Technical Memorandum:
Review of the Bayonne Bridge Navigational Clearance Program Draft Environmental Assessment

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FINAL

PREPARED FOR:
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Executive Summary

In early 2013, Sustainable Systems Research, LLC was commissioned by the Natural Resources Defense Council to review the transportation and air quality-related analyses contained in the Bayonne Bridge Navigational Clearance Program Draft Environmental Assessment (Draft EA).

In this report, we (1) analyze the Draft EA's conclusion that raising the Bayonne Bridge (the project) will have an insignificant effect on Port of NY/NJ cargo volumes; (2) provide an alternative estimate of Port cargo volumes in the baseline (no-build) and project (build) scenarios; (3) translate these alternative cargo volumes into projected truck trips west of the bridge and estimate localized emissions; and (4) demonstrate that increased cargo volumes from the project may impose environmental and public health impacts in low-income communities of color than are already experiencing elevated air pollution and health risks.

Our analysis begins by exploring the conceptual framework used to justify the project and the contradiction it raises with the concepts relied upon to dismiss the project's potential effect on Port cargo volumes. The contradictions challenge basic economic intuition and are found in excerpts throughout project-related documents. Specifically, we find that statements by the Port and studies performed for the Port are incompatible with the Draft EA's conclusion that the project will *not* substantially affect cargo volumes.

To conduct our analysis, we examined the quantitative modeling presented in the Draft EA as well as documentation associated with the Port's long-term planning. We find that the induced demand analysis in Chapter 18 and Appendix I of the Draft EA, which predicts insignificant changes in Port cargo volumes from the project, is implausible. And because the Draft EA's induced demand analyses is so opaque, it is impossible to determine whether current estimates are legitimate and have been derived using a reasonable approach. We then present the results of an alternative estimate of Port cargo volumes in the baseline (no-build) scenario which were derived using a context-similar analysis conducted at the Port of NY/NJ, and find herein that there will likely be substantial changes in Port cargo volumes when vessel size restrictions are lifted.

Based on our analysis, we conclude that the estimated cargo volumes west of the bridge in the unrestricted (build) case are on the order of 44% higher than in the restricted (no build/baseline) case, which translates to a 34% increase Port-wide. These estimates assume that: i) 20% of Port volumes move through terminals east of the bridge in 2035 (2,129,560 TEUs) and ii) those terminals experience no change in cargo volumes with the project. A 34% increase in Port-wide cargo volumes in the unrestricted case (or a 25% reduction in Port-wide cargo volumes in the restricted case), is one to two orders of magnitude greater than the 0.7% Port-wide difference arrived at in the Draft EA's induced demand analysis. The magnitude of this potential growth effect of the project shows that the impacts in the Draft EA are simply unsupportable and must be re-evaluated.

Further, using our alternative baseline and refined truck/rail "mode split" assumptions, we estimate that the project will result in 2,450 – 10,390 additional truck trips/day from the three terminals west of the bridge. This is significantly greater than 54 truck trips/day predicted in the Draft EA. These additional truck trips will impact air quality for communities surrounding the Port. These impacts have not been evaluated in the Draft EA and should be, given the potential emissions impacts.

We find the localized NOx and PM emissions that may result from the project by 2035 for each cargo volume increase scenario are not insignificant when compared with current Port-related emissions in the area. Cumulatively, the 2035 emissions from cargo handling, truck movements, and ocean going vessels that will increase due to the project are estimated to range from 2-55%, 0 – 38%, and -1 – 5% of current Port related emissions in the area for those sources, respectively. For each of the ranges, the low end of each estimate uses the Draft EA cargo volume estimates.

Such emissions are likely to have potentially significant localized impacts, especially when combined with past and future emissions in the area. We discuss existing air quality and health concerns and the demographic characteristics of the communities around the Port; these communities are the ones most likely to experience the majority of the effects from increased Port emissions, and truck emissions in particular.

For instance, the area surrounding the Port of NY/NJ has a substantial number of stationary and mobile sources of air pollution in close proximity to residents. The East Ward (Ironbound) community in Newark and the southeastern portion of Elizabeth have a particularly high density of residents in proximity to stationary pollution sources, and many roads with heavy truck traffic. These communities are also composed of a disproportionate number of minority and low-income residents, creating the potential for significant cumulative and environmental justice impacts. We illustrate this demographic data in a series of maps in this report and Appendix B. This analysis was not performed at all in the Draft EA.

