environmental Competitive	Throughout North Carolina	Monetized value of reduced highway congestion costs	Projected investment Cost from $18.8M to $54M with recommended option $18.8 M
Creates significant safety and environmental benefits	Reduce adverse impact of additional projected activity at Port on highway system	Accident reductions Fuel consumption savings Social benefits of reduced air emissions	Local and regional community affected by air emissions, accidents, and road degradation	Monetized value of reduced accidents, fuel consumption, and emissions	$260M benefits NPV at 3% discount rate and $159M at 7% discount rate
Creates significant maintenance and competitiveness benefits	Port expects to divert trucks carrying containers to rail at lower cost	Improved traffic flow and reduce delays and maintenance	Drivers realizing fewer traffic delays, higher safety through area	Monetized value of competitive benefits, reduced highway maintenance	Benefit-Cost Ratio of 13.8 at 3% NPV and 8.5 at 7% NPV

Project Description

Rail movement of import and export containerized cargo is key to the Port's expanding its container market share participation. The purpose of the Port of Wilmington Rail Improvements Project is to support the operation of The Queen City Express (QCE) an intermodal container train service operating initially between the Port and Charlotte, NC. The services will subsequently be expanded to include connections with the Carolina Connector (CCX) mega-regional rail container hub in Rocky Mount, NC.

The Port's role is that of agent and arranger of transportation for the movement of containers between the Port and Charlotte, NC, on behalf of its customers. QCE's customers are ocean carriers, intermodal marketing companies, and transportation intermediaries.

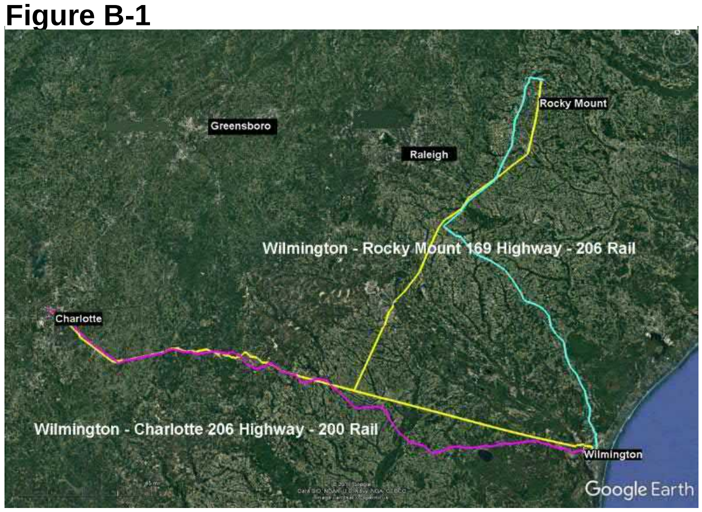
Today, the service is configured as follows:

- A rail services agreement with CSX Transportation (CSXT), the line haul rail carrier, provides service to Charlotte, 200 miles distant, and beginning in 2020, to CCX via the Pembroke, NC, connection to CSXT's north-south mainline to Rocky Mount (see Figure B-1);

- Within the Port, switching services are provided by an agreement with Wilmington Terminal Railway (WTRY), the rail switching provider at the Port, and;
- Contracts with motor carriers provide drayage services for containers or chassis.

Consequently, the Port is both a transport intermediary and provider of the capital improvements necessary to support and expand the QCE and later the CCX services which are anticipated to grow from approximately 20,000 containers per year in 2017-2018 to nearly 100,000 containers transported in 2025. The purpose of the instant capital projects is to secure all of the benefits of increased and more efficient rail operations with respect to speed and safety of rail and container handling operations. Today, trains using the Port's intermodal rail facilities are constrained by the length of rail tracks available for loading intermodal flat cars and by lack of storage for cars awaiting loads. If rail were not used, then truck transport would be used, to accommodate growth from approximately 200,000 loaded and empty container movements today to exceed 300,000 in 2025.

Figure B-1



Investments required ranged from estimated capital costs of $18.8M to $53.9M to $18.8M for Option 7, depending on the methodology and complexity, with Option 7 being the recommended option at $18.8M. Benefit-to-cost ratios are calculated based on the $18.8M option.

Methodology

This benefit-cost analysis (BCA) measures the public and competitive benefits of diverting containers from road to rail. Specifically, among quantitative inputs needed to create benefit estimates for quality of life, sustainability, safety, and competitiveness are:

- Reduced truck haulage versus increased rail haulage expressed as:
  - Miles traveled, tons hauled, ton-miles hauled, etc.
- Environmental and quality of life characteristics including:
  - Gallons of fuel consumed, hours driven, congestion effects, etc.
- Competitiveness:
  - Reduced transport cost per mile, transit time, inventory carrying cost, etc.

How to derive transport effects for this investment?

The diversion is defined as a loaded or empty container diverted onto rail, first the QCE, and then, diverted onto a broader variety of rail paths via trans-loading at CCX.

Analysis done by the Port in preparation for its FASTLane application in 2016 indicates that according to Piers[11] data the total Charlotte market (in North Carolina) for import and export containers coming through Southeast ports from Norfolk to Savannah was around 65,000 TEU's[12] or 37,000 container FEU's in 2013. This was believed to be a practical limit for QCE substitution for trucks, and is reached in terms of forecast rail container movements in 2020-21 according to the projections derived from the Port's assumed ultimate 25% rail share of its container movements.

Then, the remaining growth of containers handled by rail was assigned to other paths via CCX. Looking at the dispersion of possible lanes and end points for CCX, prior studies theorized that a 60% component of throughput would come mainly from eastern and central North Carolina including the Raleigh and Greensboro MSAs[13] and the balance of pass-through traffic would arrive from elsewhere, including Charlotte, and change trains.

Since CCX is a concentration point alone, the relationship to highway transport can be defined by making the simplifying assumption that all prior and subsequent movements via CCX are by rail and, therefore, from our perspective, benefits are limited to the dray versus substituted rail movements to and from CCX. An illustration may be helpful to illustrate this point.

Assume a container arrives via ship at Wilmington destined for Sarasota, FL. Assuming that there were no CCX, it would be placed on a truck and driven to Sarasota. Assuming further there were CCX, but no CCX rail connection to the Port, it would be driven to CCX and placed on a train for Tampa, detrained and drayed to Sarasota.

Addition of a rail service from Wilmington and including CCX would allow that container to be placed on the train at the dock, thereby saving the truck transport from Wilmington to CCX at Rocky Mount. All other aspects of the journey whether by truck or train remain the same. The following diagram illustrates the point.

Legend: Truck --------- Train ++++++

WLM ---SARA

WLM ---------------RMT/CCX++++++++++++++++++++++++TMP-------------SARA

WLM+++++++++RMT/CCX++++++++++++++++++++++++TMP-------------SARA

Summary of Benefits and Costs

A quantitative BCA was performed using available information about current truck drayage practices and current and proposed train operations, USDOT FRA guidance, and supported by documentable costs and industry research data.

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[11] PIERS is the leading provider of import and export data at the detailed, bill-of-lading level.

[12] Twenty Foot Equivalent units and Forty Foot Equivalent Units are standard measures; FEUs being equivalent to one typical marine container,

[13] Metropolitan Statistical Areas include surrounding areas. At the time of the referenced study the Raleigh MSA included the entire Research Triangle, Raleigh, Durham and Chapel Hill.

This BCA is not a comprehensive measure of the project's total potential economic impact as many likely regional benefits related to increased competitiveness of North Carolina firms and products and their employment and multiplier effects could not be readily quantified.

Identifiable future years' costs and benefits have been projected, in constant 2018 dollars, for a period extending 30 years beyond construction completion. Per Federal guidance, the monetized value of these quantified future benefits and costs are discounted to present value at discount rates of 3% for public and 7% for private capital; with the exception of the social cost of carbon, which is discounted at 3% under both scenarios.

Table B-2 Benefit-Cost Summary

Benefit or Cost Category	Present Value @ 3%	Present Value @ 7%
Capital Cost Option 7 = $18,800,000		**Quantified Benefits:**
Accident Reduction	$31,372,277	$19,548,377
Non-Carbon Emissions Reduction	($12,267,822)	($7,292,597)
Fuel Cost Savings	$126,944,877	$76,426,584
Social Cost of Carbon Savings (3% NPV)	$6,412,381	$6,412,381
Additional Savings:		
Road Wear Savings	$16,834,066	$10,225,600
Reduced Highway Congestion	$10,193,842	$6,080,799
Shipper Transport Cost Reduction	$176,180,699	$104,498,321
Increased Inventory Holding Cost	($95,505,742)	($57,045,002)
Total Quantified Benefits	**$260,164,577**	**$63,759,718.001 58,854,463**
Benefit-Cost Ratio (BCR)	**13.8**	**8.5**

Figures are presented in constant 2018 dollars.

Project Benefits

Quantified project benefits are estimated through 2048 (30 years after project construction is assumed completed). Benefits are projected using constant, 2018 dollars. A summary of calculation approach and benefits are presented Table B-3. The BCA spreadsheet is provided in Section 6.

Accident Reduction

Safety benefits are calculated based on estimated number of accidents that will be eliminated or avoided as a result of the Project. The accident data used for the analysis is based on the experience rates for North Carolina highways as found in **North Carolina 2015 Crash Facts** published by the North Carolina Division of Motor Vehicles[14]. First, avoided social costs of diverting trucks from North Carolina highways were calculated: a five-year undiscounted sample of which is shown below.

[14] See: https://connect.ncdot.gov/business/DMV/Pages/Crash-Facts.aspx

Table B-3 Truck Accident Costs

Year	Truck 100MV MT Avoided	Killed	Injured	PDO	Killed Cost	Injured Cost	PDO Cost	Truck Cost Avoided
	2.177	1.23 100MV MT	110.47 100MV MT	153.31 100MV MT	$10,140,384	$183,826	$4,431	
2019	0.0603	0.07	6.66	7.16	$754,661	$1,224,752	$31,725	$2,011,138
2020	0.0833	0.10	9.20	9.89	$1,042,227	$1,691,449	$43,815	$2,777,491
2021	0.0988	0.12	10.91	11.72	$1,235,807	$2,005,613	$51,953	$3,293,372
2022	0.1153	0.14	12.74	13.69	$1,442,526	$2,341,100	$60,643	$3,844,269
2023	0.1153	0.14	12.74	13.69	$1,442,526	$2,341,100	$60,643	$3,844,269
2024	0.1153	0.14	12.74	13.69	$1,442,526	$2,341,100	$60,643	$3,844,269
2025	0.1153	0.14	12.74	13.69	$1,442,526	$2,341,100	$60,643	$3,844,269

Next, the costs of rail accidents were calculated and used to reduce the truck calculated benefits to a net sum. The KABCO-scaled data for 2016 were evaluated and quantified using BCA guidance for valuation of accident costs, which is then converted to an annual monetized benefit[15].

Table B-4 Rail Accident Costs

Year	MM Train-Miles Added	Killed	Injured	Killed Cost	Injured Cost	Total Incremental Rail Cost	Net Decrease
		1.154 MM Train-Miles	15.338 MM Train Miles	$10,140,384	$183,826		
2019							$2,011,138
2020	0.15	0.17	2.31	$1,759,981	$424,055	$2,184,037	$593,454
2021	0.15	0.17	2.31	$1,759,981	$424,055	$2,184,037	$1,109,336
2022	0.15	0.17	2.31	$1,759,981	$424,055	$2,184,037	$1,660,232
2023	0.15	0.17	2.31	$1,759,981	$424,055	$2,184,037	$1,660,232
2024	0.15	0.17	2.31	$1,759,981	$424,055	$2,184,037	$1,660,232
2025	0.15	0.17	2.31	$1,759,981	$424,055	$2,184,037	$1,660,232

Fuel Consumption and Emissions Reduction

Fuel consumption drives both fuel savings and emissions effects to the extent that truck traffic is diverted to rail, which is more fuel efficient. Here we have used CSXT fuel efficiency as reported to the Surface Transportation Board in its 2015 R-1 Report expressed as millions of tons of cargo hauled per gallon of fuel, 431 ton miles per gallon. This is contrasted with the same calculations for a heavy duty diesel truck which moves 134 tons per gallon of diesel.

As with other diversion calculations, the savings resulting for decreased truck traffic is offset to the appropriate degree by increased fuel consumption by the railroad. Fuel cost savings are based on prices of $2.213 per gallon for mid-grade diesel. A five-year sample of undiscounted calculations is shown below.

[15] Assumes Fatal is KABCO "K," Injury is KABCO "U," and PDO is KABCO "No Injury."

Table B-5 Fuel Savings Calculation

Year	Reduced Truck Consumption	Reduced Truck Consumption	Reduced Rail Consumption	Reduced Rail Consumption	Fuel Savings
	Gallons	$2.213/Gallon	Gallons	$2.221/Gallon	
2019	770,743	1,705,655	221,595	490,389	$2,689,383
2020	1,064,458	2,355,647	313,008	692,687	$3,680,130
2021	1,262,125	2,793,083	385,080	852,182	$4,295,214
2022	1,473,269	3,260,345	462,066	1,022,552	$4,952,236
2023	1,699,014	3,759,917	544,375	1,204,702	$5,654,690
2024	1,933,743	4,279,373	629,961	1,394,103	$6,385,102
2025	2,199,919	4,868,421	727,012	1,608,878	$7,213,369

Emissions reductions are estimated for carbon and for non-carbon emissions. For the purposes of calculating fuel consumption and emissions data for heavy duty combination (tractor trailer) trucks are used.

- Annual travel time (reduced driving time) for trucks is calculated based on the assumption one container would be driven to Charlotte or CCX from Wilmington (or returned) in 4 hours 15 minutes each way and 3 hours to Rocky Mount. No “dead head” or empty movements are assumed. Train movements are much longer in time elapsed, although only 7 hours and 45 minutes represent time spent under way on the mainline. Moreover, the train is assumed to be hauling many containers at the same time so that the operating hours attributed to one container are fractional.
- Carbon emissions are estimated based on estimated reduction of fuel consumption using an assumed 22.2 pounds of CO2 per gallon of fuel consumed for heavy trucks.

Unit costs for the Social Cost of Carbon (SCC) as presented in the TIGER BCA Resource Guide, escalated to Base Year, are applied to calculate carbon-based emissions avoided, in short tons.

Non-carbon emission quantities were estimated based on EPA guidance. The appropriate unit price for each type of emission was taken from the TIGER BCA Resource Guide.

Offsetting, increased rail locomotive emissions were calculated based on EPA guidance for grams of pollutants per gallon of fuel.

Coefficients are shown in the following table for locomotives and trucks.

Table B-6 Summary Emissions for Truck & Rail

	Emissions	2012	2015	2020
CO Rail	grams/gallon	26.6	26.6	26.6
CO Truck	grams/mile	0.83	0.57	0.31
CO_2 Rail	grams/gallon	10084	10084	10084
CO_2 Truck	grams/mile	752.44	751.78	750.92
NO_X Rail	grams/gallon	144	129	99
NO_X Truck	grams/mile	3.48	2.37	1.31

	Emissions	2012	2015	2020
VOC Rail	grams/gallon	7.5	6	3.8
VOC Truck	grams/mile	0.15	0.1	0.06
$PM_{2.5}$ Rail	grams/gallon	3.98	3.3	2.23
$PM_{2.5}$ Truck	grams/mile	0.16	0.1	0.05
SO_2 Rail	grams/gallon	0.094	0.094	0.094
SO_2 Truck	grams/mile	0.0057	0.0055	0.0053

Source: USDOT, Federal Motor Carrier Safety Administration[16]

The analysis identifies an estimated annual reduction of fuel use ranging from 549,000 gallons in 2019 to 1,473,000 gallons per year in 2025. Total forecasted fuel savings and emissions reductions are summarized inTable B-7.

Table B-7 Summary of Fuel Savings and Emissions Effect

	Fuel Savings (gallons)	Carbon short tons	VOC short tons	NOx short tons	PM short tons
Total savings over 30 years	40,997,036	142,163	-52.22	-1,494	-23
Average annual savings	1,366,568	4,739	-1.74	-49.79	0.8
Average Annual Value of Fuel Consumption / Emissions Savings	**$6,692,587**	**$348,698**	**-$3,389**	**-$382,062**	**-$267,549**

Road Wear Savings

Trucks impart significantly more wear on highway pavement and bridges than do autos. When truck traffic is shifted to rail this wear is eliminated and counted as a public benefit. Railroad rights of way are privately owned and maintained. The Federal Highway Administration's Addendum to the 1997 Federal Highway Cost Allocation Study Final Report published in May 2000 and its comprehensive study of highway costs resulted in the following indicia which have been updated to 2018 cost equivalents for use here in calculating Road Wear Savings and Reduced Highway Congestion costs:

Costs to public agencies (added use-related rehabilitation and maintenance costs), and external costs such as air pollution and congestion costs imposed on others. Many marginal costs vary by either location of travel or time-of-day. For instance, incremental pavement deterioration associated with an extra mile of travel by particular vehicle classes depends on the design and condition of the pavement upon which they travel, temperature, and other local characteristics. Congestion costs associated with an additional mile of travel on low-volume rural Interstate highways are negligible, but costs on urban Interstate highways may be high, particularly during peak periods when traffic volumes are greatest. The relative costs of pavement damage, congestion,

[16] Final Environmental Assessment for the 2011 Final Hours-of-Service (HOS) of Drivers Rule, Appendix A – Analysis of Air Quality Impacts. USDOT, Federal Motor Carrier Safety Administration.

crashes, air pollution, and noise for different vehicle classes operating in rural and urban areas are as important as the individual costs themselves.[17]

For the journeys from Wilmington to Charlotte and Wilmington to Rocky Mount trips were assumed to be made throughout daylight travel hours using 60-kip, five-axle vehicles operating over 90% rural and 10% urban interstate infrastructure.

Table B-8 Costs Used for Road Wear and Congestion

2000 Pavement, Congestion, Crash, Air Pollution, and Noise Costs for Illustrative Vehicles Under Specific Conditions

Vehicle Class/Highway Class	Cents per Mile					
	Pavement	**Congestion**	**Crash**	**Air Pollution**	**Noise**	**Total**
Autos/Rural Interstate	0	0.78	0.98	1.14	0.01	2.91
Autos/Urban Interstate	0.1	7.70	1.19	1.33	0.09	10.41
40 kip 4-axle S.U. Truck/Rural Interstate	1.0	2.45	0.47	3.85	0.09	7.86
40 kip 4-axle S.U. Truck/Urban Interstate	3.1	24.48	0.86	4.49	1.50	34.43
60 kip 4-axle S.U. Truck/Rural Interstate	5.6	3.27	0.47	3.85	0.11	13.3
60 kip 4-axle S.U. Truck/Urban Interstate	18.1	32.64	0.86	4.49	1.68	57.77
60 kip 5-axle Comb/Rural Interstate	3.3	1.88	0.88	3.85	0.17	10.08
60 kip 5-axle Comb/Urban Interstate	10.5	18.39	1.15	4.49	2.75	37.28
80 kip 5-axle Comb/Rural Interstate	12.7	2.23	0.88	3.85	0.19	19.85
80 kip 5-axle Comb/Urban Interstate	40.9	20.06	1.15	4.49	3.04	69.64

NOTE: S.U. = Single Unit, Comb. = Combination; Air pollution costs are averages of costs of travel on all rural and urban highway classes, not just Interstate. Available data do not allow differences in air pollution costs for heavy truck classes to be distinguished.

Figures above are adjusted by 1.426, the total non-defense inflator registered from 2000 to 2018.[18]

Roadway Congestion Savings

Road congestion costs were calculated in the same way that pavement degradation costs were calculated using the per mile congestion costs from the table above attributed to 60-kip, five-axle combination (tractor trailer) vehicles again assuming 90% rural and 10% urban interstate travel.

Competitiveness Benefits (Transport Cost Reduction)

It is generally conceded that rail is more economical for the shipper than truck transport if rail can be employed for the same purposes. In this case the Queen City Express is expressly designed to provide a truck-competitive service. In order to calculate the beneficial competitive effects for shippers and end users we used the $0.075 average revenue returned per rail ton mile compared to the average dry van rate $0.11 per ton mile currently charged by truckers[19]. Based on an average 40,000-pound container load and given the ton miles projected to be diverted to rail, projected annual customer savings ranged from $3.6M in 2019 to $10.3M in 2025.

[17] Addendum to the 1997 Federal Highway Cost Allocation Study Final Report, FHWA May, 2000. https://www.fhwa.dot.gov/policy/hcas/addendum.cfm

[18] https://www.whitehouse.gov/omb/budget/Historicals (Table 10.1).

[19] http:www.dat.com/industry-trends/trendlines/van/national-rates

Offsetting Inventory Carrying Costs

A cost offsetting the beneficial shipper effects of rail is the fact that rail transport is slower. To reflect that offset, the carrying cost of inventory in a container was estimated based on work done by the FHWA in 1995 concerning the inventory costs for contents of five-axle combination (tractor trailer) trucks. It was assumed the contents of a container today would approximate the contents of a dry freight van trailer. Based on earlier work, and themselves inflating that to 1995 dollars, the FHWA estimated that value at $50,000. Bringing that value forward, and estimating an hourly interest rate to finance inventory, yields an updated carrying cost of 92.6 cents per hour. That financing cost is applied to the estimated differential times between truck and rail for availability in Charlotte or CCX – 67 hours loading to availability for rail versus 4 hours 45 minutes and 3 hours respectively for truck.

Table B-9 summarizes in undiscounted constant dollars the additional benefits discussed above.

Table B-9 Summary of Additional Benefits

	Road Wear Savings	Congestion Savings	Competitive Benefits	Inventory Carrying Costs	Net Competitive Benefits
Total savings over 30 years	$27,364,717	$24,620,725	$429,587,392	($151,805,872)	**$277,781,519**
Average annual savings	**$912,157**	**$820,691**	**$14,319,580**	**($5,060,196)**	**$9,259,384**

Project Costs

Project costs summarized below are discussed in Appendix D of the project report.

Supporting Exhibit	Description of Work	Estimated Capital Cost ($M)
Option 1	3 RMGs and 8 tracks	$53.9
Option 2	3 RMGs and 8 tracks (improved switching)	$44.5
Option 3	3 RMGs and 8 tracks (10K track length)	$43.1
Option 4	3 RMGs and 7 tracks (10K track length)	$38.4
Option 5	5 Reach Stackers, 4 adjacent tracks, and transfer yard west	$16.5
Option 6	5 Reach Stackers, transfer yard between 2 sets of tracks	$17.7
Option 7	5 Reach Stackers, 4 adjacent tracks, loading from both sides	$18.8

The BCA assumes that the project will be completed in phases and as necessary to support projected Port operations. Benefits will begin to accrue in 2019.

CSXT Wilmington Beltline Improvement Projects Benefit-Cost Analysis

Summary

The benefit-cost analysis for the CSXT Beltline Improvement Project (the Project) having its genesis in the Wilmington Traffic Separation Study of February 2017 (WTSS) is based on quantification of the following primary benefits:

- Reduction in Travel Delay;
- Accident Avoidance;
- Air Emission Reductions; and
- Fuel Cost Savings.