In summary, the proposed Bayonne Bridge project will likely increase cargo volumes moving through the Port of NY/NJ. These cargo increases are of particular concern for communities surrounding the Port, which are already greatly impacted by air pollution and which are composed of a disproportionate number of minority and low-income residents. The analysis presented here provides an estimate of the magnitude of the potential effects from the project. Based on the limited data reviewed, it is our opinion that there is a significant potential for adverse environmental effects that the Draft EA has not considered.

REFERENCES

The following project-related documents have been consulted to support our analysis, and are referred to using the abbreviations indicated. The Draft EA is used for the majority of references, therefore where a page reference is provided without a document reference, the page is from the Draft EA. General references (i.e. not project related) are cited in footnotes.

- **Draft EA**: Bayonne Bridge Navigational Clearance Program Draft Environmental Assessment. Port Authority of NY&NJ, December 2012.
- **Bayonne Bridge Air Draft Analysis**: Bayonne Bridge Air Draft Analysis. Prepared for The Port Commerce Department & The Port Authority of New York and New Jersey. Prepared by the United States Army Corps of Engineers New York District. September 2009.
- **NEPA Workplan Response to Comments**: US Coast Guard First Coast Guard District Bridge Program Bayonne Bridge Navigational Clearance Program Responses to Scoping Comments NEPA Workplan. February 2012.

- **CPIP**: CPIP Consortium Port of New York and New Jersey Comprehensive Port Improvement Plan. Prepared by Halcrow with Gannett Fleming, MDS Transmodal, Duncan Maritime, Moffatt & Nichols Engineers, Zetlin Strategic Communications, Hirani Engineering. September 2005. Volumes 1 and 2.
- **TIGER Grant Application**: Surface Transportation Infrastructure Discretionary Grant Application Package, Opportunity Number DTOS59-10-RA-TIGER2, Competition ID TIGER2-11, Bayonne Bridge Navigational Clearance, 8/2010.
- **Port Truck Origin-Destination Survey:** Draft Report Port Authority Marine Container Terminals Truck Origin-Destination Survey 2005. Prepared for The Port Authority of NY&NJ. Prepared by Vollmer, Eng-Wong, Taub& Associates, Stump/Hausman, New Jersey Institute of Technology, Stevens Institute of Technology. November 2005, Revised 2/27/06.
- **2009 NJDEP Port Air Quality Study**: Estimated Air Quality Impacts on Surrounding Communities of PM2.5 and SO2 Emissions Resulting from Maritime Operations at Elizabeth Port Authority Marine Terminal and Port Newark. NJDEP. October 9, 2009.
- **2011 NJDEP Future Port Air Quality Study**: Estimated Air Quality Impacts on Surrounding Communities of PM2.5 and SO2 Emissions Resulting from Maritime Operations at Elizabeth Port Authority Marine Terminal and Port Newark: Phase 2 Future Impacts (2015). NJDEP. August 16, 2011.
- **Port Authority's 2008 Emissions Inventory**: Port Authority of New York and New Jersey 2008 Multi-Facility Emissions Inventory of Cargo Handling Equipment, Heavy-Duty Diesel Vehicles, Railroad Locomotives and Commercial Marine Vessels, December 2010. Prepared by Starcrest Consulting Group, LLC.

CONTRADICTIONS BETWEEN PROJECT PREMISE AND POTENTIAL FOR PORT GROWTH

As the Draft EA states, fundamentally the project is premised on keeping the port 'modern, efficient, and competitive' and removing 'potential impediments to marine transport along the Kill Van Kull to adapt to change in the shipping industry and ensure the long-term vitality and efficiency' of the port (p 1-1). Project benefits from raising the bridge can be achieved in two ways – via reductions in the cost of Port activities and/or via increases in the overall activity at the Port. The Draft EA indicates that the economies of scale that accompany the use of larger Post-Panamax ships will reduce the per unit cost of shipping. At the same time, the Draft EA indicates that these cost savings, and the increased flexibility to shippers that allowing larger ships presumably entails, will not have a 'substantial' effect on the volume of cargo moved through the Port. That is, a higher bridge that lowers per unit costs for shippers will not change the level of future cargo volumes. The lack of effect on cargo volumes is reflected in a comparison between the 'baseline' cargo forecast and the cargo forecast in the project scenario. These forecasts differ only in terms of the size of vessels forecasted to use the Port, but total cargo volumes moving through the Port does not change.

The Draft EA indicates that the port's vitality and competitiveness is a singularly important driver for the project. Page 12 states that "…losing these efficiencies and shipping cost reductions would make it more difficult for the Port to compete with other ports serving the margins of the Port's outer hinterland." The footnote on page 18-10 of the Draft EA describes the expansions and improvements expected at competing ports. Economic fundamentals would suggest that if the Port's vitality and competitiveness were at risk in the no-build scenario, freight volumes would decline at a significant rate.

The notion that a market is at risk without infrastructure improvements, yet has no diminishment of service without the infrastructure is counterintuitive. Basic economic principles state that in a competitive market, reducing costs to supply a service or good leads to increases in demand for that service or good. The bridge height restricts the types of vessels that can use the Port, which has implications for both costs and the timing and flexibility of shipping options.

The Port's forecasts assume that Port cargo volumes will increase with population and economic changes. Implicit in the forecasts is the underlying assumption that the Port of NY/NJ will remain competitive with other Ports--to the same degree in the project and no-project scenarios. However if the bridge is not raised, this competitive position will be at least partially compromised, as indicated by economic fundamentals and the project's stated justification. The Draft EA examines the possibility of Port growth induced by cost savings resulting from raising the bridge in Chapter 18 and Appendix I, finding small changes in cargo volumes which the analysis deems insignificant. The effects of this small change in cargo volumes are not evaluated. The Draft EA also indicates that the uncertainties associated with the projections are large, but does not evaluate these uncertainties or their potential effect on the induced cargo volumes.

Conflicting accounts abound throughout a variety of port-related documents on the expected effects of the proposed project on cargo volumes moving through the Port. On the one hand the project is necessary for maintaining the Port's competitiveness with other Ports, but on the other hand the Draft EA analysis indicates that the Port market is so secure that the project will not affect the desirability of the Port, or the cargo volumes arriving and departing from the Port. In the 2010 TIGER Application for federal funding for the environmental review process related to the Bayonne Bridge Navigational Clearance Program, the discussion indicates that raising the bridge will prevent cargo from moving to other ports:

> Increasing the air draft restriction of the Bayonne Bridge is crucial for maintaining and developing the regional economies of New York and New Jersey. The existing Bayonne air draft restriction may damage the economies of New York and New Jersey, as shipping companies will be encouraged to divert to ports capable of handling larger, economically efficient vessels. [Page 3, TIGER Grant Application]

In the same document, this benefit is represented as distinct from the benefits that might accrue from cost savings related to economies of scale:

> Given existing Bayonne clearance restriction, the potential that post Panamax vessels will not be able to call at the Port of New York and New Jersey, and they could divert to ports outside of the region that are able to accommodate these vessels, may result in a loss of economic activity in the region. Improving the air draft restriction will ensure that New York and New Jersey remain capable of handling their shipping needs for years to come, by maintaining and expanding local business access to market. Additionally, as shown in Table 3, enabling larger vessels to reach the ports in Newark and Elizabeth will result in economies of scale with regards to shipping costs, thereby reducing shipping costs and providing a boost to the local economy…" [page 5, TIGER Grant Application]

Comments from the public on the NEPA workplan indicate that the project is perceived to bring port growth by those with knowledge of the shipping industry, for example:

> This project is both necessary and critical to ensure the ports' continued growth…ensuring the port's competitive position in the worldwide market and allowing for future business growth…. (page 3 of the NEPA Workplan Responses to Comments. Submitted by Joseph C. Curto, President of New York Shipping Association)

Contradictory accounts of port growth are also reflected in documents analyzing Port activities. Evidence from a survey conducted as part of the Bayonne Bridge Air Draft analysis suggests that air draft restrictions at the bridge may affect decisions about which port to use: "Eleven of the 15 carriers interviewed say that they may need to bypass the Port of NY/NJ in the future if the Bayonne Bridge remains a restriction" (Bayonne Bridge Air Draft Analysis, pp. 26-27).