Additional project benefits were not quantified, although they present opportunities to enhance the quality of life and economic vitality in the community surrounding the project:

- Economic impacts, including property tax benefits as well as income and sales tax revenues, due to enhanced mobility in Wilmington;
- Health benefits realized by diversion of local trips from passenger vehicles to cycling or walking trips; and
- Accident prevention benefits realized from improving the general track and bridge structures.

Table B-10 Summary

Current Status/ Baseline & Problem to be Addressed	Change to Baseline	Type of Impacts	Affected Population	Economic Benefits	Summary of Results
Numerous railroad crossings and significant grade crossing delay plus secondary effects on traffic at adjacent intersections	Railroad improvements to eliminate need to stop trains along 13 mile path from Hilton Bridge area to the Port of Wilmington	Reduce wait times at intersections	Number of drivers traversing grade crossing and affected by grade crossing preemption and related delays	Monetized value of reduced waiting costs	Travel time savings average 3.5 minutes per car or truck trip
Quality of life impacts as a result of long “gate down” times due to slow speed and stopping of trains	Reduce total stopped vehicle delay at the 26 grade crossings comprising the CSXT Beltline, by increasing overall train speeds	Improved traffic flow, reduce delays, and reduced fuel consumption	Number of drivers realizing reduced traffic delays through project area	Monetized value of reduced traffic delay plus monetized value of reduced fuel consumption	The average annual value of travel time savings is $9.4M and $1.4M for passenger and truck, respectively
Social costs of air emissions caused by congestion at the 13 grade crossings and adjacent intersections	Reduce impact of possible additional projected activity at Port	Social and community benefits of reduced air emissions	Local and regional community affected by air emissions	Monetized value of reduced air emissions	Average annual $134,197 in reduced social cost of carbon and $63,254 average annual benefit related to non-carbon emissions

Project Description

The proposed project in Wilmington having a capital cost of approximately $30M will focus on five main categories of improvements as shown in the accompanying map:

- Wilmington Traffic Separation Study recommended grade crossing projects costing $12M including improvement many of 26 grade crossings (3 minor crossing would ultimately be closed in five to eight years), many of which would receive enhanced crossing protection under the study recommendations;
- Fernside Junction curve realignment $3M;
- Realign curves at Old Smith Creek Yard $3M
- Rehabilitate tracks from Davis Yard to 3rd Street to meet FRA Class 2 approximately $6M; and
- Rehabilitate Hilton and Cape Fear Bridge decks and ties two bridge structures $6M.

The purpose of the project is to improve speed and safety of rail operations and create more efficient rail operations. Today trains pass at approximately 8-10 MPH creating the potential for extremely long delays to vehicles at grade crossings. These trains have significant impacts in terms of fuel usage, emissions, and quality of life measures including the economic costs of delay to vehicle occupants.

No Build and Build Assumptions

The Base Case assumption used for the benefit-cost analysis is the No-Build Scenario, with continued use of the existing railroad plant including 13 miles of mostly single-line railroad tracks, 5.5 miles of which are in the heavily impacted vehicular traffic zone, with 26 grade crossings. A longer-term proposal to relocate the railroad tracks entirely was not presented as an alternative in the WTSS nor in this study.

To establish the Base Case, the Consultant recomputed the delay data provided by the WTSS using Consultant's observed train speeds and observed crossing delays to recalculate baseline Crossing Blockage Time (in minutes) statistics. These were then compared to the benefits of constructing the WTSS improvements – the Alternate Case.

Train operating assumptions:

Days of operation per year = 260 (5 days)

Trains operated per day = 1 merchandise train each way to Port (2 trains) and one local switcher.

Train Speeds = No Build 10 MPH and Build 15 MPH. Current CSX operations limit train speeds to 10 MPH in all sections and 5 MPH at Fernside Junction due to visibility and curvature.

Train Length = Average Feet per Train 3,000 or 9,000 total feet per day (see below).

Area of Study = 5.5 miles starting at King Street and ending at S. 4th Street

No Build Scenario

The rail line serves mainly the Port of Wilmington for which it is a vital link to the national rail network for approximately half of the tonnage traffic handled by the Port. Today that traffic is primarily bulk and breakbulk traffic handled in conventional freight cars.

It is assumed that rail traffic will continue to be bulk and breakbulk traffic as today plus the addition of new wood pellet traffic to the trains crossing the city. Taken together, this bulk and breakbulk traffic coming to and from the Port averages approximately 3,000 feet each way each day including wood pellet cars that were formerly handled as separate trains. The Queen City Express, a weekly container rail shuttle service between Wilmington and Charlotte is also a factor in this analysis. Current base case expectations are that the equivalent of 3,000 to 5,000 feet of intermodal traffic would be added to the existing merchandise trains. Thus, a cumulative average of 9,000 feet of train length each day seems to accommodate near and medium term traffic expectations.

Build Scenario

The Project envisions several elements key to train operations. One element is a general rehabilitation of the track structure to support faster operations over the entire 13 miles. Two additional track revision projects also benefit operating speeds. Although the target speed for the upgraded sections would be higher, CSXT imposes a 15 MPH speed limit on operations within yard limits and the Project trackage falls within yard limits. Thus, for the Build scenario train speeds are increased to 15 MPH and grade crossing delay calculations are calibrated on the cumulative train lengths and improved speeds. Associated fuel usage and emissions data are recalibrated based on the lowered delay times encountered.

Under these assumptions the logic matrix would be the following:

Scenario	No-Build		Build	Benefit
Base Case Port Rail Traffic	10 MPH speed 3 trains (1 Merchandise pair and 1 local) Projected average feet of train length 9,000 feet total	Versus	15 MPH speed 3 trains (1 Merchandise pair and 1 local) Projected average feet of train length 9,000 feet total	Reduced Traffic Delay Costs including income, fuel, and emissions. Accident Reduction -- 42% of crossings improved with flashers and or gates

Summary of Benefits and Costs

By fully equipping railroad crossings with appropriate safety devices and increasing train speeds favorable impacts on both the safety and efficiency of vehicle traffic and rail movements is attained. The CSXT Beltline improvement project realizes significant public benefits in mobility (travel time savings), safety (accident reduction), fuel consumption and emissions. Additional benefits related to the state of good repair of transportation infrastructure (reduced maintenance cost) will also be realized.

A quantitative benefit-cost analysis (BCA) was performed using available Wilmington Traffic Separation Study observation data[20], USDOT FRA guidance, supported by documentable costs and industry research data. This BCA is not a comprehensive measure of the project's total potential economic impact as many likely benefits could not be readily quantified.

Future years' costs and benefits have been projected, in constant 2018 dollars, for a period extending 30 years beyond construction completion. Per federal guidance, the monetized value of these quantified future benefits and costs are discounted to Present Value at discount rates of 3% and 7% for private capital; the exception is the social cost of carbon, which is discounted at 3% under both scenarios.

Table B-11 Benefit-Cost Analysis Summary

Benefit or Cost Category	Present Value @ 3%	Present Value @ 7%
Capital Cost	**$30,000,000**	**$30,000,000**
Quantified Benefits		
Travel Time Savings	$197,920,997	$115,713,134
Accident Reduction	$800,224	$506,622
Non-Carbon Emissions Reduction	$1,161,741	$679,203
Fuel Cost Savings	$7,815,575	$4,569,322
Social Cost of Carbon Savings (3% NPV)	$2,332,572	$2,332,572
Total Quantified Benefits	**$210,031,109**	**$123,800,853**
Benefit Cost Ratio (BCR)	**7**	**4.1**

Figures are presented in constant 2018 dollars.

Project Benefits

Quantified project benefits are estimated through 2049 (30 years after project construction is completed). Benefits are projected using constant, 2018 dollars.

A summary of calculation approach and benefits are presented below. The BCA spreadsheet is provided under separate cover in native Excel format.

Travel Time Savings

Travel time savings benefits are, in part, based upon data presented in the traffic impact study conducted in support of the Wilmington Traffic Separation Study completed February 2017. The analysis is based upon 2008 traffic data, actualized to 2016. This analysis assumes that project improvements would be in place by year end 2018, and that benefits would begin accruing from 2019 to 2048 in accord with an assumed useful life of 30 years.

The value of travel time savings is taken from the USDOT guidance, using per-hour monetized values for All Local Travel (for passenger vehicles) and for Trucks.

- Baseline average daily vehicle traffic (2018) was established by updating GradeDEC data at an intrinsic annual growth rate from 2014 to 2018 of 3%. This same rate of increase is assumed for years beyond 2018.

[20] Wilmington Traffic Separation Study, Wilmington MPO, February 2017 pages 65 – 70.

- A 3,000 foot train will sequentially affect at least 10% of the 5.5 mile study segment at any given time. Accordingly, our calculations relate to a train's progress through this 5.5 mile segment exclusively.
- Annual vehicle time savings are assigned to Passenger Vehicle or Truck using 93%/7% split.

Total Annual Travel Time Savings realized by the Project is 708,934 hours per year, divided proportionately (93%/7%) between passenger vehicles and trucks.

This equates to reduced trip time through the Project grade crossings that averages 3.5 minutes for each of the 259.1 million affected vehicle trips over 30 years.

Table B-12 Travel Time Savings Benefits

	Passengers	Truck
Total trips over 30 years	240,996,642 passenger vehicle trips	18,139,758 truck trips
Total time savings over 30 years	19,779,249 passenger-hours	1,448,761 hours
Average time savings	4.9 minutes per passenger-trip	4.9 minutes per trip
Average Annual Value of Travel Time Savings	**$9,375,364**	**$1,400,924**

Accident Reduction

Safety benefits are calculated based on estimated number of accidents that will be eliminated or avoided as a result of the Project. The accident data used for the analysis included 39-year accident reporting at each of the grade crossings included in the Project. There have been only two accidents (and one with injury) on the tracks over the last 10 years and 31 non-fatal crashes over the past 39 years.

Table B-13 Crash Summary

Crossing No.	Street Name	Total # of Crashes	# of Fatalities	# of Injuries	PDO
629 445S	S. 4th Street	0	0	0	0
629 443D	Hooper Strret / Martin Street	0	0	0	0
629 442W	S. 5th Street	0	0	0	0
629 441P	S. 6th Street	1	0	0	1
629 440H	S. 7th Street	0	0	0	0
629 439N	S. 8th Street	1	0	0	0
629 438G	S. 9th Street	0	0	0	0
629 437A	S. 10th Street	5	0	1	4
630 436T	S. 12th Street	0	0	0	0
630 4335L	S. 13th Street	1	0	0	1
631 434E	Marstellar Street	1	0	1	0
631 433X	S. 16th Street	1	0	0	1
632 432R	S. 17th Street	1	0	0	1
632 431J	US76/ Oleander Drive	0	0	0	0
633 430C	Wrightsville Avenue	1	0	0	1
629 429H	Colonial Drive	2	0	1	1

Crossing No.	Street Name	Total # of Crashes	# of Fatalities	# of Injuries	PDO
629 428B	Forest Hills Drive	0	0	0	0
629 427U	Mercer Avenue	3	0	1	2
629 426M	Covil Avenue	2	0	1	1
629290C	US17/ Market Street	1	0	0	1
629 289H	Henry Street	2	0	1	1
642 724T	Clay Street	2	0	0	2
629 288B	Princess Place Drive	2	0	0	2
629 287U	N. 30th Street	5	0	1	4
629286M	N. 23rd Street	0	0	0	0
269 284Y	King Street*	0	0	0	0

Source: FRA highway-Rail Grade Crossing Accident/Incident Report (1975 to Accessed December 22, 2014)
*CSXT had a derailment at Crossing # 629 284Y

Accidents avoided are monetized at rates defined in the USDOT FRA BCA guidance.

- All accidents at three grade crossings are assumed to be avoided since these crossings (Clay St., S 9th St., S 16th St.) will be closed. Historical experience is three crashes – all of which were property-damage-only (PDO) over the 1975-2014 period
- Accident severity and type at the at ten grade crossings will be mitigated and/or averted due to installation and/or upgrading of protection to a minimum of flashers and gates. (King St., N. 30th St., Henry St., Mercer Ave, Forest Hills Dr., Colonial Dr., Oleander Dr., S. 13th St., S. 12th St., S. 10th St., S. 8th St., S. 7th St., S. 4th St.) Historical experience is 15 crashes involving 5 injuries and 9 PDO incidents.
- The KABCO-scaled data is evaluated and quantified using BCA guidance for valuation of accident costs, which is then converted to an annual monetized benefit.
- Given the paucity of accidents, the lack of fatalities (which each would cost more than $10 million in 2018 dollars), and the predominance of PDO events (each of which is estimated to cost $4,467 in 2018 dollars), annualized savings from accidents are quite small, amounting to $40,827 per year, undiscounted.
- Savings are based on historical annual injury and PDO accidents and projected remaining percentage of such accidents after improvements.

Table B-14 Accident Reduction Benefits

Accident Type	30-Year Totals		% Remaining After Improvements
	Historical all crossings	Improved / Closed Crossings	
Without Project projected 30 years:			
Incidents	31	20	
Fatalities	0	0	
Injuries	8	7	
Non-Injury PDO Accidents	23	13	
With Project:			
Fatalities		0	0
Incidents		11	.846
Injuries		1	.143
Non-Injury Accidents		10	.769
Monetized Value of Accidents Avoided/Yr.			$40,827

Fuel Consumption and Emissions Reduction

Emissions reductions are estimated for carbon and for non-carbon emissions. For the purposes of calculating emissions impacts per hour of reduced delay, fuel consumption and emissions data for idling vehicles are used. This idling condition is consistent with the queuing effects noted at the subject 26 grade crossings addressed by the Project.

- Annual travel time savings (reduced vehicle idling time) for passenger vehicles and for trucks are taken from the calculations performed under Travel Time Savings section above.
- Passenger vehicle and truck fuel consumption rates (0.28 gallons per hour and 0.64 gallons per hour, respectively) are based on information provided in Energy.gov FACT #861 Idle Fuel Consumption for Selected Gasoline and Diesel Vehicles (February 23, 2015) and Real-World Energy Use and Emission Rates for Idling Long-Haul Trucks and Selected Idle Reduction Technologies, Journal of the Air & Waste Management Association (H. Christopher Frey & Po-Yao Kuo, 2009).
- Carbon emissions are estimated based on estimated reduction of fuel consumption (in gallons) using an assumed 19.4 pounds of CO_2 per gallon of fuel consumed for passenger vehicles and 22.2 lbs. of CO_2 per gallon of fuel consumed for heavy trucks.
- Unit costs for the Social Cost of Carbon (SCC) as presented in the TIGER BCA Resource Guide, escalated to Base Year, are applied to calculate carbon-based emissions avoided, in short tons.
- Non-carbon emission reductions that will be avoided by project implementation are estimated using factors presented in EPA's Idling Vehicle Emissions for Passenger Cars, Light-Duty Trucks, and Heavy-Duty Trucks (October 2008). The appropriate unit price for each type of emission was taken from the TIGER BCA Resource Guide.
- Fuel cost savings are based on prices of $2.25 per gallon for gasoline (mid-range) and $2.10 per gallon for diesel, as reported by AAA for the Raleigh-Durham area.

The analysis identifies an estimated annual reduction of passenger vehicle fuel use ranging from 613,752 gallons each year and heavy truck fuel savings of 107,512 gallons per year. Total forecasted fuel savings and emissions reductions are presented in Table B-15.

Table B-15. Fuel Consumption Savings and Emissions Reduction Benefits

	Fuel consumption (gallons)	CO_2 (short tons)	VOC (short tons)	NO_X (short tons)	PM (short tons)
Total savings over 30 years	5,849,677	57,963	58.7	75.3	3.4
Average annual savings over 30 years	194,989	1,932	2.0	2.5	0.1
Average Annual Value of Fuel Consumption / Emissions Savings	**$425,538**	**$134,197**	**$3,798**	**$19,222**	**$40,223**

Other Benefits

The following tangible benefits of the project have not been monetized in this analysis because sufficient data was not available to quantify their value:

- Benefits to local land values and economic development opportunities that will result from improved rail traffic flow.
- Benefits related to enhanced pedestrian and bicycle access and safety, including shifting of trips from passenger vehicles to non-motorized transport, resulting in reduced ADT as well as health benefits related to cycling and walking. A recent study on the economic benefits of investments in non-motorized transportation indicates that as much as 1% of local passenger vehicle traffic may be shifted to non-motorized transport modes, simply by providing adequate bicycle and pedestrian facilities realized as a consequence of WTSS.
- This could realize not only further benefits related to fuel consumption and air emissions as a result of reduced ADT, but could also realize tangible health care savings for the local community, estimated at $2.11 and $4.07 (in 2015 $) per mile of cycling and walking, respectively[21].

Project Costs

Project costs are projected from preliminary engineering cost estimates and right-of-way acquisition estimates prepared in 2011. Costs are escalated to 2015 (Base Year) dollars and spread by year to match anticipated delivery schedule assuming award of federal grant in September 2016. Previously incurred expenses (sunk costs) are not included in the analysis.

Table 6. Capital Cost Estimate (2017 $)

Project	Base Year Cost (in $M)
Fernside Curve Realignment	$3.0
Realign Curves Smith Creek Yard	$3.0
Tie and Surfacing	$6.0
Rehabilitate Bridges	$6.0
Wilmington Traffic Separation	$12.0
Total Project Cost	**$30.0**

[21] Litman, Todd, Evaluating Active Transport Benefits and Costs, Victoria Transport Policy Institute, 23 March 2016

BCA assumes that the project will be complete and all costs expended by 2018. Benefits will begin to accrue in 2019.

BCA Spreadsheet

The BCA Spreadsheet, provided under separate cover in native Excel format, includes the following worksheets:

Summary of Benefits & Costs

Project Statistics

Monetized Values

Travel Time Savings Emissions

Accident Reduction

Intersection Accident Stats

Fuel Cost Savings

C. Traffic Separation Study

As part of this report, Mott MacDonald was asked to review the Wilmington Traffic Separation Study (TSS), February 2017, to determine if any of the recommendations from that study would be beneficial for train movements to and from the port. Table 11 of the TSS report provides a listing of the specific recommendations. The TSS report primarily recommends a program of safety improvements for the crossings, along with a select few crossing closures. While these safety improvements are clearly beneficial to highway and rail traffic, there was no specific recommendation that would substantially improve mobility for highway traffic through the study area.

The TSS report recommendations are included in the Beltline Speed and Safety Improvements for safety and mobility improvements to the CSXT Beltline between Davis Yard near Leland through the Third Street at-grade crossing.

Table C-1: Wilmington TSS Cost Estimates

Milepost	Street Name	Recommendations	Estimated Construction Cost ($M)
ACB 244.25	King Street	Install flashers and gates; re-align King Street and improve crossing surface with rail seal	$0.85
ACB 244.97	SR 1302 (N. 23rd St.)	Improve crossing surface and install concrete median	$0.35
ACB 245.72	N. 30th St.	Install flashers and gates; improve crossing surface	$0.35
ACB 245.91	SR 1301 (Princess Place Dr.)	Install cantilevers, improve crossing surface and upgrade sidewalks at crossing	$0.50
ACB 245.98	Clay Street	Close at-grade crossing; construct new street connection between Henry and Clay Streets	$0.80
ACB 246.04	Henry Street	Upgrade signal system	$0.25
ACB 246.24	US 17 (Market St.)	Improve crossing surface and install concrete median	$0.35
ACB 247.28	Covil Avenue	Install cantilevers, improve crossing surface	$0.50
BELTLN 247.37	Mercer Ave.	Install gates	$0.35
ACB 247.65	Forest Hills Drive	Install gates	$0.35
ACB 247.79	Colonial Drive	Install gates	$0.35
ACB 248.04	SR 1411 (Wrightsville Ave.)	Improve crossing surface with rail seal, upgrade signal system	$0.695
ACB 248.41	US 76 (Oleander Dr.)	Upgrade signal system, install concrete median	$0.50
ACB 248.64	SR 1219 (S. 17th St.)	Improve crossing surface and upgrade sidewalks at crossing	$0.35
ACB 248.72	SR 1218 (S. 16th St.)	Improve crossing surface and upgrade sidewalks at crossing	$0.35
ACB 248.92	Marsteller Street	Improve crossing surface with rail seal, extend gate arms to ensure horizontal coverage	$0.80
BELTLN 248.95	S. 13th Street	Install gates	$0.25
ACB 249.03	S. 12th Street	Install flashers and gates	$0.25
ACB 249.19	S. 10th Street	Upgrade flashers and install gates, close Kidder Street at crossing.	$0.65
ACB 249.27	S. 9th Street	Close at-grade crossing; construct Kidder Street connection between 8th and 9th streets	$0.80
ACB 249.35	S. 8th Street	Install flashers and gates	$0.25
ACB 249.42	S. 7th Steet	Install flashers and gates	$0.25
Total			$10.145

Source: Wilmington Traffic Separation Study, February 2017

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D. Intermodal Yard Reconfiguration Options

Option 1 RMG

This option lays out the intermodal yard in approximately the same location as existing rail operations and is based on a concept developed by the Port for a 6,000-foot train. Working track lengths are extended to increase track length to 8,630 feet on 8 sidings. The intermodal yard located is east of the ENVIVA tracks (18A and 18B) and the transfer area is located east of the intermodal yard. Reach stackers would unload tractors in an operating area 50 feet wide into a stacking area 25 feet wide adjacent to the RMG, with a capacity of approximately 620 TEUs. Containers would be loaded onto the trains by RMGs from the stacking area.

Pros:

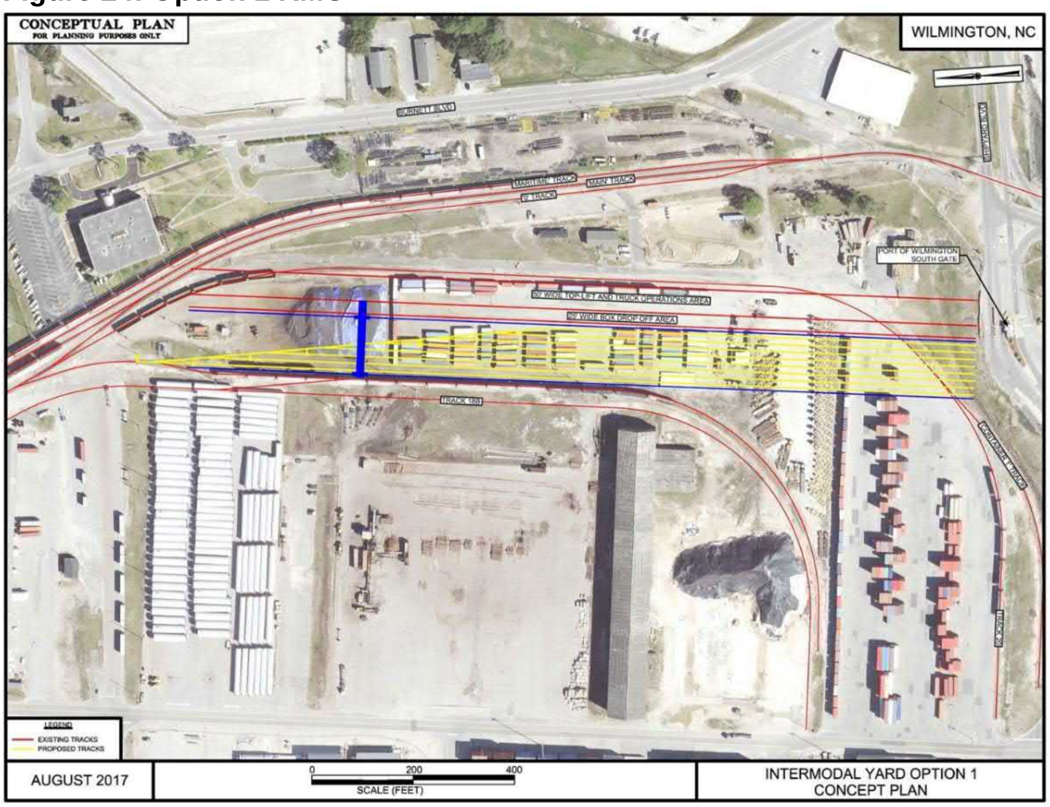
- Allows for future expansion south of yard, provided South Gate Access Road is realigned.
- All transfer operations are located on one side of the intermodal yard.
- Aligned with existing tracks 18A/B facilitating continued short term use, if needed.
- Not required to move the Ports America and 1st Seaman's buildings.