The likelihood that restricting access of large vessels to the Port will affect cargo volumes is directly stated in an analogous analysis of constraints to larger ships encountered earlier at the Port of NY/NJ. The 2005 Comprehensive Port Improvement Plan (CPIP), which evaluated demand at the Port when the ship channel is dredged from 45 feet to 50 feet thereby allowing larger ships to enter (alongside an assessment of potential improvements), states that:

> Demand at the port is dependent on its ability to accept the size of ships in the markets served by the Port. In the process of defining demand for cargo at the Port it was therefore necessary to consider the vessel fleet that would wish to call at the Port…[CPIP page 27]

The CPIP analysis further states that

> These [post-Panamax] ships will be deployed on most relevant trade routes whether the Port of New York and New Jersey can accept them or not. For example Halifax and Norfolk can accept these ships, and work already done for PIDN shows that even within the Port's immediate hinterland there is already a considerable overlap between different port hinterlands. [CPIP page 29]

The CPIP then proceeds to provide a dramatically different projection of Port cargo volumes that can be expected to occur with and without the dredging project (CPIP page 20). In terms of affecting the access of vessels of various sizes, removing the channel depth restriction is conceptually similar to the keel to mast height restriction imposed by the bridge, despite the very different treatment of forecasted cargo volumes in each case. This is discussed in more detail later in this memo.

In conclusion, the discussions in various documents about the potential effects of restricting access to the Port are incompatible with the conclusion in the Draft EA that removing the air draft restriction will not substantially affect cargo volumes.[1] We explore the technical assessments of this question in the sections that follow.

[1] Similar concerns are raised by EPA personnel, as gleaned through documents made available through a Freedom of Information Act request: an email from Gavin on 11-28-12, an email from Gavin on 11-30-12, a 12-6-12 email from Birkett, a 12-6-12 email from Kopits, a 12-7-12 email from Gavin, EPA remarks on a pre-draft of the EA (12-6-12), an earlier draft of those remarks (8-16-12), and a 11/26/12 response to EPA and CEQ comments. A summary of comments and responses (also obtained through a FOIA request) related to data gaps from October 5, 2012 indicates that both EPA, NMFS, and potentially the USCG raised this concern.

EVALUATING THE POTENTIAL FOR PORT GROWTH DUE TO THE PROJECT

In order to illuminate the possible outcomes of the project in terms of cargo volumes, we examine the quantitative modeling in the Draft EA as well as much of the documentation associated with the Port's long-term planning. We find that the induced demand analysis in Chapter 18 and Appendix I of the Draft EA, which predicts insignificant changes in Port cargo volumes from the project, is lacking sufficient plausibility. We then present an alternative estimate of Port cargo volumes in the baseline (no-build) scenario based on a similar analysis conducted at the Port of NY/NJ, finding that there will likely be substantial changes in Port cargo volumes when vessel size restrictions are lifted.

The Draft EA Estimate

The US Environmental Protection Agency and a number of other commenters on the NEPA workplan requested that the Draft EA include an analysis of the project's effects on overall demand for cargo at terminals west of the bridge. This analysis (in Chapters 18 and Appendix I) indicates that the additional freight volumes induced by the project are expected to be only 0.7% greater in the build scenario than in the no-build scenario in 2035, which the Draft EA computes as equivalent to an additional 54 truck trips/day from the Port. It characterizes this estimate as highly uncertain. The analysis undertaken in the Draft EA is unsubstantiated. For example, the technical analysis underpinning several questions is either missing entirely or too vague to be useful:

1. **Applicability of price elasticities used is unclear.** Price elasticities of demand are essentially measures of the extent to which demand for a market changes when prices change. Elasticities are based on what we know about the market which, when paired with predictions of how prices may change, can be used to predict how the market will change with changes in costs.

   In this case, the elasticities used in Appendix I reflect an estimate of how much the shippers will change their use of the Port if their costs of using the Port change (e.g. lower shipper costs from the ability to use larger ships). However, Appendix I (and the Draft EA) lacks even a basic description of how the elasticities were estimated. This is problematic because estimates of elasticities can vary widely depending on how they are estimated and the data upon which they are based. This is important because any errors in the elasticities are carried forward into the forecasted changes in cargo volumes. The Draft EA documents provide no information about the data source for the elasticities shown in Table 1 of Appendix I, nor do they provide a reference to the Halcrow model mentioned in Appendix I.[2] Given their importance in the induced demand analysis, the way in which the estimates were derived should be transparent.

   Consider that elasticities can be estimated in two ways. They can be simulated, e.g. based on what we can guess about shipper preferences and the relative costs of using different Ports, we might make predictions about how shippers react to different price changes. If the elasticities used in Appendix I are based on simulations, it is important to understand what was assumed about shipper preferences as well as what was used to generate

[2] Similar concerns are raised by EPA and CEQ personnel, as gleaned through a document made available through a Freedom of Information Act request: 11-26-12 response to EPA and CEQ comments.

estimates of the costs of shipping to different ports, because the elasticities will depend directly on the accuracy and completeness of those assumptions.

Elasticities can also be estimated based on historical observations, e.g., how port traffic has varied with prices in the past. This can occur via observations of differences in prices over time, across different geographic areas, or both. Because Port and travel network characteristics vary in different geographic areas, it would be very difficult to obtain a reliable result from an estimate based solely on geographic variation. Alternatively, estimates that rely on observations of changes over time depend on the time period in which they were observed. Typical questions about elasticities that are time-based might include, for example, were the calculated elasticities based on short or long term economic observations? If they were estimated based on observations of too short of a time period (i.e. using a time period that is shorter than the period it takes for shippers to adjust their practices) then we would expect them to provide an underestimate the shipper's response in the long run.

More general questions that arise when using elasticities, regardless of whether they are based on time or space, include: what price variations were observed? If the price variations that were observed in the data used to estimate the elasticities were smaller than the price changes modeled in the Draft EA analysis, we would expect the elasticities to underestimate the reaction of the shippers, as there may be transaction costs (e.g. gathering information) associated with changing practices that are only overcome if the incentives (i.e. price differentials) are great enough. Additionally, were the observed price fluctuations related to differences in vessel sizes, or other economic changes? It is possible that there are challenges associated with using smaller ships that are not well characterized by the prices modeled, in which case the elasticities would again underestimate the shipper's reaction. Finally, what mathematical function is used to generate the elasticities, and how well do the predictions fit the observations? While the mathematical aspects of economic demand analysis are too complex describe here, we note that any number of mathematical functions can be used to estimate elasticities from observations, and each formulation would result in a different level of accuracy and different predictions about the effect of the project on cargo volumes.

2. **Applicability of costs applied is unclear.** Once elasticities have been derived, they are used in combination with forecasted price changes (as a percent of the base price) to arrive at an estimate of how a market might change in response to price variations. The accuracy of the forecasted base prices and price changes used to simulate effects of market changes, in this case effects associated with raising the bridge, are obviously very important to understanding how demand may change in the future.

   The base prices and price changes over time are used to estimate induced demand in the Draft EA. In attempting to understand what approach has been taken in the Draft EA, we note a number of concerns. First, the price estimates lack a sufficient description of their basis. The prices are described as representing ocean freight rates, port related charges, and intermodal rail rates, and are described as being simulated to reduce by 0%, 5%, 10%, 15%, 20%, and 25%. Rates are based on many factors, e.g., ocean-based rates can be a function of whether a full or partial container load is shipped. To estimate future rates, long-terms trends in pricing must be forecasted. The Draft EA currently has no information on how these future rates have been established (e.g., long-term trends in past rates? A model of future trends in pricing? Do estimates account for changes in fuel costs, etc?). Obviously, the forecasted base price and how that price changes over time are critically influential to estimates of future demand. While the modeling of future prices may be proprietary, the basic characteristics of the price forecasts (e.g. a basic description of observations and/or simulations) and the actual price (or the mean and variance of the prices, as discussed below) being used to justify analysis in the Draft EA should be transparent. If the price estimates for using various ports are not reasonable, then the inclination to shift ports when prices change would be inaccurately forecasted.