Cons:

- Does not accommodate a complete 10.0000-foot train.
- Unused space between the east side of intermodal yard and east terminal boundary.
- Mainline junction arrangement leaves a certain amount of unused space.
- The transfer area is located on the east side of the intermodal yard detached from the main container yard.
- Cannot add tracks to increase yard capacity if the South Gate is not realigned.

Costs: $53.9 M

Figure 24: Option 1 RMG



Option 2 RMG

This option is similar to Option 1, but the incoming mainline junction is optimized and the working tracks are moved east to allow for the transfer area to be located west of the intermodal yard. This option also provides 8,880 feet of working track on 8 sidings. Operations are similar to Option 1, with the transfer area west of the yard. This will allow for slightly shorter distance for tractors delivering containers to the intermodal yard.

Pros:

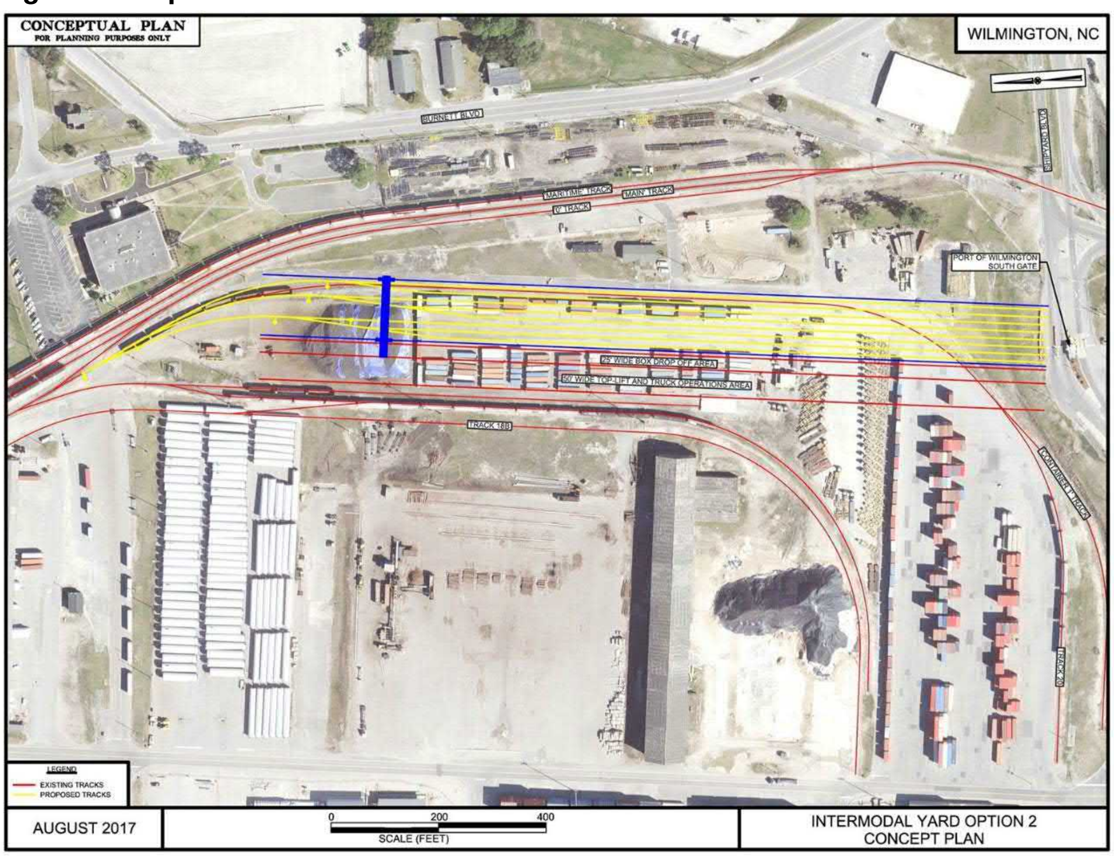
- Allows for future expansion south of the yard, provided the South Gate Access Road is realigned.
- Allows for limited future expansion south of the yard, without the South Gate Access Road being realigned.
- Better efficiency with transfer operations located on the terminal side of the intermodal yard, west of the intermodal yard.
- Aligned with existing tracks 18A/B facilitating their continued use in the short term, if needed.
- Not required to move the Ports America and 1st Seaman's buildings.

Cons:

- Does not accommodate a complete 10.0000-foot train.
- Unused space between the east side of the intermodal yard and the east boundary of the terminal.
- Unless allowed for, cannot add tracks to increase yard capacity if the South Gate is not realigned.

Costs: $44.5 M

Figure 25: Option 2 RMG



Option 3 RMG

This option realigns and moves the intermodal yard east to minimize the unused space at the east boundary of the Port. Additionally, realignment of the tracks provides the space to construct 10,000 feet of track on 8 sidings. The mainline junction arrangement is also optimized. Operations are similar to Option 2, with the transfer area located on the west side of the intermodal yard.

Pros:

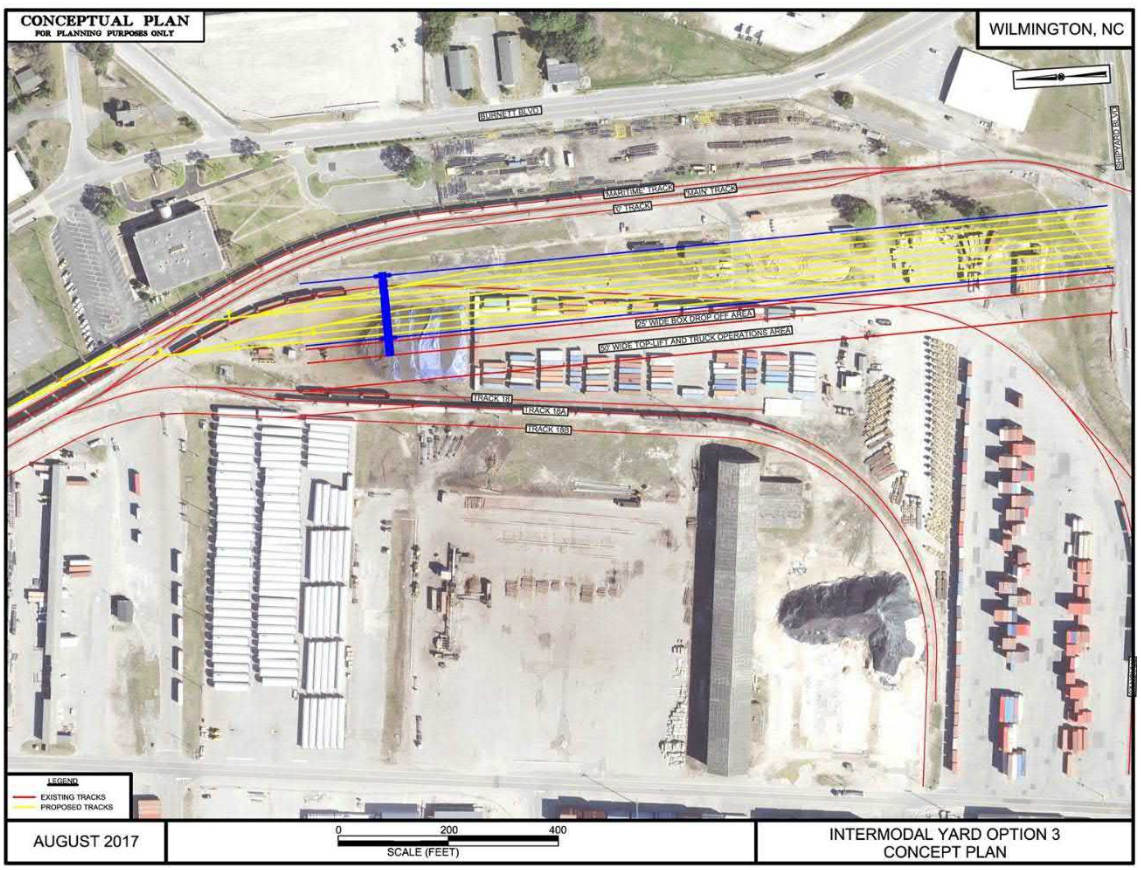
- Provides sufficient track to accommodate a complete 10,000-foot train.
- Minimizes unused space on the east boundary of the Port.
- Maximizes container terminal yard area.
- Better efficiency with transfer operations located on the terminal side of the intermodal yard, west of the intermodal yard.
- Separated from existing tracks 18A/B facilitating their continued use in the short term if needed.

Cons:

- Future extension of the intermodal yard is limited due to conflicts with the Shipyard Boulevard intersection and the main rail line.
- Required to move the Ports America and 1st Seaman's buildings.

Costs: $43.1 M

Figure 26: Option 3 RMG



Option 4 RMG

This option is similar to Option 2, with two sidings removed and the working tracks extended in length on the basis that the south gate is realigned from the start. 10,000 feet of working track is provided on 7 sidings. This allows for a narrower gauge RMG and improves efficiency of the rail operations. Operations are similar to Option 2 with the transfer area west of the intermodal yard.

Pros:

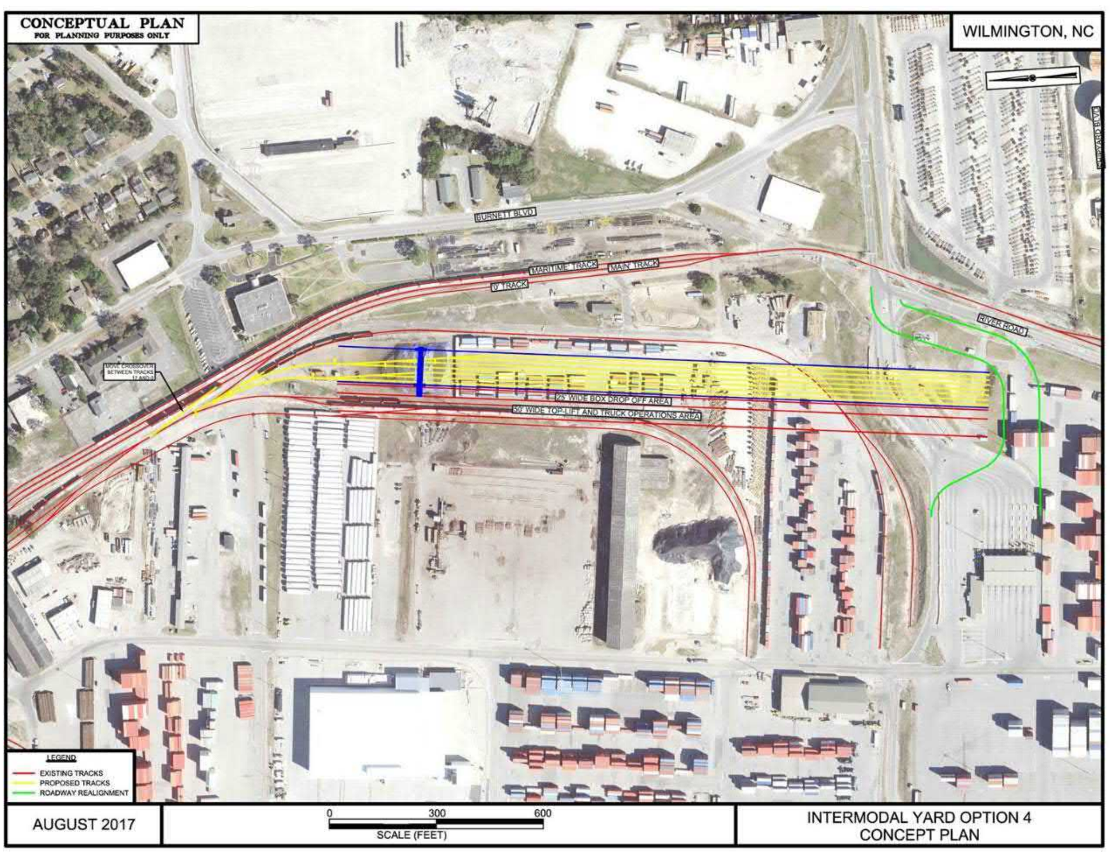
- Provides sufficient track to accommodate a complete 10,000-foot train.
- Fewer sidings - improved efficiency of train operations and allows a narrower RMG span - greater efficiency in rail and RMG operations.
- Better efficiency with transfer operations located on the terminal side of the intermodal yard, west of the intermodal yard.
- Aligned with existing tracks 18A/B facilitating their continued use in the short term if needed.
- Not required to move the Ports America and 1st Seaman's buildings.

Cons:

- Unused space between the east side of the intermodal yard and the east boundary of the terminal.
- Requires realignment of south gate access road from the start.
- Future extension of the intermodal yard is limited unless the south gate entrance is moved further South.

Costs: $38.4M

Figure 27: Option 4 RMG



Option 5 Reach Stacker

This option provides 5,600 feet of working track on 4 sidings. The working tracks are aligned with the east boundary of the Port, with the transfer area is west of the intermodal yard. A 53-foot buffer area for reach stacker operations and a 50-foot stacking area to stage containers is provided. Operations for reach stacker options include tractors delivering the containers to the transfer area and unloaded by reach stackers into a staging area, or directly onto a train. Reach stackers load the train from the staging area or directly from tractors. In this option, reach stackers will be limited to loading the eastern two tracks prior to rail cars being moved into the western two working tracks.

Pros:

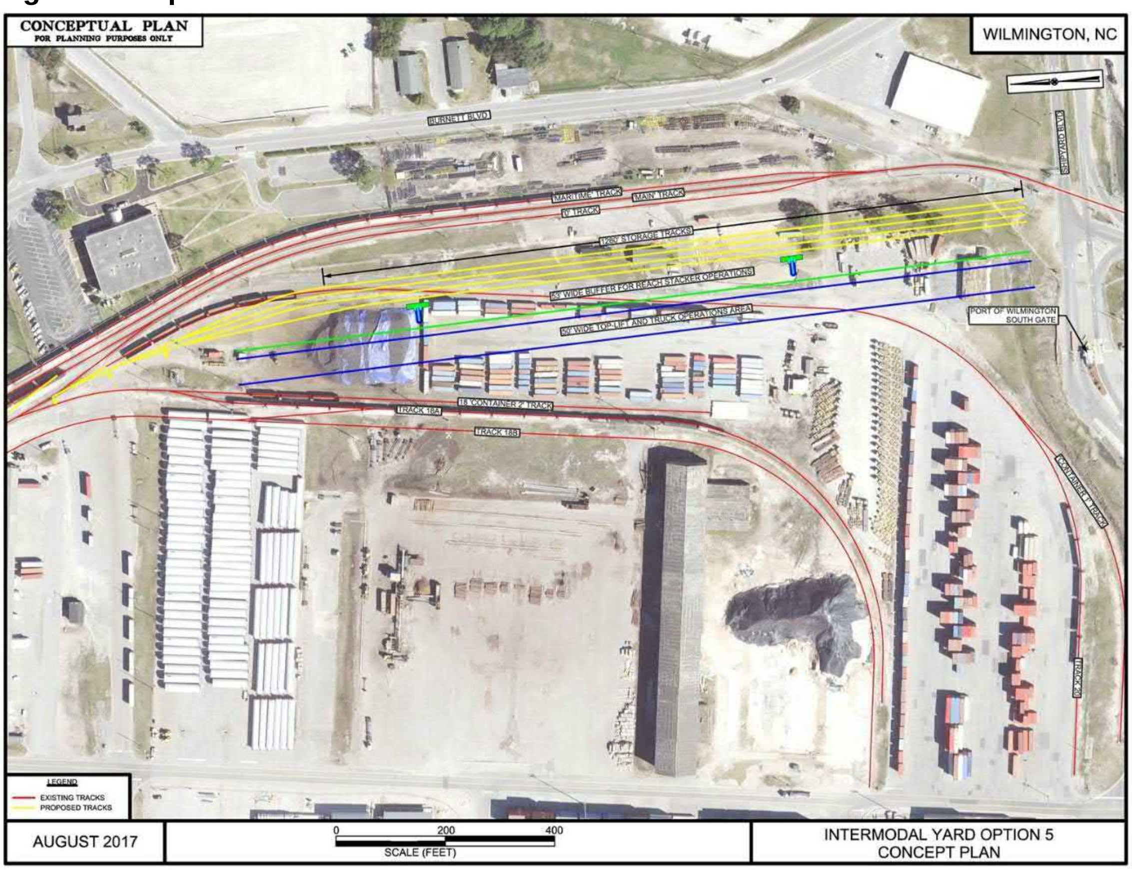
- Minimizes unused space at the east boundary of the Port.
- Better efficiency with transfer operations located on the terminal side of the intermodal yard, west of the intermodal yard.
- Allows for a potential pull thru operation, where trains can connect to the mainline from the South.
- Allows for conversion to RMG operations in the future.

Cons:

- Reach stackers will be limited in loading/unloading two East tracks prior to the West tracks.
- Required to move the Ports America and 1st Seaman's buildings.

Costs: $16.5 M

Figure 28: Option 5 Reach Stacker



Option 6 Reach Stacker

This option provides 5,000 feet of working track on 4 sidings. The intermodal yard is separated into two sets of two tracks, with the transfer area located between the tracks. This requires the addition of an additional 53-foot reach stacker buffer area, with reach stacker operations on both side of the staging area. This allows for 5,000 feet of train to move into the yard and the reach stackers to load the trains simultaneously. Tractors delivering containers to the staging area would be required arrive at the correct side of the stacking area.

Pros:

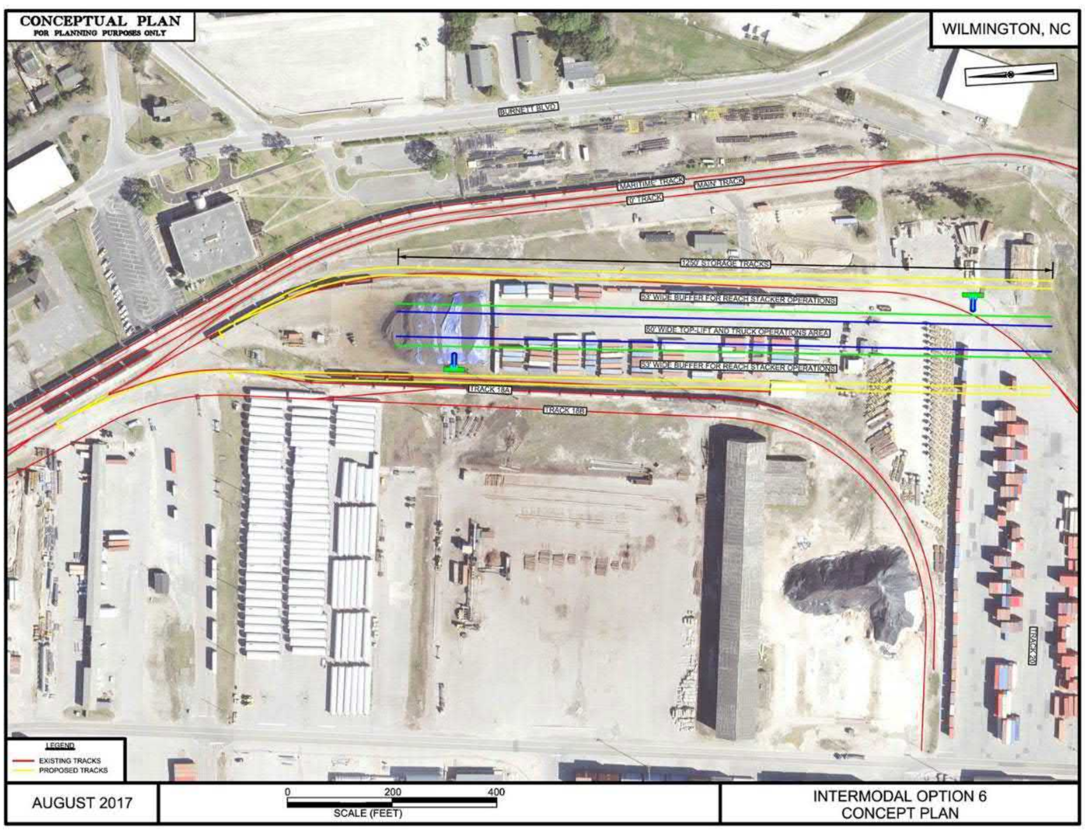
- Allows for all working tracks to be occupied during operations.
- Not required to move the Ports America and 1st Seaman's buildings.
- Potential to integrate with tracks 18A/B in the short term.

Cons:

- Potential congestion in the transfer area.
- Not as efficient with transfer area separated from the main terminal.
- Unused space between the east side of the intermodal yard and the East boundary of the terminal.
- Limited ability to convert to RMG operations in the future.

Costs: $17.7 M

Figure 29: Option 6 Reach Stacker



Option 7 Reach Stacker

This option provides 5,000 feet of working track on 4 sidings. Transfer areas are located on both the east and west side of the intermodal yard. Reach stackers will work both sides of the intermodal yard with separate staging areas on each side of the yard. Tractors will be required to deliver containers to the appropriate staging area.