On a more technical note, it seems as though, from the Draft EA explanation, the price changes that are used are parameterized as normally distributed statistical probabilities. For example, instead of representing the price of option X as $1, one can represent it as a distribution of probabilities: the price of option X has a 30% chance of being $0.80, a 20% chance of being $1.00, a 50% chance of being $1.20. In the induced demand analysis, the probabilities were assigned to each price using a 'normal' distribution, also known as a 'bell curve'. To simulate any parametric distribution like the normal distribution, the average and the variance are specified.[3]

The Draft EA states that 'the mean and variance were estimated for a dataset that comprised the percentage change in each of the landed-cost components for each port' (page 12, Appendix I). Does this dataset reflect real prices that have been observed over time? Or simulated prices that might be seen depending on whether the project is built? Or, is it simply based on the simulated price reductions of 0%, 5%, 10%, 15%, 20%, and 25% described above. Based on the quote, the latter seems more likely. If the price 'dataset' is simply simulated price reductions from 0 to 25% (with an equal probability of each price change occurring), then the effect of raising the bridge on costs seems to have been arbitrarily assigned instead of using an actual expectation of change in costs that might be associated with raising the bridge. On the other hand, if the mean and standard deviation are instead based observations of the likelihood of each price reduction, which is not described in Draft EA, then it would be important to know if they actually fit a normal distribution (i.e., the bell curve).

A mean and variance can be calculated for any group of numbers, and any mean and variance can be used to create a normal distribution. In some cases the group of numbers closely resemble a normal distribution, e.g. for randomly measured heights of adult males. However in some cases, naturally occurring data are not normally distributed, e.g. in the case of measurements of rainfall events in a particular location, where most storms may drop between 0.1 and 0.9 inches of rain, the smallest storm may drop just over 0 inches, but there may also be a number of extreme events whereby large storms periodically drop 5 or 10 inches. Standard statistical methods can be used to test how well data fit a normal distribution. The Draft EA does not provide any indication that such tests have been applied here. If the normal distribution is a poor fit, an appropriate mathematical transformation might be applied to correct it (and it should be

[3] As an explanation of this terminology, note that a 'bell curve' is like the phenomenon of setting grades so that most students get Cs, some get Bs and Ds, and a few get As and Fs. Defining a normal distribution based on the mean and variance means that the preparers had several price values, and from those price values they calculated an average value (or mean), which tells them where to center the bell curve (e.g. at a grade of a C), and they calculated a variance, which would tell them how wide to make it (e.g. greater variance would allow more As and Fs).

documented), or a Monte Carlo simulation might be used to simulate the results using the actual values of costs (that is, the raw data that were used to generate the mean and variance) instead of imposing a normal distribution on those costs. The selection of an appropriate distribution is a key part of the outcome of this analysis, since it determines the price values used to simulate the effects of the project.

Although we cannot determine the source of the price data used in the analysis, we can cross check it with another source of information about the expected effect of the project on shipping costs. For the percent change for ocean freight rates, from visual inspection of the graph on Page 16 of the Draft EA, it seems that the median probability for a decrease in ocean freight rates used in the Draft EA is somewhere between 12 and 13%. We can compare this 'expected' percent decrease in ocean freight rates to the difference in vessel operating costs used in Appendix E of the Bayonne Bridge Draft Air Analysis: $279.17/TEU for an example large ship of 10,000 TEUs, versus $305.85/TEU for an example smaller ship of 7,000 TEUs. In this example, the cost savings from switching from the 7,000 TEU ship to the 10,000 TEU ship is approximately 17.3%, much greater than the median value used in the induced demand analysis in Appendix I (of between 12 and 13%).

From Figure 2 of Appendix I, we can visually infer that if a value closer to 17.3% had been used, the forecasted change in total TEUs at the median would have been approximately 53,000 instead of what appears to be 38,000 at the median value used in the Draft EA. This translates to an estimated 40% greater increase in the cargo volumes for a change in ocean freight rates. Note that the median value is not used in the Appendix I analysis - instead a value of 34,205 (estimated as the expected value, discussed below) is used in Appendix I. However the difference in the median values that we observe calls into question the accuracy of the price data used in the analysis. We've only conducted this cost comparison for one of the three costs used to determine cargo shifts, as information about that cost is available in the Bayonne Bridge Draft Air Analysis.