Pros:

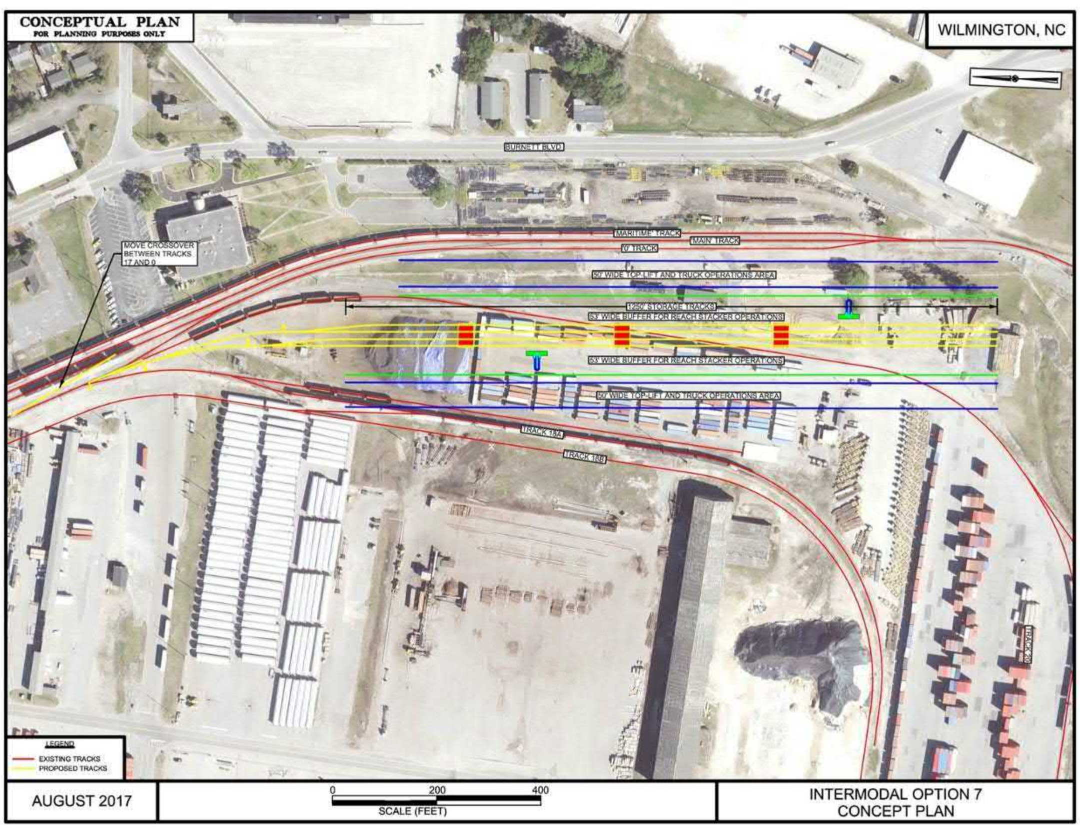
- Allows for all working tracks to be occupied during operations.
- Reduces potential congestion in the transfer area.
- Allows for conversion to RMG operations in the future.
- Allows for future expansion south of the yard, provided the South Gate Access Road is realigned.
- Minimizes unused space between the east side of the intermodal yard and the east boundary of the terminal.

Cons:

- Required to move the Ports America and 1st Seaman's buildings.
- Slightly less efficient use of space with two separate transfer areas.
- West transfer area slightly restricted at North End by ongoing use of tracks 18A/B if needed in the short term.

Costs: $18.8M

Figure 30: Option 7 Reach Stacker



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E. Maps

Fig 01 – Vicinity Map.pdf

Fig 10 – Fernside.pdf

Fig 11 – Curve Improvement at Old Smith Creek Yard.pdf

Fig 12 – CSXT Beltline Speed and Safety Improvements.pdf

Fig 13 - Overview of Improvements Third Street to Port.pdf

Fig 14 - Improvements at North Gate- Wood Yard- West.pdf

Fig 15 - Improvements at North Gate - Wood Yard- East.pdf

Fig 16 - Improvements at South Gate- Engine Run-Around.pdf

Fig 17 - Front Street Improvements.pdf

Fig 22 - Option 7 Reach Stacker.pdf

Fig 23 - Option 1 RMG.pdf

Fig 24 - Option 2 RMG.pdf

Fig 25 - Option 3 RMG.pdf

Fig 26 - Option 4 RMG.pdf

Fig 27 - Option 5 Reach Stacker.pdf

Fig 28 - Option 6 Reach Stacker.pdf

Fig 29 - Option 7 Reach Stacker.pdf

5.2.1 Rehab Track 1.pdf

5.2.2 Rehab Track 18.pdf

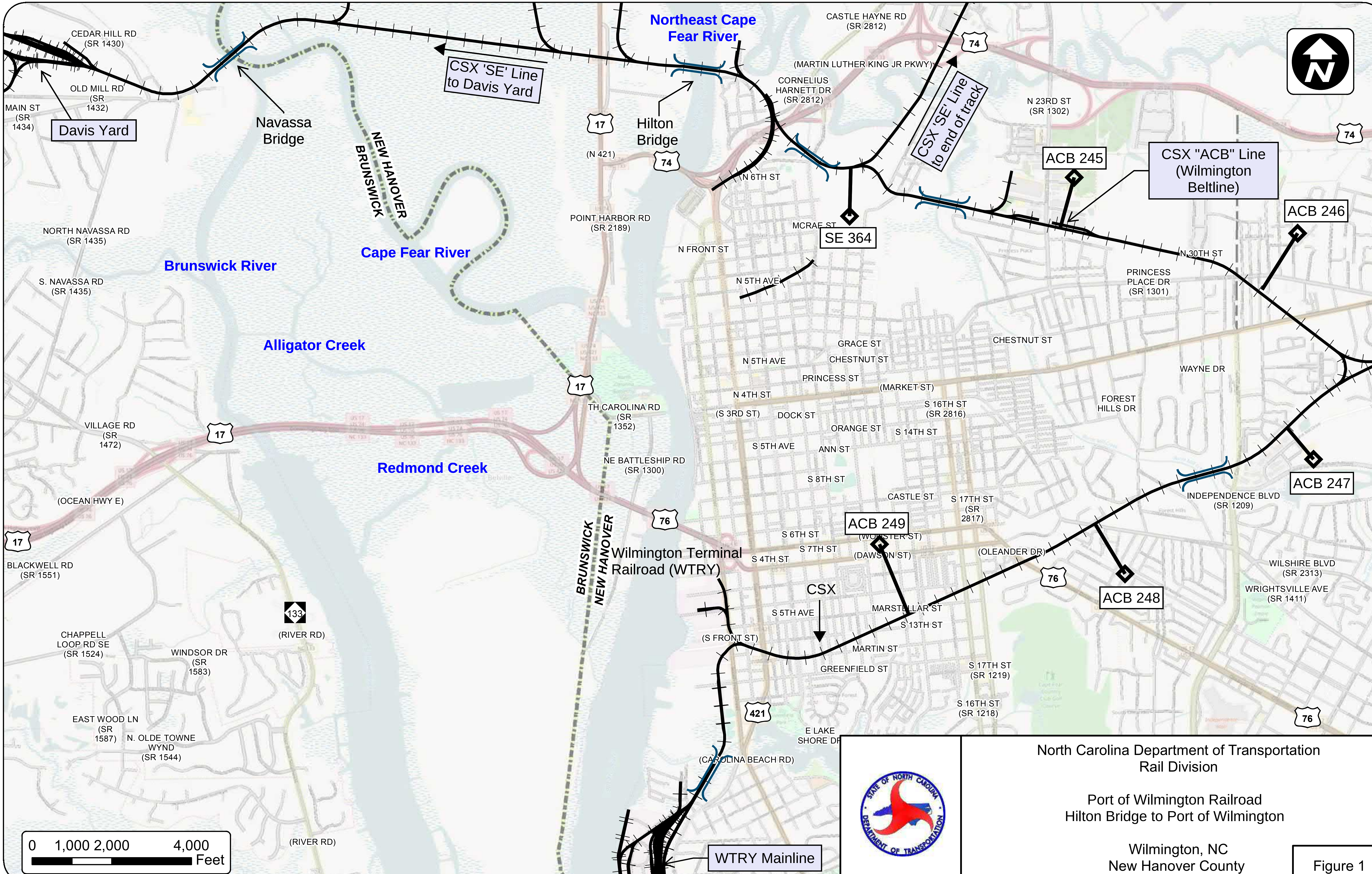
5.2.3 Rehab 3rd St to Port Lead Switch.pdf

5.2.4 Rehab Main from Port Lead to Ship Yard.pdf

5.2.5 Rehab Maritime Siding.pdf

5.2.6 Rehab 0 Track.pdf

5.2.7 Rehab Wood Siding Track.pdf



North Carolina Department of Transportation
Rail Division

Port of Wilmington Railroad
Hilton Bridge to Port of Wilmington

Wilmington, NC
New Hanover County

Figure 1


MARITIME MAIN
CONTAINER
ENVIVA STORAGE
0 200 400
SCALE (FEET)
DATE PRINTED 05-04-2017
TRANSMITTED BY PHILLIP DAVIES
SCALE 1"=200' @ 22x34
PORT OF WILMINGTON
EXISTING TRACK CONFIGURATION

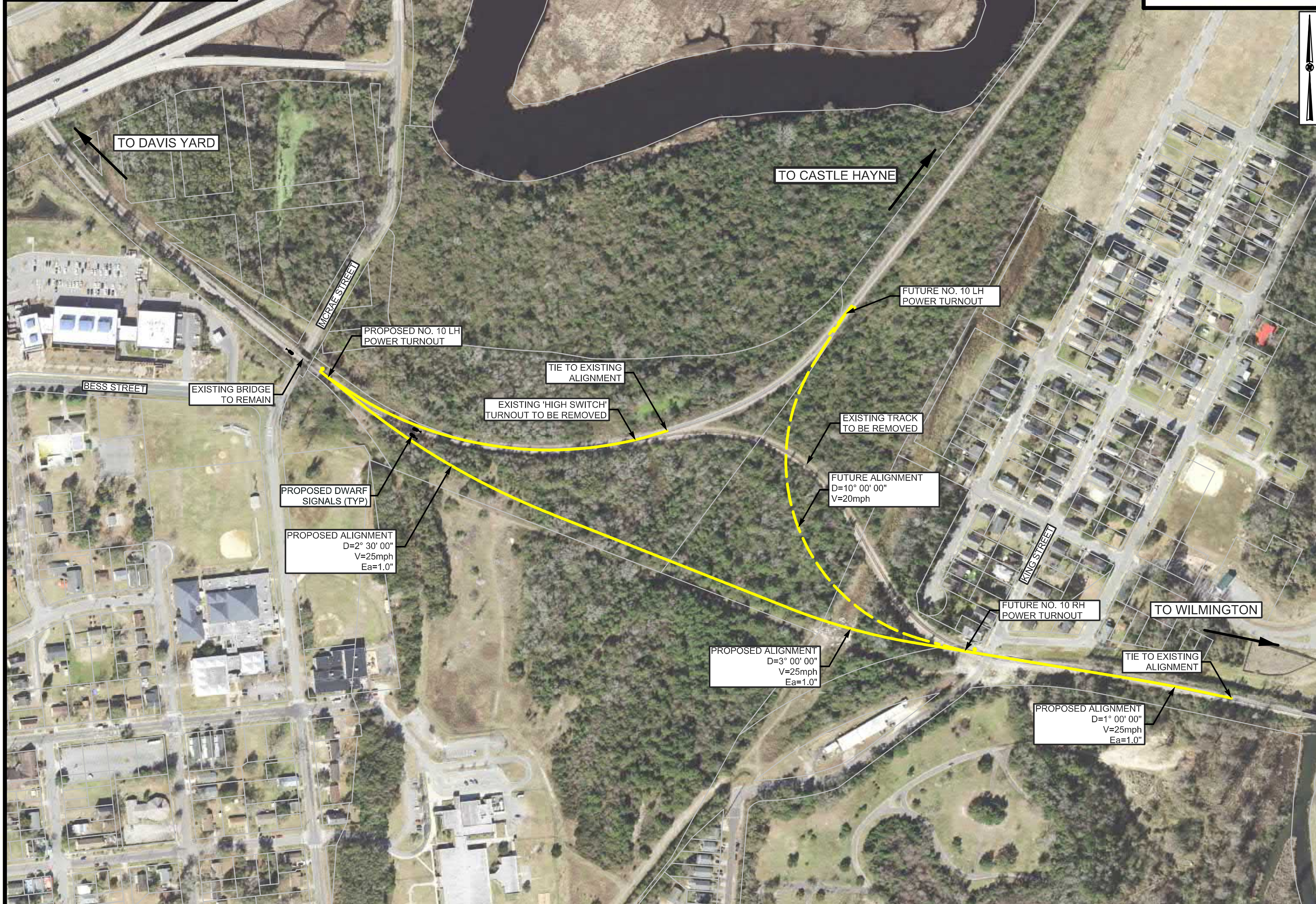
AUGUST 2017

0 400 800
SCALE (FEET)

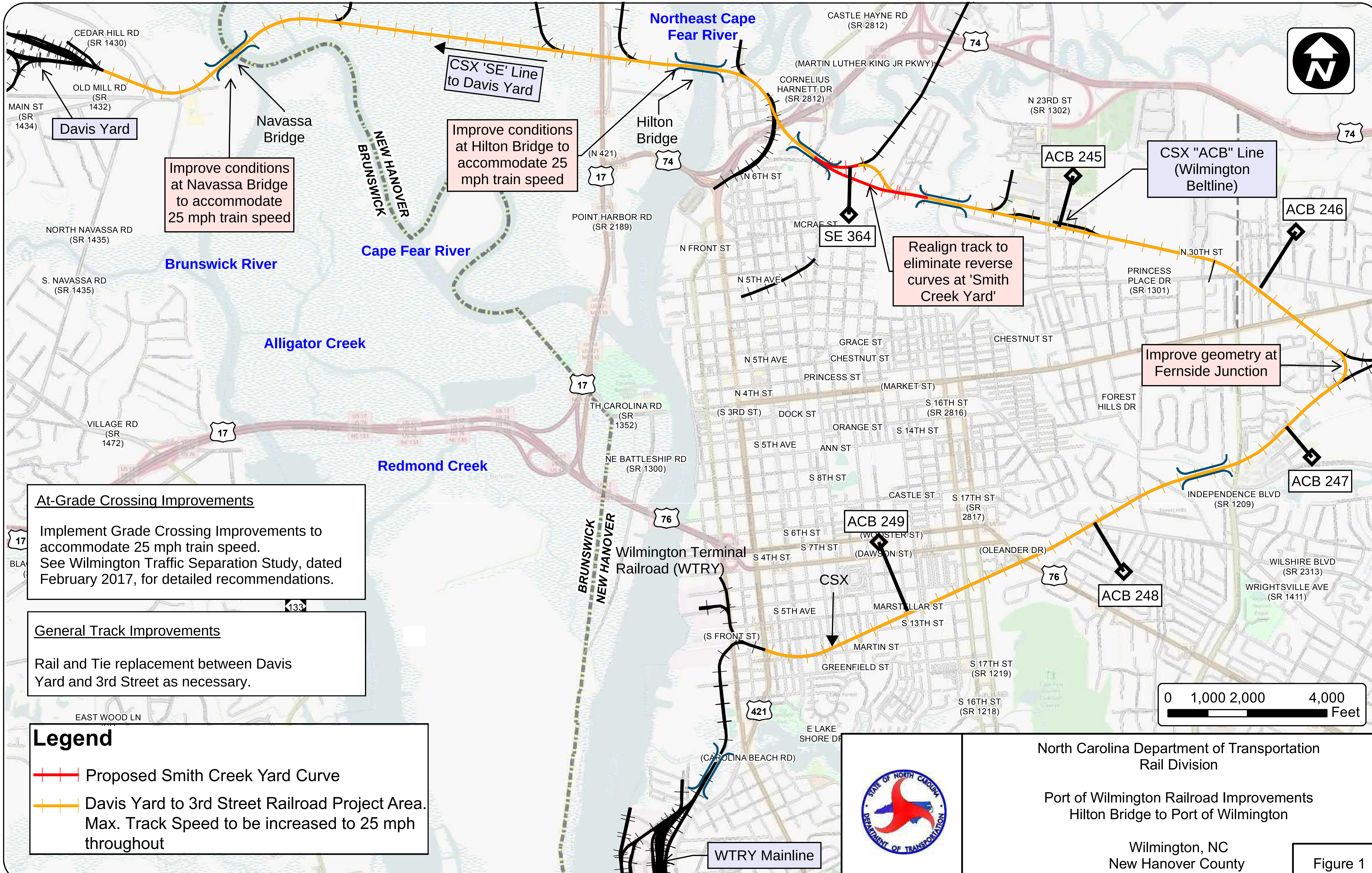
FERNSIDE JUNCTION IMPROVEMENT
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC



AUGUST 2017	0 — 400 — 800 SCALE (FEET)	CURVE IMPROVEMENT AT OLD SMITH CREEK YARD CONCEPT PLAN



Northeast Cape Fear River
CSX 'SE' Line to Davis Yard
Hilton Bridge
Improve conditions at Hilton Bridge to accommodate 25 mph train speed
Navassa Bridge
Improve conditions at Navassa Bridge to accommodate 25 mph train speed
Davis Yard
CEDAR HILL RD (SR 1430)
OLD MILL RD (SR 1432)
MAIN ST (SR 1434)
NORTH NAVASSA RD (SR 1435)
S. NAVASSA RD (SR 1435)
VILLAGE RD (SR 1472)
EAST WOOD LN
Brunswick River
Cape Fear River
Alligator Creek
Redmond Creek
NEW HANOVER
BRUNSWICK
CASTLE HAYNE RD (SR 2812)
(MARTIN LUTHER KING JR PKWY)
CORNELIUS HARNETT DR (SR 2812)
N 23RD ST (SR 1302)
ACB 245
CSX "ACB" Line (Wilmington Beltline)
ACB 246
N 30TH ST
PRINCESS PLACE DR (SR 1301)
SE 364
Realign track to eliminate reverse curves at 'Smith Creek Yard'
N 6TH ST
MCRAE ST
N FRONT ST
N 5TH AVE
POINT HARBOR RD (SR 2189)
(N 421)
Improve geometry at Fernside Junction
CHESTNUT ST
GRACE ST
PRINCESS ST
(MARKET ST)
N 4TH ST
(S 3RD ST)
DOCK ST
ORANGE ST
S 16TH ST (SR 2816)
S 14TH ST
FOREST HILLS DR
S 5TH AVE
ANN ST
S 8TH ST
CASTLE ST
S 17TH ST (SR 2817)
INDEPENDENCE BLVD (SR 1209)
ACB 247
TH CAROLINA RD (SR 1352)
NE BATTLESHIP RD (SR 1300)
ACB 249
S 6TH ST
S 7TH ST
(WOOSTER ST)
(DAWSON ST)
(OLEANDER DR)
S 4TH ST
Wilmington Terminal Railroad (WTRY)
CSX
ACB 248
WILSHIRE BLVD (SR 2313)
WRIGHTSVILLE AVE (SR 1411)
MARSTELLAR ST
S 13TH ST
(S FRONT ST)
MARTIN ST
GREENFIELD ST
S 17TH ST (SR 1219)
S 16TH ST (SR 1218)
E LAKE SHORE DR
(CAROLINA BEACH RD)
WTRY Mainline
0 1,000 2,000 4,000 Feet
At-Grade Crossing Improvements
Implement Grade Crossing Improvements to accommodate 25 mph train speed.
See Wilmington Traffic Separation Study, dated February 2017, for detailed recommendations.
General Track Improvements
Rail and Tie replacement between Davis Yard and 3rd Street as necessary.
Legend
Proposed Smith Creek Yard Curve
Davis Yard to 3rd Street Railroad Project Area. Max. Track Speed to be increased to 25 mph throughout
North Carolina Department of Transportation
Rail Division
Port of Wilmington Railroad Improvements
Hilton Bridge to Port of Wilmington
Wilmington, NC
New Hanover County

Figure 1


Greenfield Lake
South Wilmington Heights
Lakeside Park
Woodlawn
Pinecrest Terrace
Summer Hills
Summer Oaks
Sunset South
Rehab Main 3rd Street to
Port Lead Switch (Brown)
Rehab Main - Port Lead Switch
thru Shipyard Blvd.(Yellow)
Rehab Maritime
Siding (Green)
Rehab Main - Port Lead Switch
thru Shipyard Blvd. (Yellow)
Rehab 0 Track (Red)
Rehab Tk. 18 a.k.a.
Container 2 (Magenta)
Rehab Tk. 20 a.k.a.
Container 1 (Blue)
© 2017 Google
Google Earth

AUGUST 2017	0 400 800 SCALE (FEET)	WOOD YARD WEST CONCEPT PLAN

AUGUST 2017

0 400 800
SCALE (FEET)

WOOD YARD EAST
CONCEPT PLAN

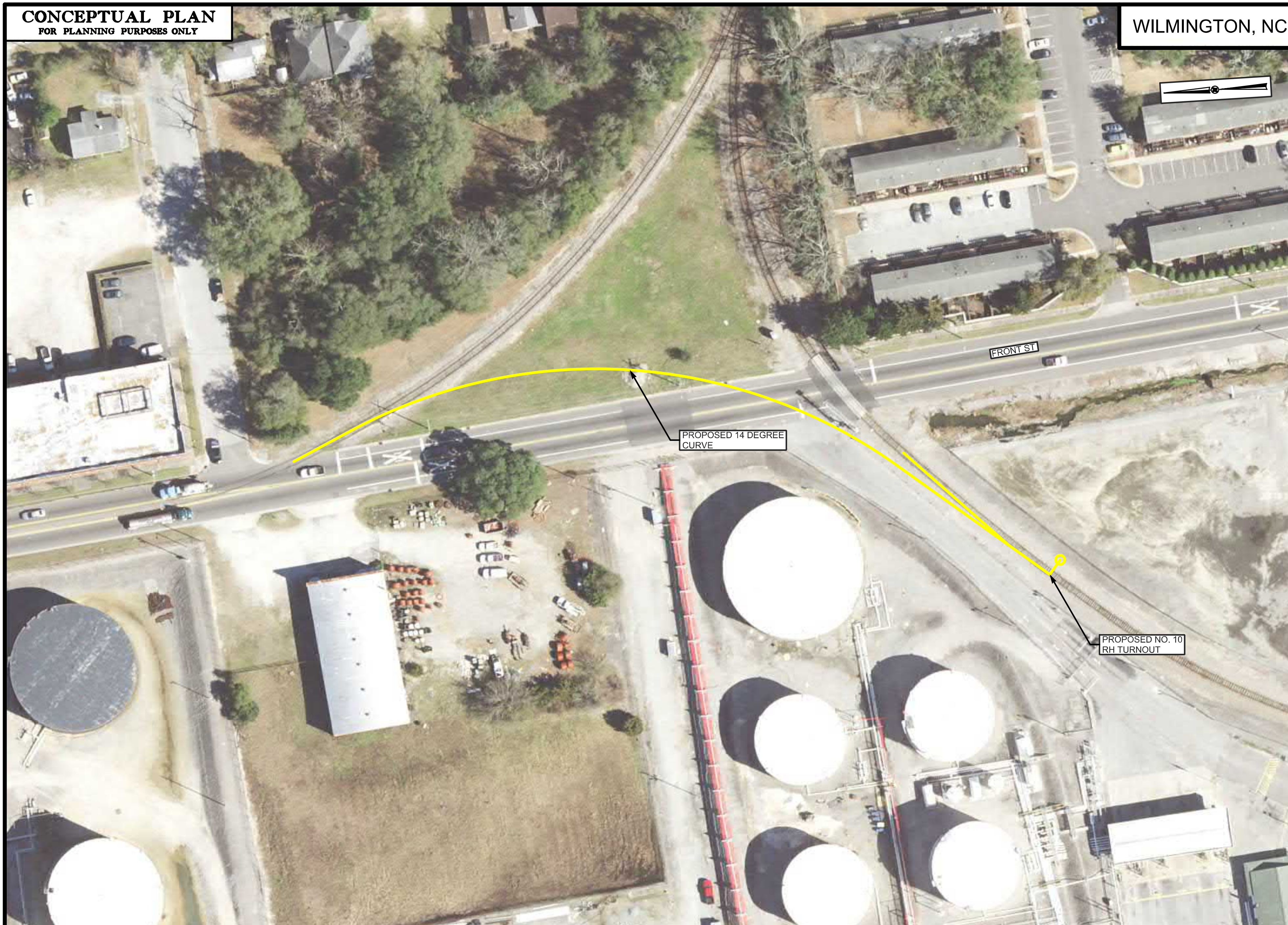
CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC

AUGUST 2017	0 100 200 SCALE (FEET)	ENGINE RUN-AROUND SOUTH END CONCEPT PLAN

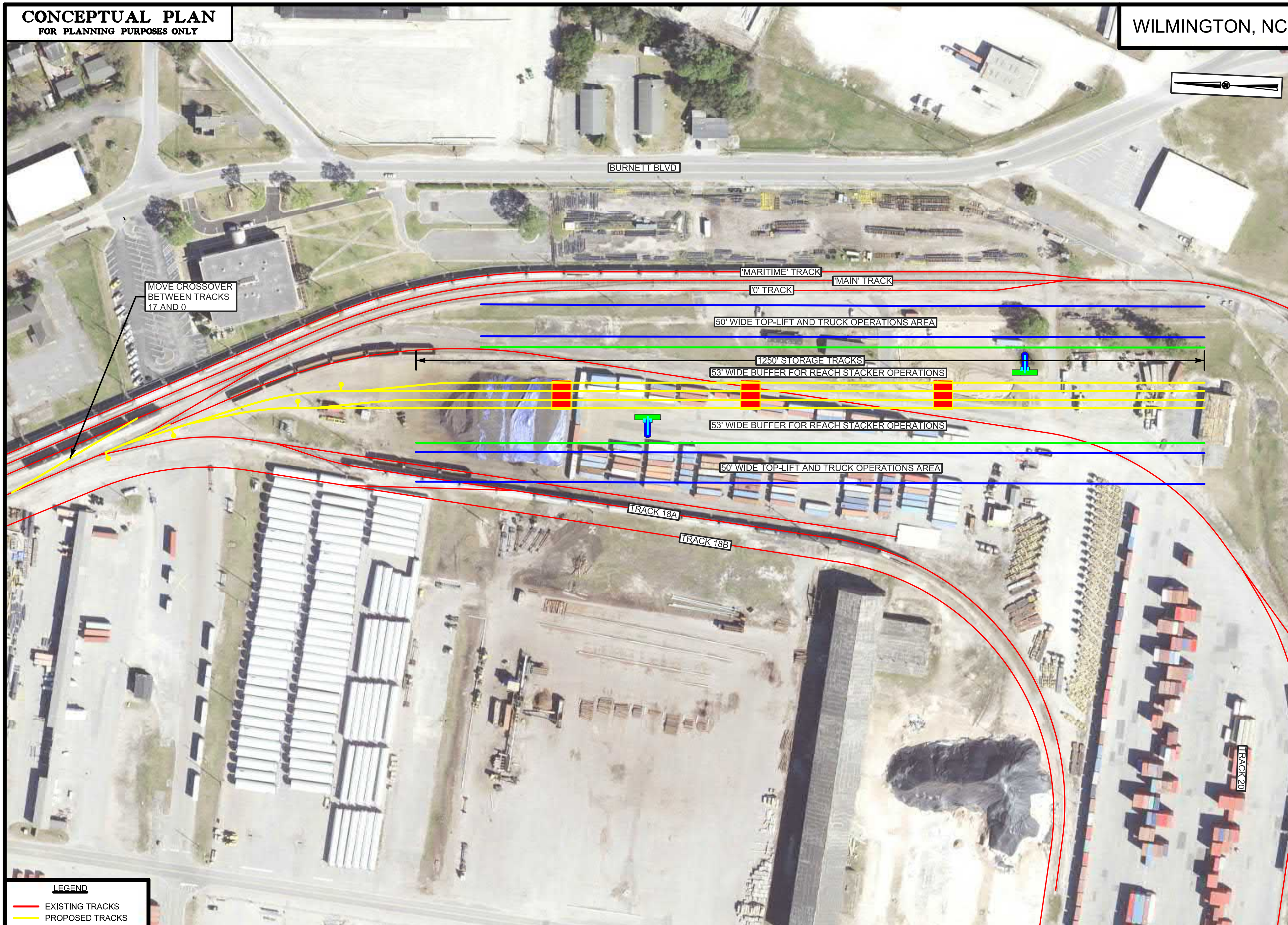
CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC

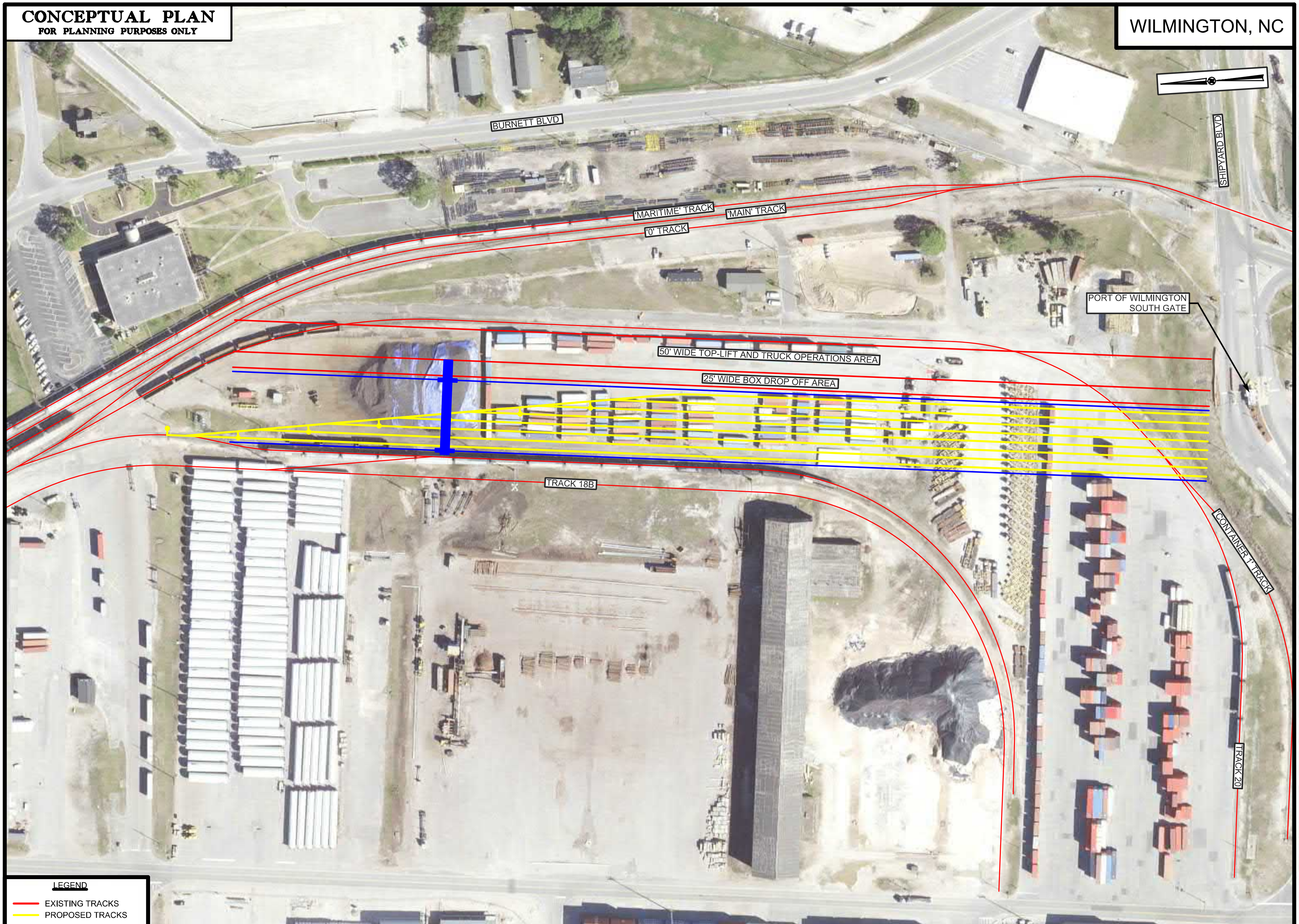


AUGUST 2017

REALIGN CURVE AND FRONT ST TURNOUT
CONCEPT PLAN



AUGUST 2017	0 200 400 SCALE (FEET)	INTERMODAL OPTION 7 CONCEPT PLAN



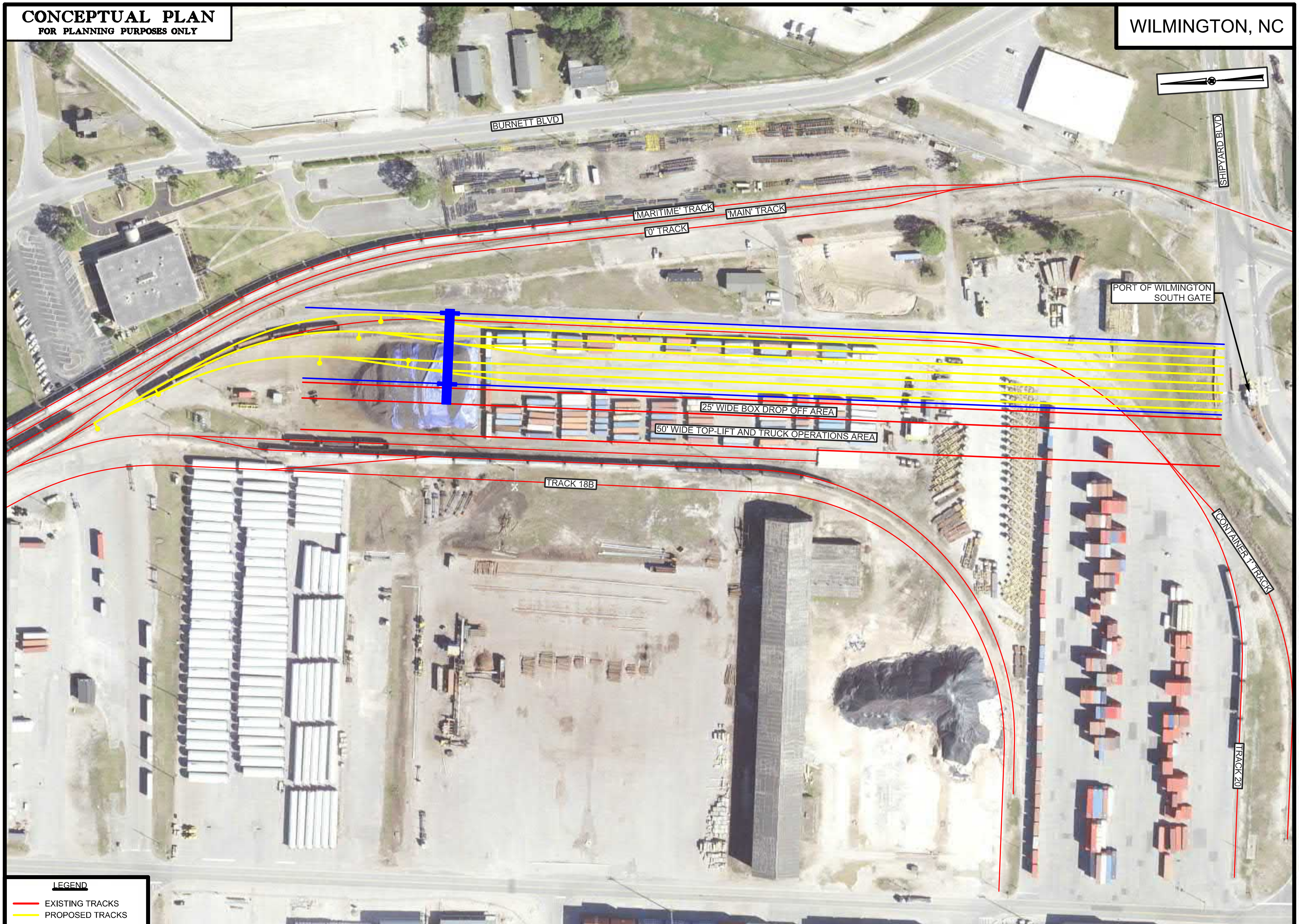
AUGUST 2017

0 200 400
SCALE (FEET)

INTERMODAL YARD OPTION 1
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC

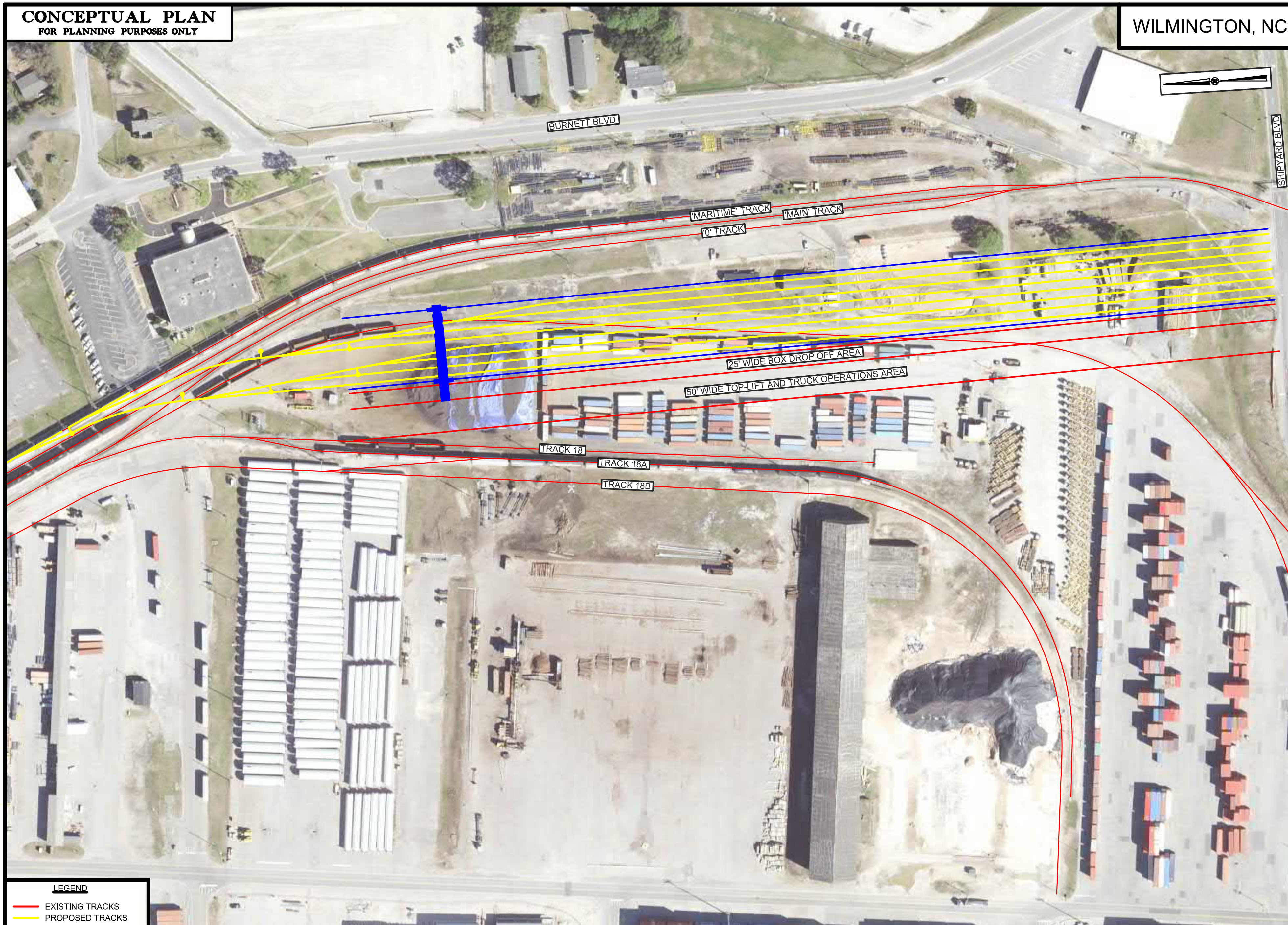


AUGUST 2017

INTERMODAL YARD OPTION 2
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC



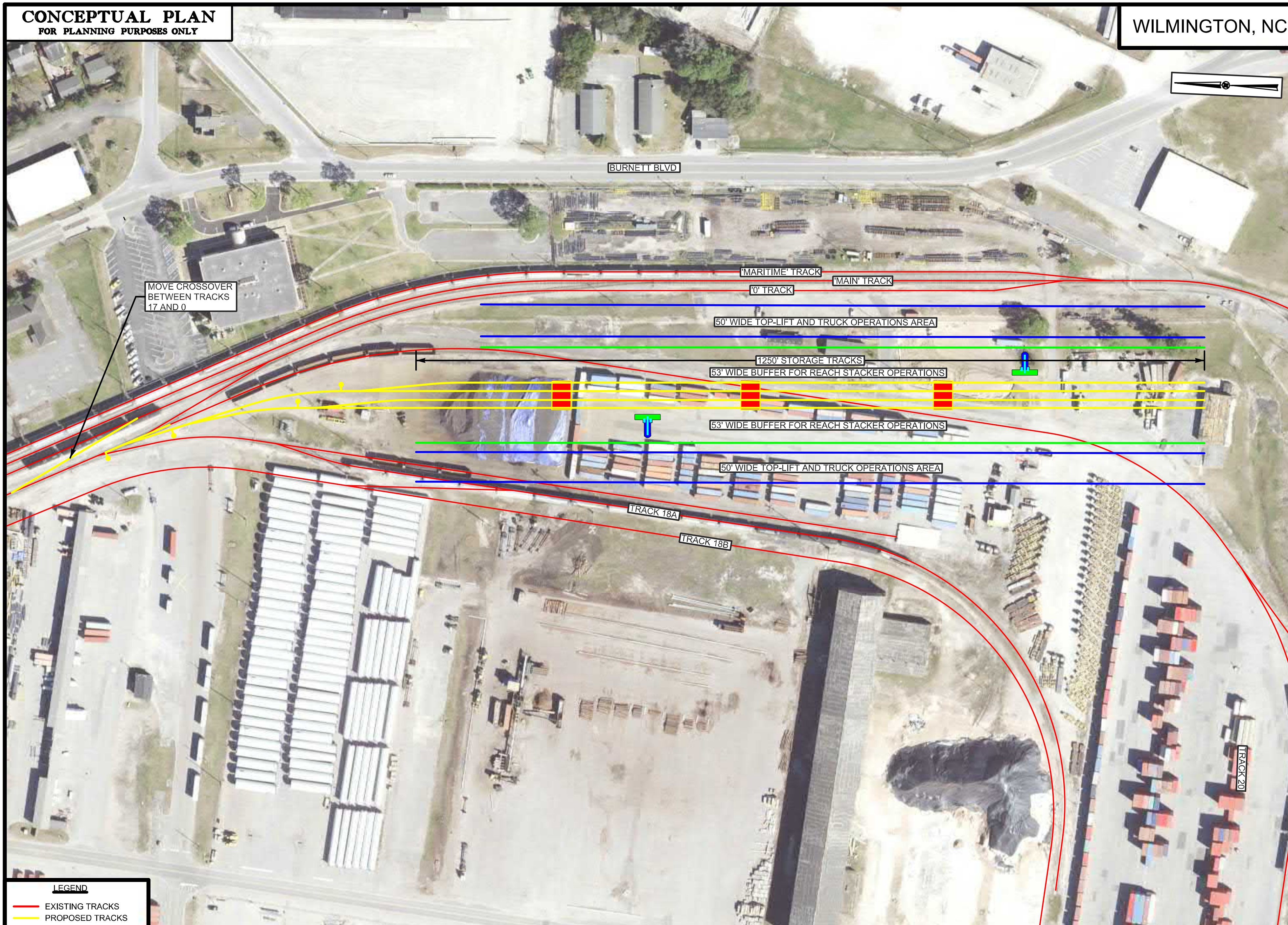
AUGUST 2017

0 200 400
SCALE (FEET)

INTERMODAL YARD OPTION 3
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC



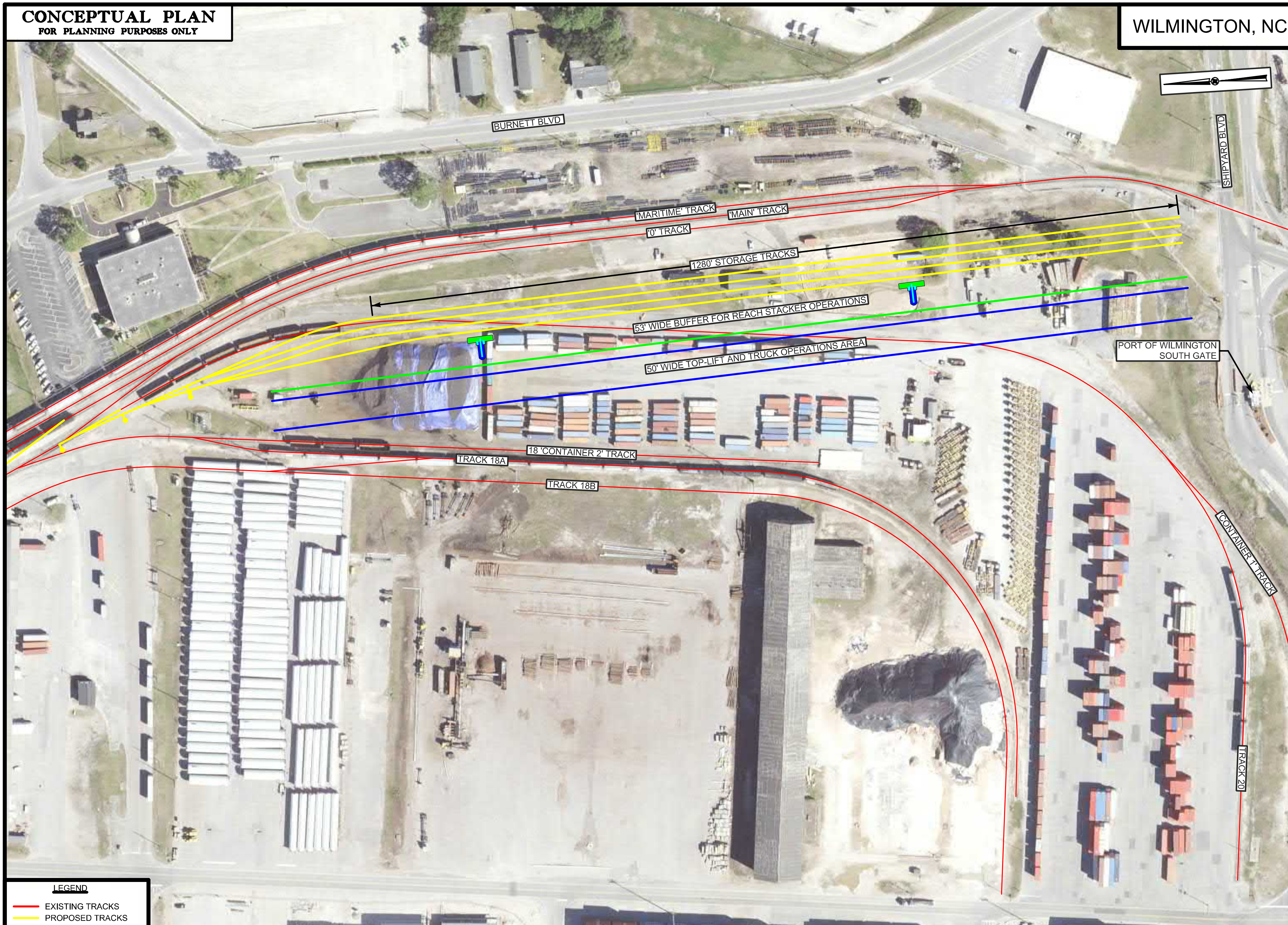
AUGUST 2017

0 200 400
SCALE (FEET)

INTERMODAL OPTION 7
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

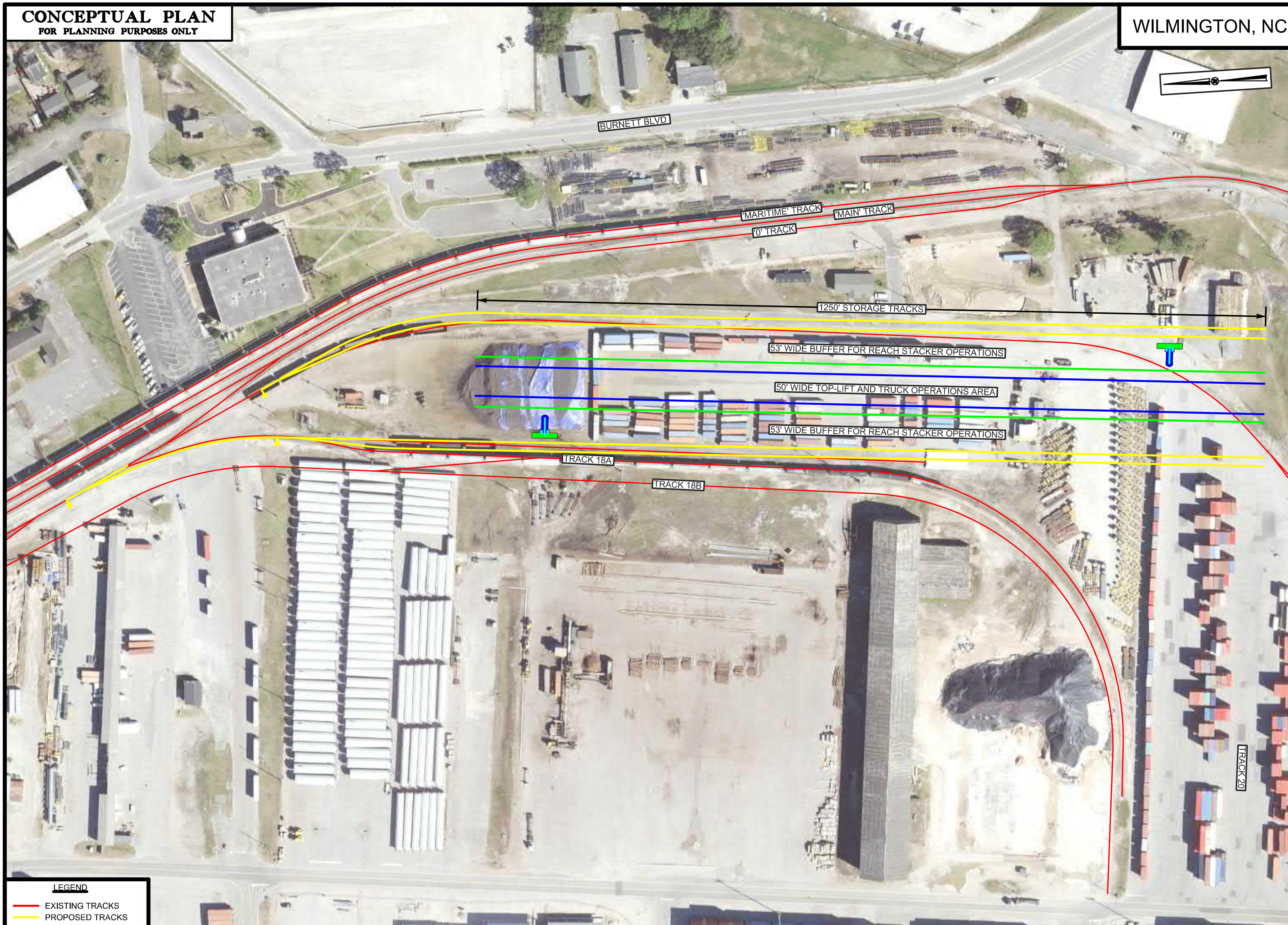
WILMINGTON, NC



AUGUST 2017

0 200 400
SCALE (FEET)

INTERMODAL YARD OPTION 5
CONCEPT PLAN



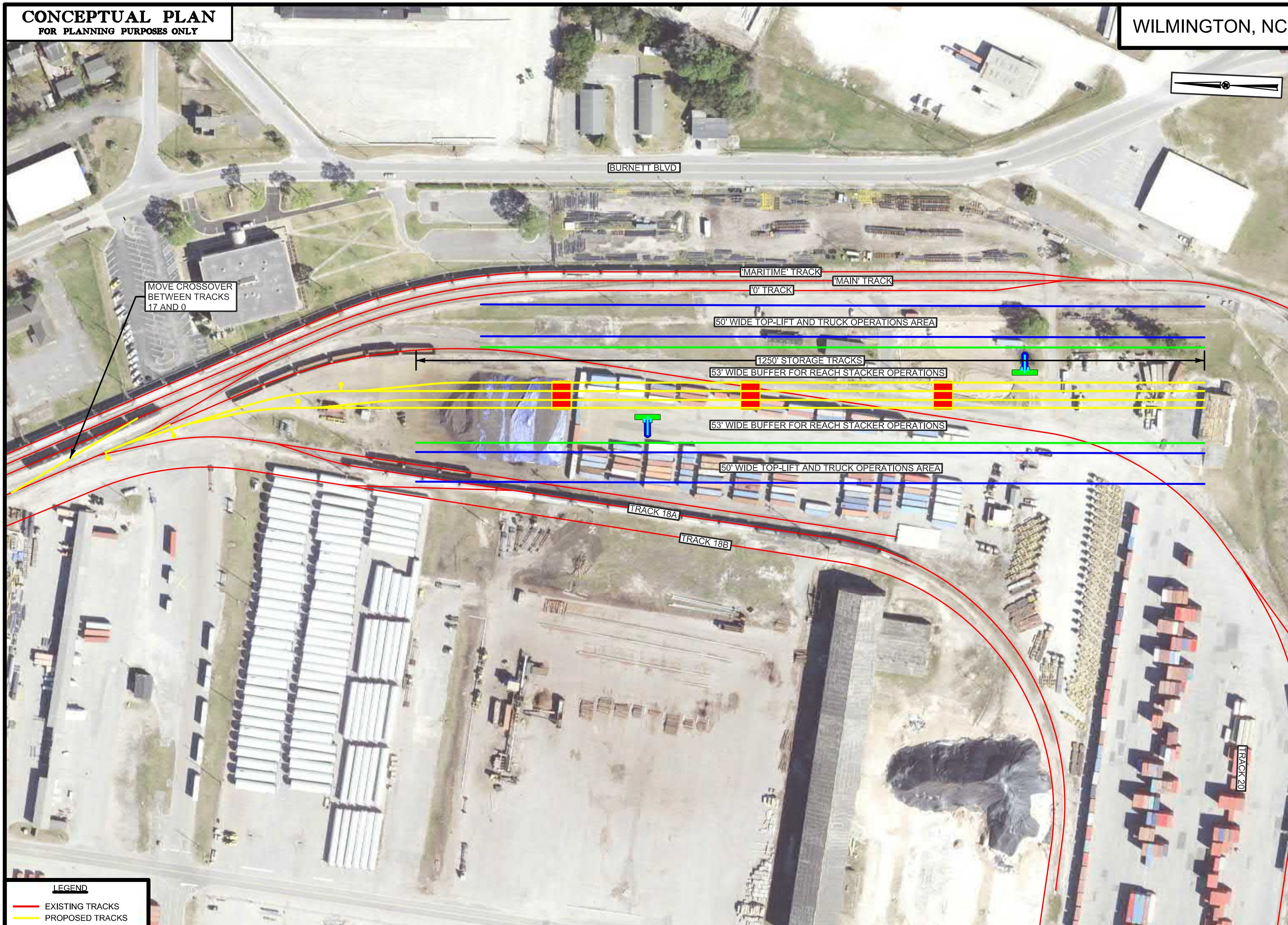
AUGUST 2017

0 200 400
SCALE (FEET)

INTERMODAL OPTION 6
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC

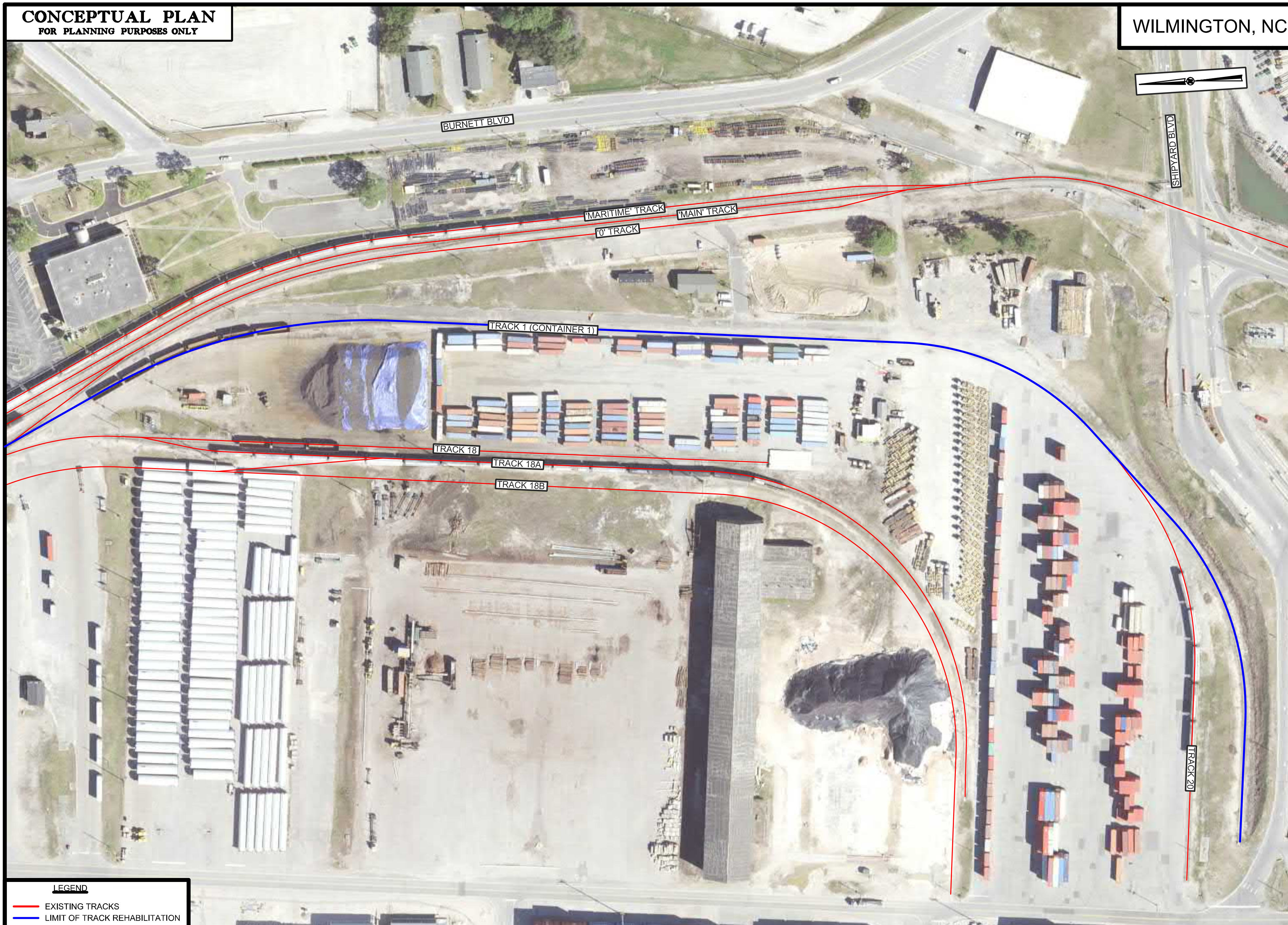


AUGUST 2017

INTERMODAL OPTION 7
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC

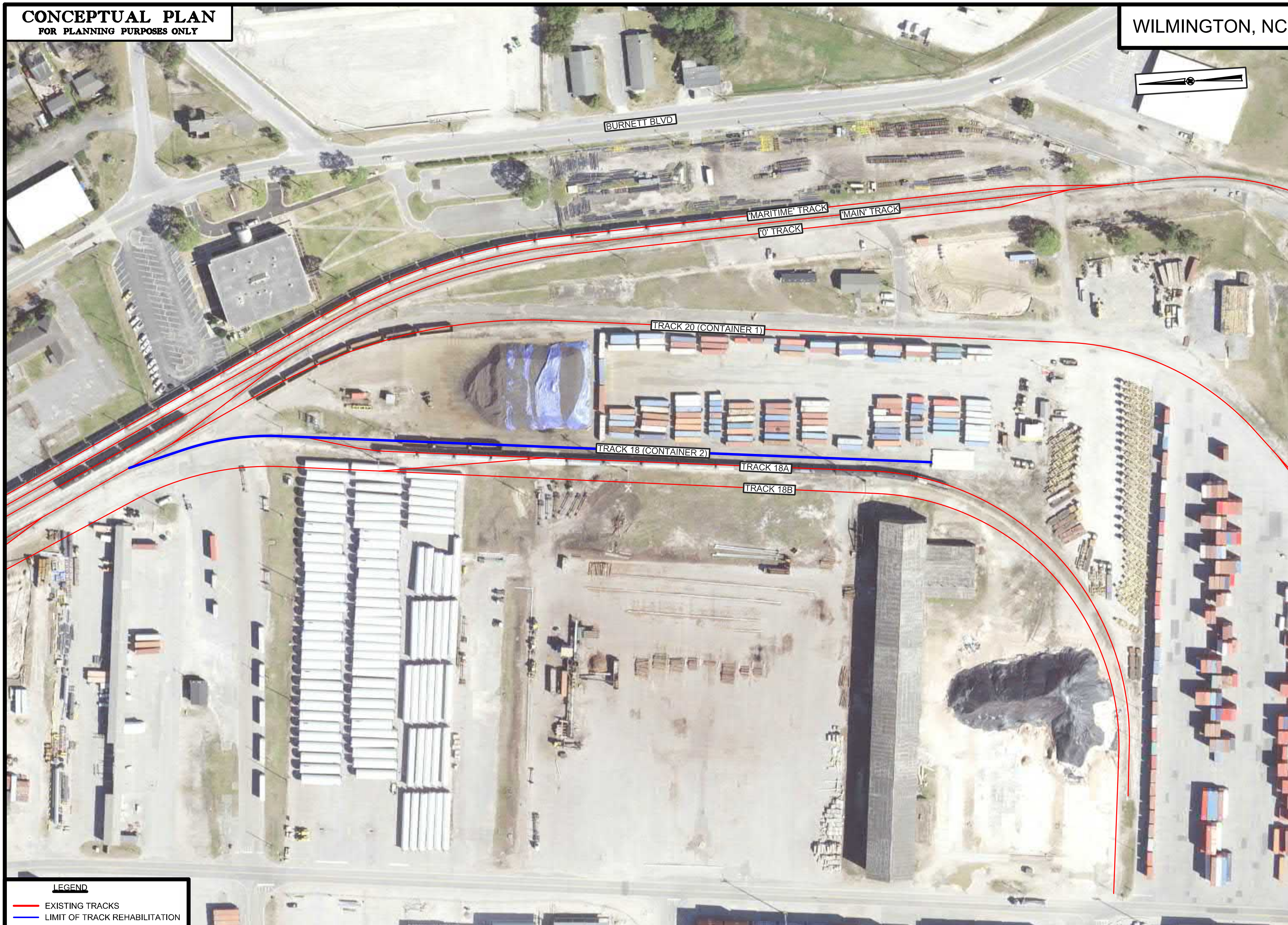


AUGUST 2017

REHABILITATE TRACK 1
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC

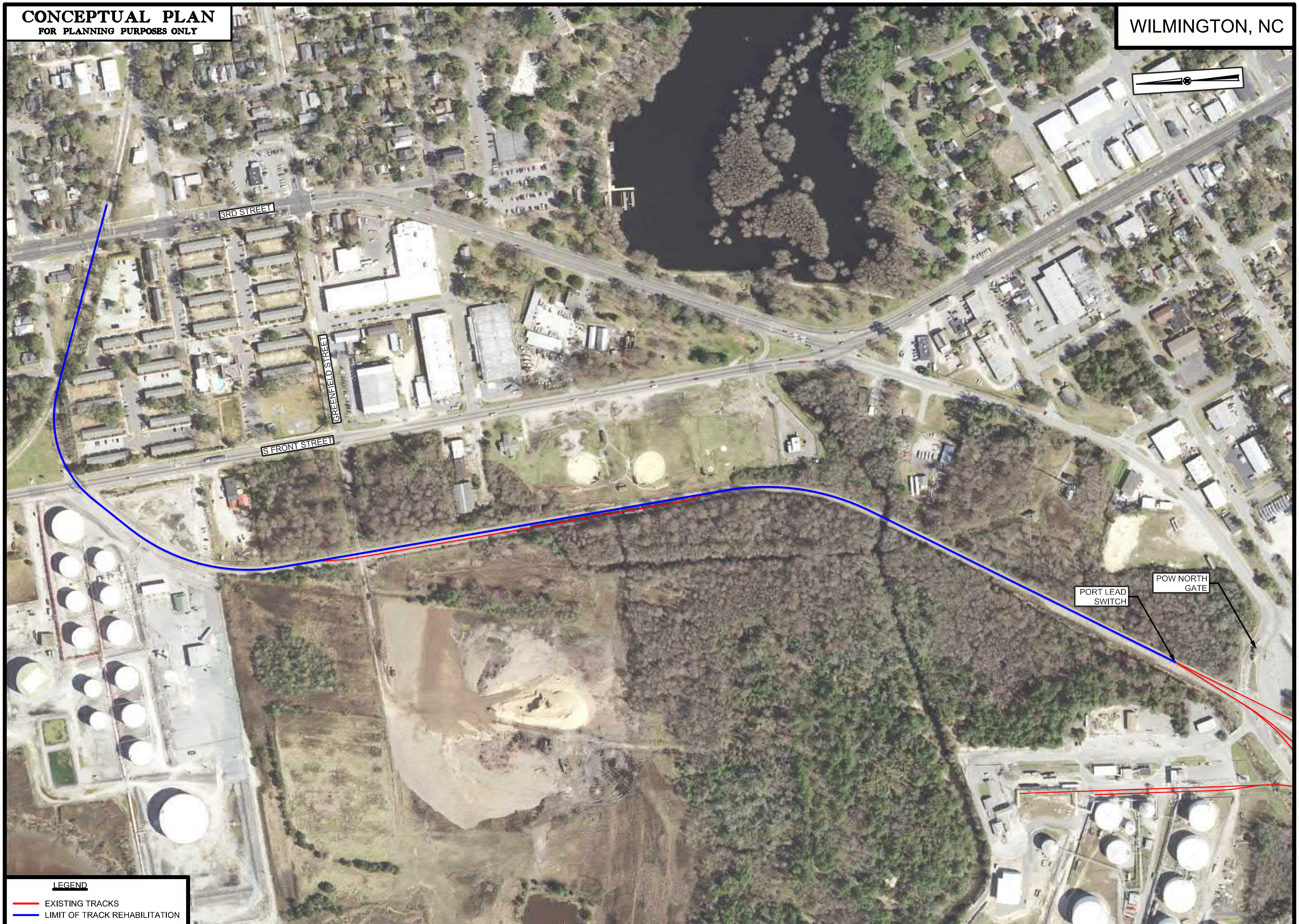


LEGEND
EXISTING TRACKS
LIMIT OF TRACK REHABILITATION

AUGUST 2017

0 200 400
SCALE (FEET)

REHABILITATE TRACK 18
CONCEPT PLAN

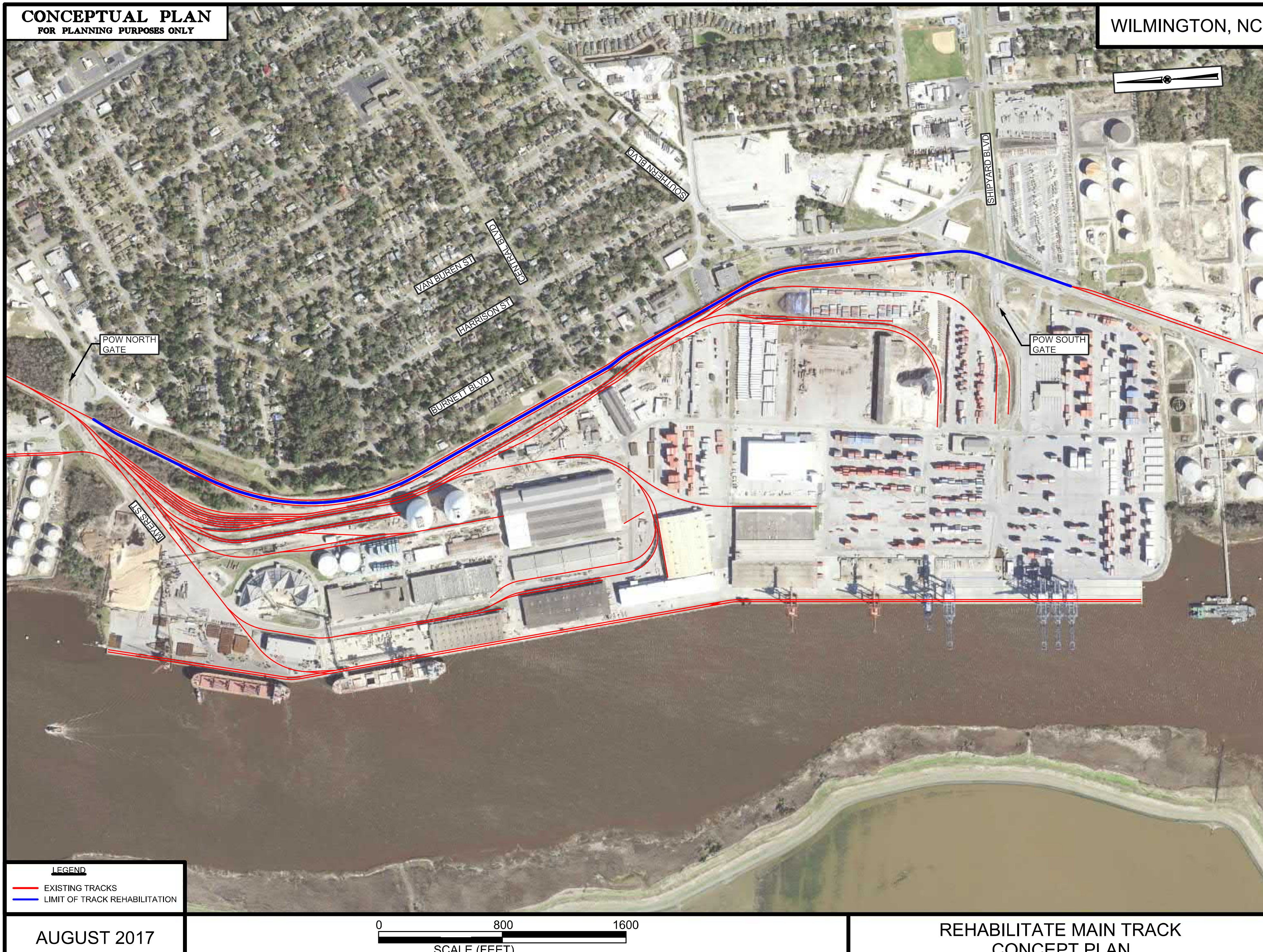


AUGUST 2017

REHABILITATE 3RD ST TO PORT LEAD SWITCH
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC

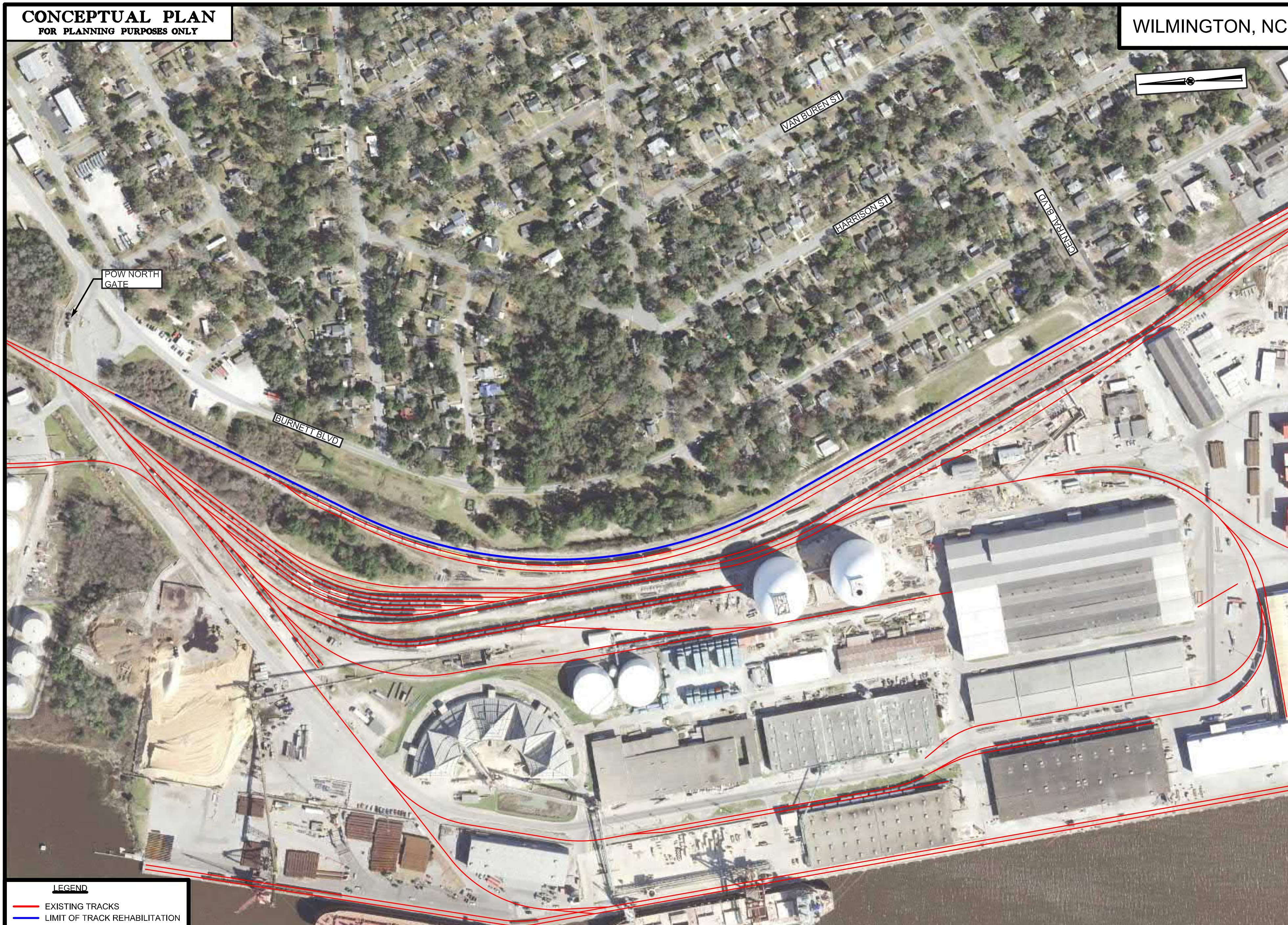


AUGUST 2017

REHABILITATE MAIN TRACK
CONCEPT PLAN

CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC



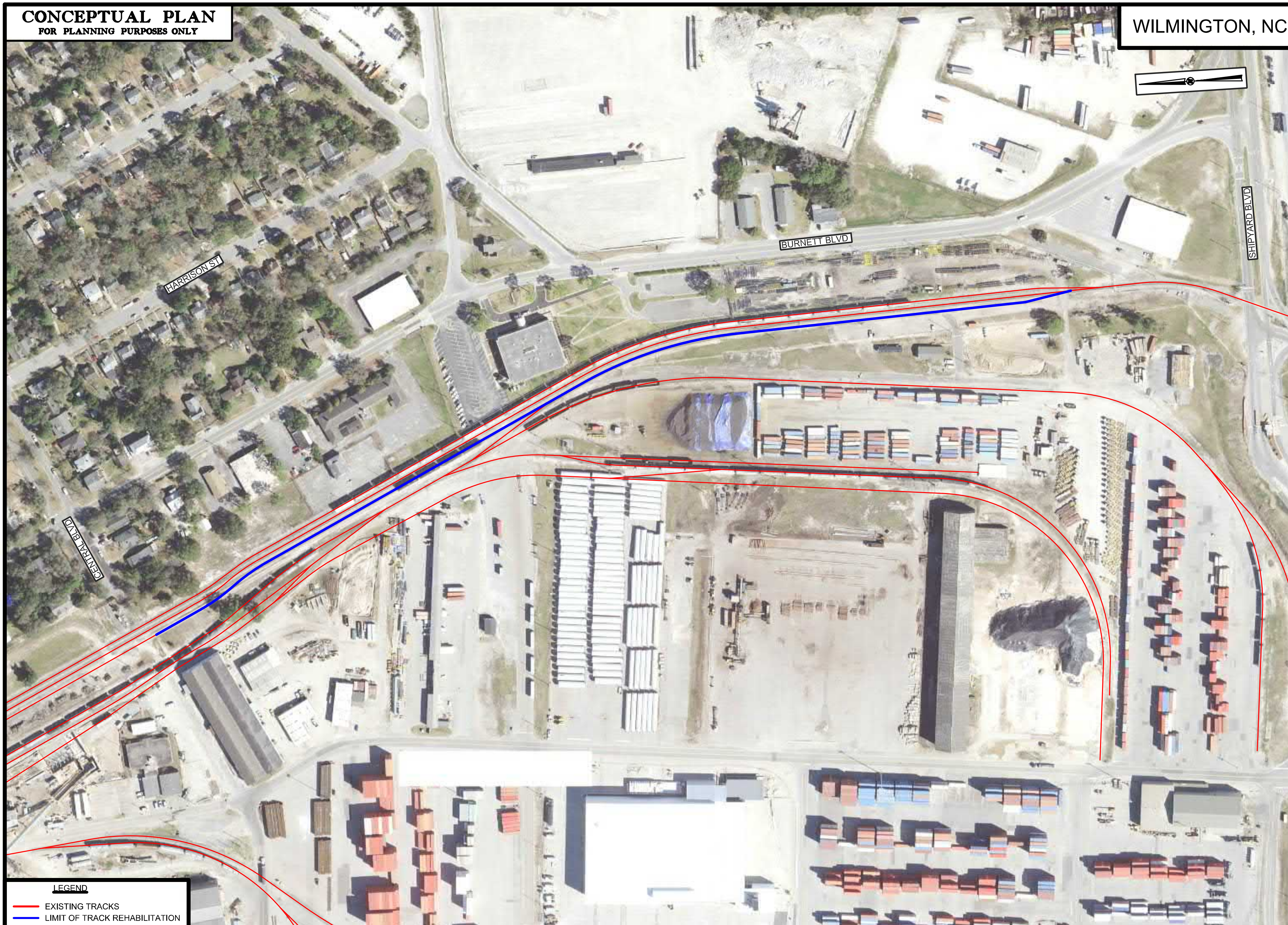
0 400 800
SCALE (FEET)

AUGUST 2017

REHABILITATE MARITIME SIDING
CONCEPT PLAN

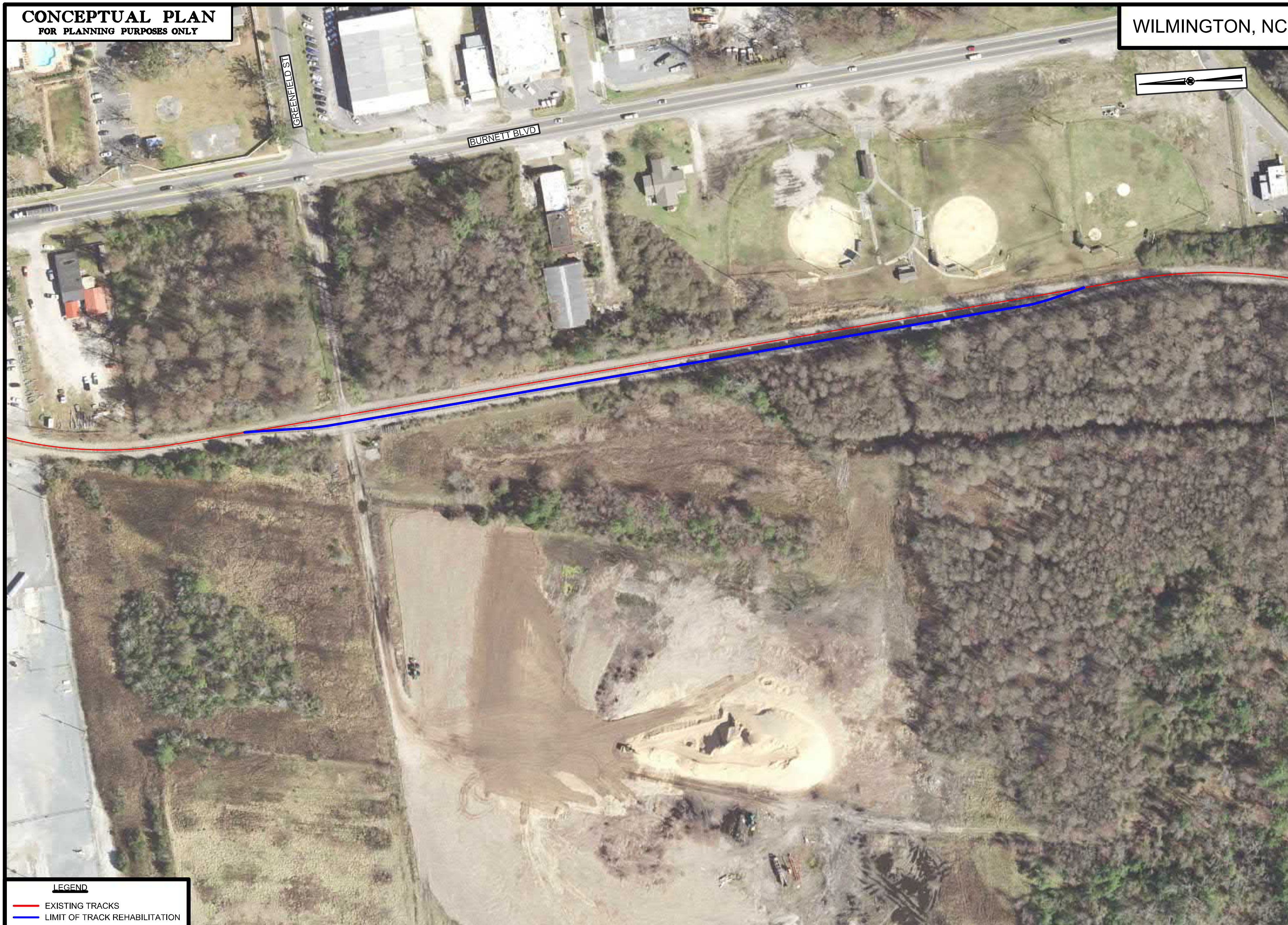
CONCEPTUAL PLAN
FOR PLANNING PURPOSES ONLY

WILMINGTON, NC



AUGUST 2017

REHABILITATE 0 TRACK
CONCEPT PLAN



AUGUST 2017

0 200 400
SCALE (FEET)

REHABILITATE WOOD SIDING
CONCEPT PLAN

F. Environmental Screening

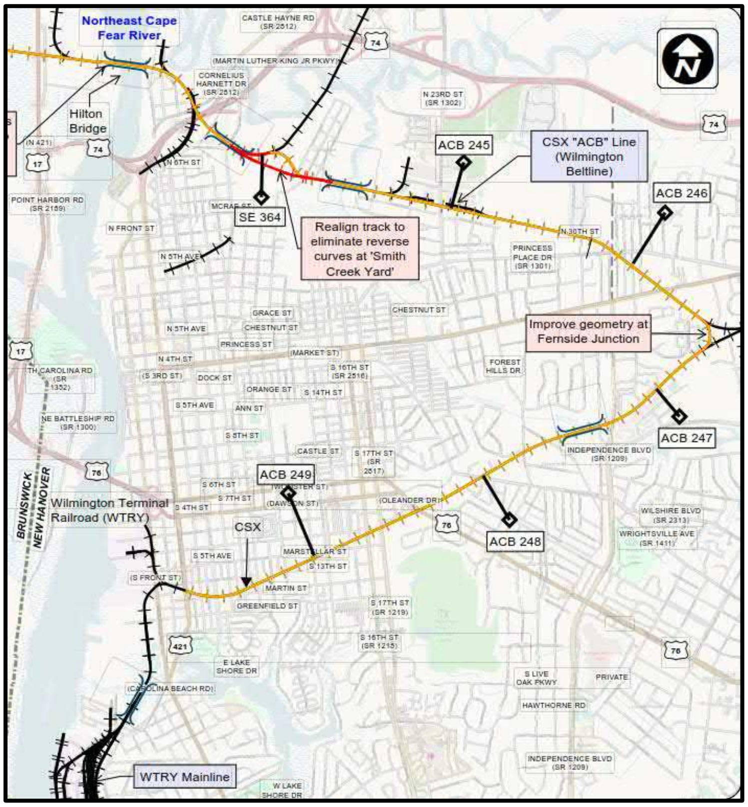


Figure 1.A

REALIGN TRACK

TO ELIMINATE REVERSE CURVE

AT THE SMITH CREEK YARD

Wilmington, NC

New Hanover County

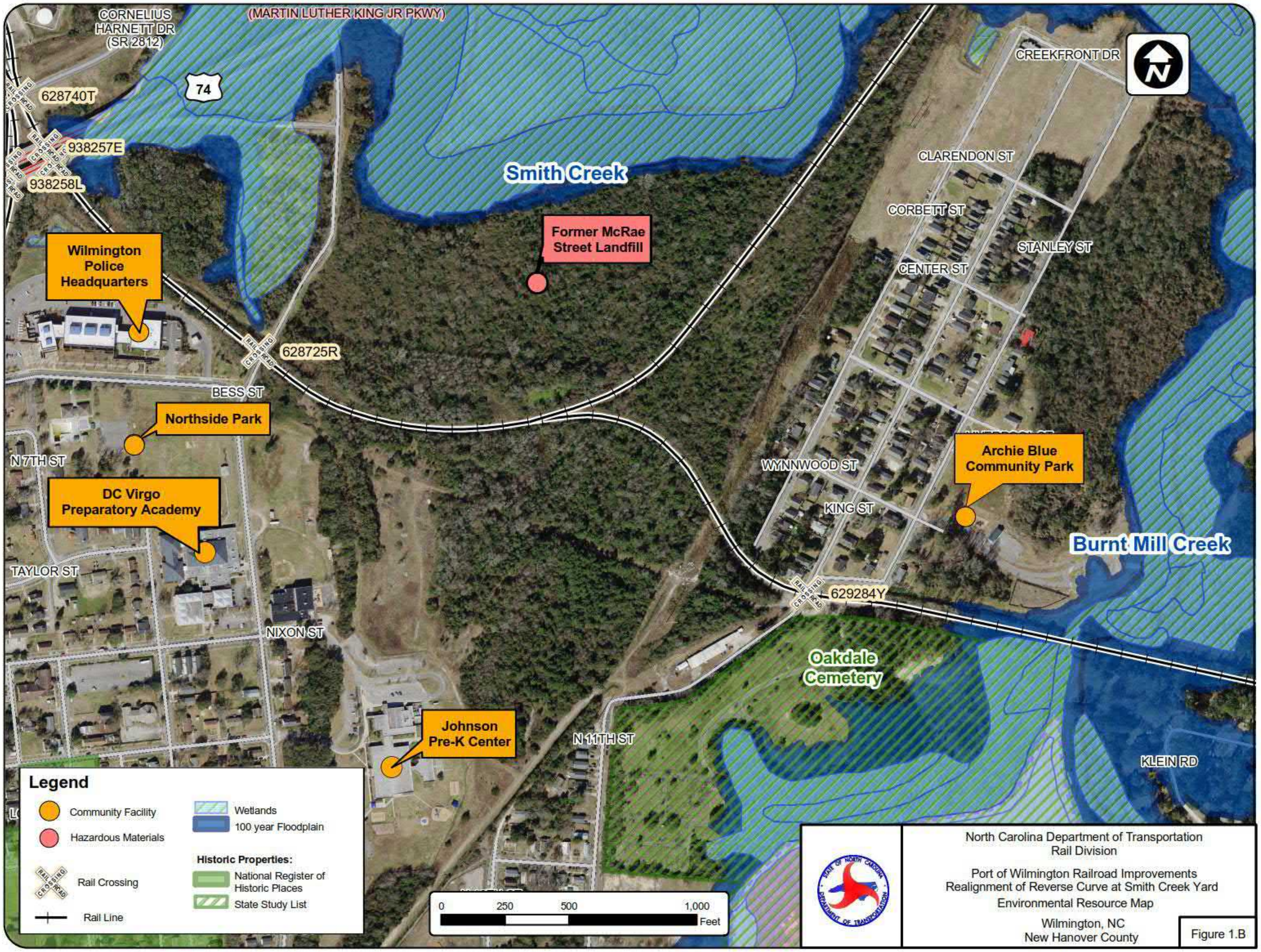
LAT: 34.251816

LONG: -77.935025

See Figure 1.B for Environmental Resource Map.

Resource		**Notes**
Streams	**Name(s)**	Burnt Mill Creek (Stream Index 18-74-63-2) Smith Creek (Stream Index 18-74-63)
	Classification(s)*	C; Sw C; Sw
Wetlands		Southeast end of project area, adjacent to Burnt Creek
FEMA 100 year Floodplain		East end of project area, adjacent to Burnt Mill Creek
Hazardous Materials		Former McRae Street Landfill: Rated “No Further Action” in NCDEQ’s Inactive Hazardous Sites inventory
Historic Properties		State Study List: Oakdale Cemetery
Parks and Open Spaces		Archie Blue Community Park Northside Park
Community Facilities and Services		DC Virgo Preparatory Academy Johnson Pre-K Center Oakdale Cemetery Wilmington Police Headquarters
Other		None

Notes: C: Aquatic Life, Secondary Recreation, Fresh Water
Sw: Swamp Waters


CORNELIUS HARNETT DR (SR 2812)
(MARTIN LUTHER KING JR PKWY)
74
628740T
938257E
938258L
Smith Creek
CREEKFRONT DR
CLARENDON ST
CORBETT ST
STANLEY ST
CENTER ST
Former McRae Street Landfill
Wilmington Police Headquarters
628725R
BESS ST
Northside Park
N 7TH ST
DC Virgo Preparatory Academy
TAYLOR ST
WYNNWOOD ST
KING ST
Archie Blue Community Park
Burnt Mill Creek
629284Y
NIXON ST
Oakdale Cemetery
N 11TH ST
Johnson Pre-K Center
KLEIN RD
Legend
Community Facility
Hazardous Materials
Rail Crossing
Rail Line
Wetlands
100 year Floodplain
Historic Properties:
National Register of Historic Places
State Study List
0 250 500 1,000 Feet
North Carolina Department of Transportation
Rail Division
Port of Wilmington Railroad Improvements
Realignment of Reverse Curve at Smith Creek Yard
Environmental Resource Map
Wilmington, NC
New Hanover County
Figure 1.B

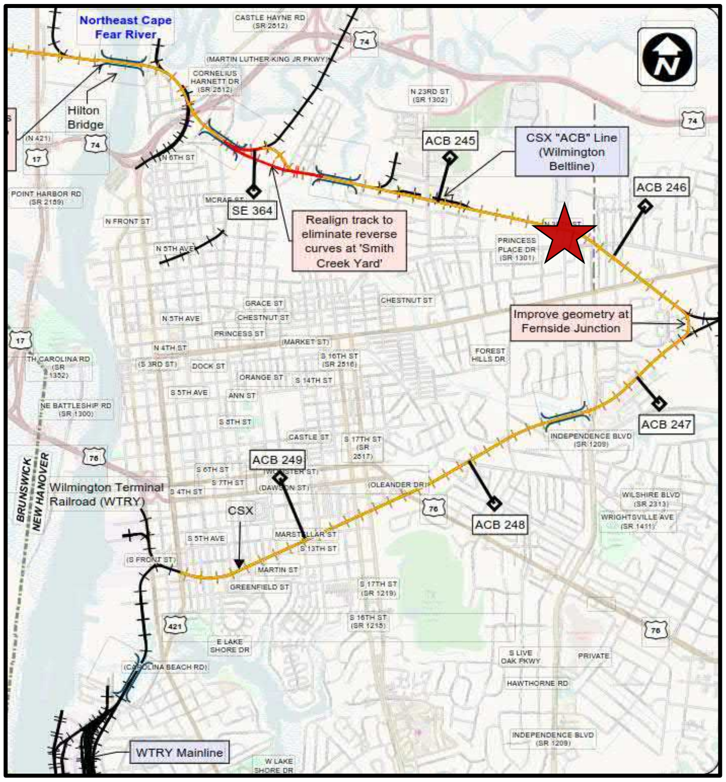


Figure 2.A

IMPROVE GEOMETRY AT

FERNSIDE JUNCTION

Wilmington, NC

New Hanover County

LAT: 34.237664

LONG: -77.894911

See Figure 2.B for Environmental Resource Map.

Resource		Notes
Streams	**Name(s)**	None
	Classification(s)	None
Wetlands		North of project area
FEMA 100 year Floodplain		None
Hazardous Materials		Brownfield Project #: 18016-14-065, Wetsig Yachts
Historic Properties		None
Parks and Open Spaces		None
Community Facilities and Services		Wilmington Preparatory Academy Pearsall Memorial Presbyterian Church
Other		None


(MARKET ST)
CINEMA DR
BUSINESS 17
629290C
Pearsall Memorial Presbyterian Church
Wilmington Preparatory Academy
S KERR AVE (SR 1175)
WETSIG RD
GUINEVERE LN
Wetsig Yachts
TRISTRAM PL
EXCALIBUR WAY
SIR GALAHAD LN
NYMUE PT
METTING RD
DISCOVERY PL
EMERSON ST
FROG POND PL
ACADEMY COVE
Legend
Community Facility
Hazardous Materials
Wetlands
Rail Crossing
Rail Line
0 250 500 1,000 Feet
North Carolina Department of Transportation
Rail Division
Port of Wilmington Railroad Improvements
Improve Geometry at Fernside Junction
Environmental Resource Map
Wilmington, NC
New Hanover County
Figure 2.B

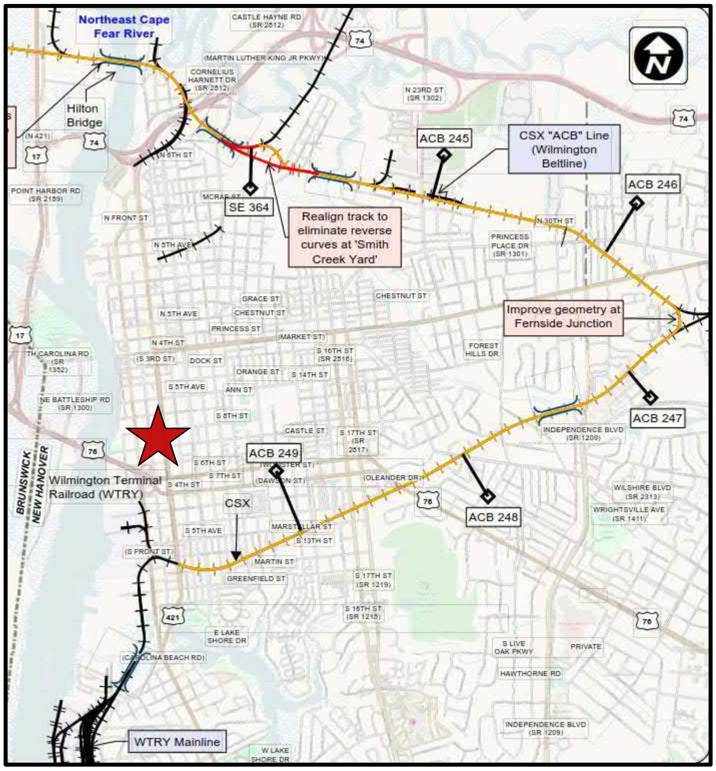


Figure 3.A

REALIGNMENT OF

FRONT STREET CROSSING

Wilmington, NC

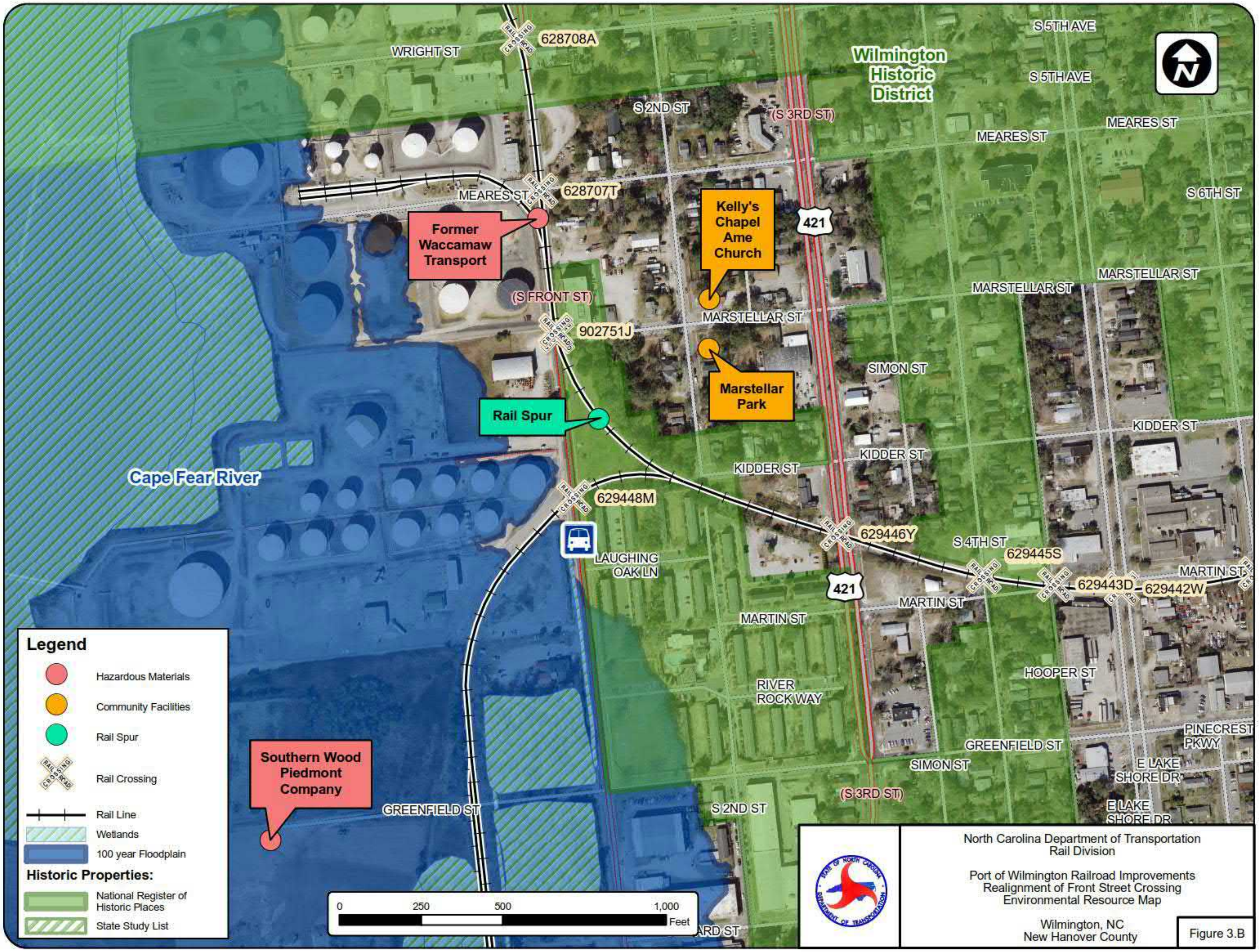
New Hanover County

LAT: 34.218937

LONG: -77.946622

See Figure 3.B for Environmental Resource Map.

Resource		Notes
Streams	**Name(s)**	None
	Classification(s)	None
Wetlands		South and east of project area
FEMA 100 year Floodplain		West of project area
Hazardous Materials		Former Waccamaw Transport: included on the NCDEQ Inactive Hazardous Waste Sites Priority List State Deferred, Non-NPL Superfund site: Southern Wood Piedmont Co EPA ID: NCD058517467
Historic Properties		The Rail Spur, located northwest of rail mainline is a contributing site in the Wilmington Historic District
Parks and Open Spaces		Marstellar Park
Community Facilities and Services		Wave Bus Route 201 NB Stop # 11055, located immediately south of S Front Street rail crossing Kelly's Chapel AME Church
Other		NCDOT STIP No. U-5734: widen US 421 (South Front Street) to multilanes from US 17 Business/US 76/US 421 (Cape Fear memorial Bridge) to US 421 (Burnett Boulevard)


628708A
WRIGHT ST
Wilmington Historic District
S 5TH AVE
S 5TH AVE
S 2ND ST
(S 3RD ST)
MEARES ST
MEARES ST
MEARES ST
628707T
S 6TH ST
Former Waccamaw Transport
Kelly's Chapel Ame Church
421
MARSTELLAR ST
MARSTELLAR ST
(S FRONT ST)
902751J
MARSTELLAR ST
SIMON ST
Marstellar Park
Rail Spur
KIDDER ST
KIDDER ST
KIDDER ST
Cape Fear River
629448M
629446Y
S 4TH ST
629445S
LAUGHING OAK LN
MARTIN ST
629443D
629442W
421
MARTIN ST
MARTIN ST
HOOPER ST
RIVER ROCK WAY
PINECREST PKWY
GREENFIELD ST
SIMON ST
E LAKE SHORE DR
Southern Wood Piedmont Company
(S 3RD ST)
GREENFIELD ST
S 2ND ST
E LAKE SHORE DR
Legend
Hazardous Materials
Community Facilities
Rail Spur
Rail Crossing
Rail Line
Wetlands
100 year Floodplain
Historic Properties:
National Register of Historic Places
State Study List
0
250
500
1,000
Feet
North Carolina Department of Transportation
Rail Division
Port of Wilmington Railroad Improvements
Realignment of Front Street Crossing
Environmental Resource Map
Wilmington, NC
New Hanover County
Figure 3.B

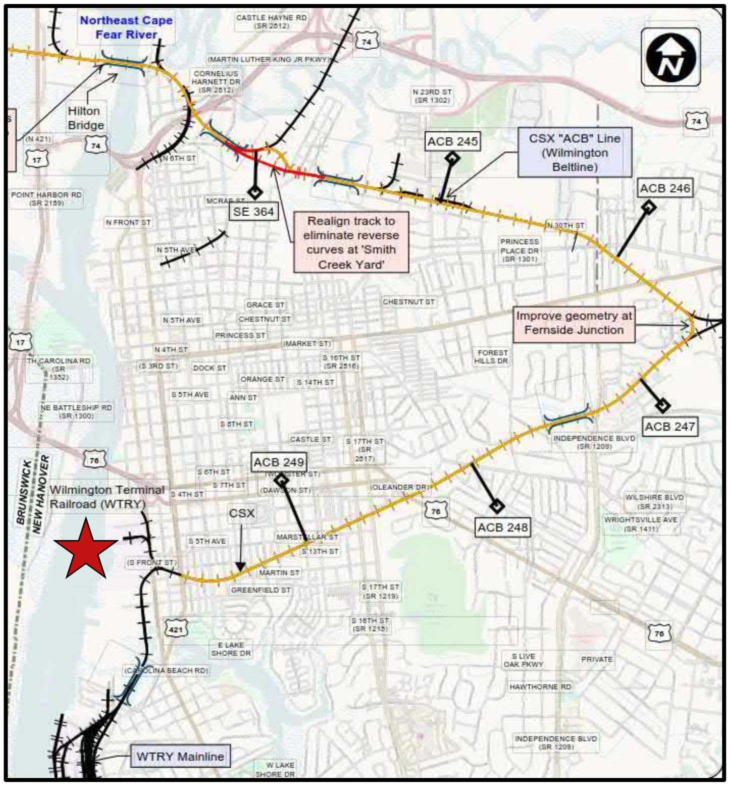


Figure 4.A

RAIL IMPROVEMENTS

FROM Third Street

TO PORT OF WILMINGTON

Wilmington, NC

New Hanover County

LAT: 34.212607

LONG: -77.947379

See Figures 4.B and 4.C for Environmental Resource Maps.

Resource		Notes
Streams	**Name(s)**	Greenfield Creek (Stream Index 18-76)
	Classification(s)*	SC; Sw
Wetlands		Within project area, particularly west of existing tracks
FEMA 100 year Floodplain		Adjacent to project area, particularly west of existing tracks
Hazardous Materials		Sunoco Bulk Terminal and Koch North Paraxlene are included on NCDEQ's Inactive Hazardous Sites List
Historic Properties		Sunset Park Historic District
Parks and Open Spaces		Optimist Park (Front Street) Greenfield Lake Park and Gardens Sunset & Adams Park
Community Facilities and Services		None
Other		None

Notes: * SC: Aquatic Life, Secondary Recreation, Salt Water
Sw: Swamp Waters


Optimist Park
S FRONT ST
Optimist Ball Park
BURNETT BLVD
421
Greenfield Park
Greenfield Creek
WOODBINE ST
BURNETT BLVD (SR 1140)
W LAKE SHORE DR
KENTUCKY AVE
ELM ST
CAROLINA BEACH RD
S CAROLINA AVE
ADAMS ST
OAK ST
N CAROLINA AVE
TENNESSEE AVE
PINE ST
Cape Fear River
Sunset and Adams Park
WASHINGTON ST
SUNSET AVE
ADAMS ST
JEFFERSON ST
NORTHERN BLVD
MADISON ST
MONROE ST
JACKSON ST
SUNSET PARK HISTORIC DISTRICT
NORTHERN BLVD
HARRISON ST
ADAMS ST
JEFFERSON ST
VAN BUREN ST
MONROE ST
CENTRAL BLVD
JACKSON ST
POLK ST
Legend
Community Facilities
Hazardous Materials
Rail Crossing
Rail Line
Wetlands
100 year Floodplain
Historic Properties:
National Register of Historic Places
State Study List
0 250 500 1,000 Feet
North Carolina Department of Transportation
Rail Division
Port of Wilmington Railroad Improvements
3rd Street through Port of Wilmington
Environmental Resource Map
Wilmington, NC
New Hanover County
Figure 4.B


VAN BUREN ST
JACKSON ST
CENTRAL BLVD
JEFFERSON ST
HARRISON ST
MONROE ST
SUNSET PARK HISTORIC DISTRICT
NCSPA BLDG C-1
POLK ST
BURNETT BLVD
CENTRAL BLVD
VAN BUREN ST
JACKSON ST
HARRISON ST
SOUTHERN BLVD
VIRGINIA AVE
MONROE ST
LOUISIANA AVE
MARYLAND AVE
BURNETT BLVD
DELAWARE AVE
Cape Fear River
117
629463P
(SHIPYARD BLVD)
NC STATE PORT
SUNOCO BULK TERMINAL
KOCH NORTH PARAXYLENE
RIVER RD
Legend
Community Facilities
Hazardous Materials
Rail Crossing
Rail Line
Wetlands
100 year Floodplain
Historic Properties:
National Register of Historic Places
State Study List
0
250
500
1,000
Feet
North Carolina Department of Transportation
Rail Division
Port of Wilmington Railroad Improvements
3rd Street through Port of Wilmington
Environmental Resource Map
Wilmington, NC
New Hanover County
Figure 4.C

Glossary

Articulated cars	Rail vehicles consisting a number of cars which are semi-permanently attached to each other and share common axles and/or have car elements without axles suspended by the adjacent car elements.
Belt Line or Terminal Railroad	A short line railroad operation within and/or around a city and connecting with one or more larger or trunk line railroads.
Branch Line	A rail line which serves one or more stations beyond the junction of the main line or another branch line. A feeder line which brings freight to main lines.
Bulk	Cargo that is transported unpackaged in large quantities. It refers to material in either liquid or granular, particulate form, as a mass of relatively small solids, such as petroleum/crude oil, grain, coal, or gravel.
Breakbulk	Cargo are goods that must be loaded individually, and not in intermodal containers nor in bulk as with oil or grain.
Carload	Shipment of not less than five tons of one commodity.
Carolina Connector (CCX)	CSXT Intermodal terminal in Johnston County, North Carolina
Class I Railroad	Railroad with operating revenues of more than $259.4M annually.
Container	Receptacle that resembles a truck trailer that is lifted onto flatcars without the chassis. Most containers are 20, 45, 48 or 53 feet in length.
Container Chassis	A container chassis is a special type of undercarriage or chassis developed specifically to transport containers.Container chassis refer to the skeleton structure which is a part of the semi-trailer designed specifically to transport containers.
Conventional Car	Intermodal single platform flat car for conventional piggyback loading as opposed to stack loading. Designed to carry single stacked trailers or containers. They are equipped with one or two stanchions, depending on length, for shipment of one

	or two trailers and are about 89ft long with a tare weight of about 35 tons.
Dedicated Train	Train that, by design, transports a dedicated commodity or type of cars. In the case of intermodal shipments, trains only carry trailers and/or containers.
Double-Stack	1. Movement of containers on articulated rail cars that enable one container to be stacked on another container for better ride quality and car utilization. 2. Flat cars enabling containers to be stacked one atop another.
Double Track	Parallel sets of main line tracks typically found in areas with high densities of traffic. Parallel sets of main line tracks typically found in areas with high densities of traffic.
Drayage	Transportation of intermodal freight over-the-road from a rail head to a customer's facility. There are 6 types of drayage: 1. Shuttle Drayage: Movement of an intermodal unit either loaded or empty from a hub to another parking lot because the railroad runs out of room at the hub. 2. Expedited Drayage: Special movement of an intermodal unit over-the-road to get it there on time. This exceptional drayage usually involves time-sensitive freight. 3. Crosstown or Inter-Carrier Drayage: Dray movement of an intermodal unit "across town" to the intermodal hub of a competing or interchange rail carrier. 4. IMX or Intra-Carrier Drayage: Movement of an intermodal unit from a carrier's rail hub to the same carrier's intermodal hub. An IMX dray extends the reach of an intermodal hub. 5. Door-to-door Drayage: Retail dray involving over-the-road movement of a unit to a customer location. 6. Pier Drayage: Over-the-road movement of an intermodal unit from a carrier's rail hub to a port's dock or pier.
Dwell	Number of hours a car spends without line haul movement. Same as Demurrage.
Empty Car	Freight car without a load.

Forty Foot Equivalent Unit (FEU)	Ocean-freight term meaning containerized cargo equal to one forty-foot (40 x 8 x 8 feet) or two twenty-foot (20 x 8 x 8 feet) containers. One FEU equals about 2 TEUs or 25 metric tons or 72 cubic meters.
Flat Car	Freight car that has a floor without any housing or body above. Frequently used to carry containers and/or trailers or oversized/odd-shaped commodities. Three types of flat cars used in intermodal transportation are conventional, spine and stack or well cars.
Gantry Crane	A type of crane built atop a gantry, a structure used to straddle an object or workspace. For freight applications, they are used to load intermodal containers on and off container ships.
Grade	Degree of inclination of a railroad track or slope Degree of inclination of a railroad track or slope.
Grade crossing	Crossing of highways, railroad tracks, or pedestrian walks or combinations of these on the same level.
Grade Separation	Highway or railroad crossing using an underpass or overpass.
Hopper Car	Freight car with its floor sloping to one or more doors designed for unloading the contents (such as coal or ore) by gravity.
Intermodal	Mode of rail transportation that covers the multi-modal transportation of trailers and/or containers by ship, rail, and truck.
Intermodal Train	A freight train that consists of any combination of equipment, double-stack or pedestal flat cars, and flat cars equipped for multi-level auto-rack or auto frames.
Junction	Station where railroads interchange railcars at a common point or within the switching limits over their own lines, or intermediate line or lines.
Lead Track	An extended track connecting either end of a yard with the main track.
Line Abandonment	Discontinuation of service and maintenance on certain tracks or line segments of a railroad subject to approval of appropriate federal and state agencies Discontinuation of service and maintenance on certain tracks or line segments of a railroad subject to approval of appropriate federal and state agencies.
Line Haul	Movement of freight over tracks of a railroad from one station to another (not a switching service). Also, known as road haul.

Local Freight Train	Train with an assigned crew that works between predesignated points. Local trains handle the switching outside the jurisdiction of a yard switcher.
Local Move	Traffic originating and terminating on a railroad's lines without any interchange. The one carrier serves both the origin and destination station.
Long Ton	Unit of weight equal to 2,240 pounds (1.016 metric tons).
Merchandise Train	Freight train transporting freight other than bulk commodities.
Piggyback	Transportation of a highway trailer on a railroad flat car.
Rail Mounted Gantry Crane (RMG)	A gantry crane supported on a trestle, where the trestle bents are constructed on wheels so the whole structure travels on a track laid on the ground or floor.
Rail on Dock	Railroad tracks on dock to support loading and unloading of intermodal freight.
Reach Stacker	A vehicle used for handling intermodal cargo containers in small terminals or medium-sized ports that transport a container short distances very quickly and stack them in rows depending on access.
Reefer	Refrigerated Railcar.
Regional Railroad	Non-Class I, line-haul freight railroad that operates at least 350 miles of road and/or has operating revenues of at least $40M.
Right-Of-Way	Roadway. Property owned by a railroad over which tracks have been laid.
Run-through Train	Train interchanged between two roads with locomotive and cars.
Rubber Tire Gantry (RTG)	A mobile gantry crane used in intermodal operations to ground or stack containers.
Shortline	Small railroad that originates or terminate traffic and participates in division of revenue. It is usually less than 100 miles in length. It is usually affiliated with or sold by a major railroad. Small railroad that originates or terminate traffic and participates in division of revenue. It is usually less than 100 miles in length. It is usually affiliated with or sold by a major railroad.
Short tons	Unit of weight equal to 2,000 pounds (0.907 metric ton).
Siding	Track adjacent to a main or secondary track for meeting or passing trains.

Spur	Track extending out from the main track that usually serves customers.
Stack Car (Well car)	Intermodal car specifically designed to place one container on top of another for better utilization and economics. Also referred to as a well car because the cars are depressed in the center to allow clearance of the double stacked containers when moving under low-lying structures. A single well stack car has a tare weight of about 27.2 tons.
Tare Weight	Tare. Weight of clean, empty equipment, i.e., the car contains no lading or packing and debris resulting from the lading.
Terminal	Railroad facility used for handling freight and the receiving, classifying, assembling and dispatching of trains.
Terminal Dwell Time	Average hours a car is at the specified terminal location expressed in hours. The measurement begins with a customer release, received interchange, or train arrival event and ends with a customer placement (actual or constructive), delivered interchange, or train departure event. Heavy, bad ordered, stored, and maintenance of way cars are generally excluded from the calculation.
Twenty-foot Equivalent Unit (TEU)	A unit of cargo capacity based on the volume of a 20-foot-long (6.1 m) intermodal container, a standard-sized metal box which can be easily transferred between ships, trains and trucks.
Tonnage	The capacity of a merchant vessel, expressed either in units of weight, as deadweight tons, or of volume, as gross tons.
Trailer	Rectangular shaped box with permanent wheels attached for the transport of goods on rail, highway, or a combination of both.
Trailing Ton	Total lading tons and tare tons of a train.
Transload	Facility used for transferring shipments from truck to rail and vice versa.
Transshipment	Shipments transferred from one transportation line to another, particularly from rail to a water carrier or vice versa.
Unit	1. Carload unit (for non-intermodal traffic) 2. Trailer or container unit (for intermodal traffic) 3. Measure of rail volume
Unit Train	Freight trains moving great tonnages of a single bulk product between two points without intermediate

	yarding and switching. Such trains cut costs because they eliminate intermediate stops in yards and reduce cycle times. Also known as a shuttle.
Universal 53 foot cars	Domestic rail cars typically are 53 feet in length.
Waybill	Document covering a shipment. A waybill shows the forwarding and receiving station, the names of consignor and consignee, the car initials and number, the routing, the description and weight of the commodity, instructions for special services, the rate, total charges, advances and waybill reference for previous services and the amount prepaid. Created from shipping instructions.
Yard	System of tracks with defined local boundaries, which provides for the making up of trains, storing of cars and other related functions.
Yard Move	Train or rail cars ordered to move from one location to another in a rail yard.

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