3. **Use of expected values is not justified.** It is unclear why the expected value of the distribution of effects is used as the most relevant estimate of the project's induced demand. An expected value is essentially an average of a group of values; in this case it is the average of all of the predicted estimates of induced demand that result from combining the elasticities with the distribution of costs (described above). The use of expected value is most appropriate in situations where the benefits and costs can be weighed uniformly, e.g. in a situation where risk is not an issue; for this case the average value of what is likely to happen is the most important piece of information. However, in risk averse situations, it may not be appropriate to use the expected value to make a decision. For example, in analyses of environmental and health impacts, it is often useful to evaluate conservative estimates, e.g. to arrive at a moderately likely worst case scenario or a range of possible scenarios. If in evaluating the public health effects of the project, a preparer takes a risk averse approach, then we would expect to see a distribution of outcomes and their probabilities, or at least reasonably likely minimum/maximum estimates.

4. **Omitted costs.** The Bayonne Bridge Draft Air Analysis notes that some vessels currently make adjustments to pass under the Bayonne Bridge, but that these adjustments are costly

(page 8 of Air Draft Analysis). These costs do not appear to be quantified or included in the analysis in Appendix I, thus underestimating the potential effect of raising the bridge on cargo volumes.

5. **Omitted competing ports.** The induced demand analysis estimates cargo shifts related to the Ports of Los Angeles/Long Beach, Charleston, Savannah, and Norfolk (although from the description in Appendix I it is not totally clear how these Ports enter the model or affect the results). Page 18-14 in the Draft EA describes the reason for eliminating Philadelphia, Boston, and Baltimore: they currently handle a relatively small amount of cargo although they are located in the NY/NJ hinterland (within 260 miles). However, small cargo volumes may change over time, especially in relation to capacity expansion, population growth, and vessel size restrictions. Several ports that were not included in the analysis may become more serious market participants:
    a. Baltimore, which is Post-Panamax ready and is located just 180 miles from NY/NJ, saw 631,802 TEUs of container cargo in 2011, over 10% of volumes at the Port of NY/NJ in the same year [4]. By 2060 Baltimore is expected to import and export 2% of national container volumes, relative to 11.5% at the Port of NY/NJ (CPIP page 16). Baltimore is increasing capacity related to handling Post-Panamax vessels (footnote 1 on page 18-10 of the Draft EA).
    b. Wilmington and Philadelphia ports will both have channel depth restrictions deepened to 45 feet (footnote 1 on page 18-10 of the Draft EA). By 2060 Philadelphia is expected to carry 1.7% of national container volumes (CPIP page 16) and it is only 85 miles from the Port of NY/NJ.
    c. In Miami the channel will be deepened to 50 feet (footnote 1 on page 18-10 of the Draft EA). Miami will also be Post-Panamax ready. By 2060 Miami is expected to handle 6% of national container cargo (CPIP page 16). Although it is located much farther away from NY/NJ than mid-Atlantic and Southeast ports, it is not farther than Los Angeles/Long Beach, which are included in the analysis.
    d. Jacksonville is increasing capacity related to handling Post-Panamax vessels (footnote 1 on page 18-10 of the Draft EA).
    e. According to the Port Authority of New York & New Jersey (PANYNJ) website (http://www.panynj.gov/port/inland-access.html), the Port of NY/NJ competes with Halifax for cargo moving to Montreal and Toronto. Halifax is also noted as an alternative destination for large ships in the NEPA Workplan for this project (page 2-1 of NEPA workplan), and is noted as a port that can accept Post-Panamax ships (CPIP page 29).

Fundamentally, the Chapter 18 assertion that the project may cause cargo increases equal to 92,400 TEUs/year, or 74,000 TEUs west of the bridge out of a total of 10,650,000 TEUs/year west of the bridge, which amounts to an increase of 0.7% in forecasted cargo volumes, is not well substantiated, and cannot be taken at face value.

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[4] Estimated from data obtained at http://aapa.files.cms-plus.com/Statistics/NORTH%20AMERICAN%20PORT%20CONTAINER%20TRAFFIC%202011.pdf

An Alternative Baseline Cargo Forecast

The Draft EA and supporting analyses depend upon the assertion that the total number of containers moved through the Port of NY/NJ under the baseline (no build) will be precisely equal to the total number of containers moved through the Port of NY/NJ under the Raise the Bridge (build) Alternative. Chapter 18 of the Draft EA summarizes the forecasted TEU volumes west of the bridge in both 2020 and 2035 with and without the project (Draft EA, p. 18-12). Total TEUs under the build and no build scenarios are equal in both forecast years.

The Draft EA argues that because demand for goods is driven by local economic factors, shippers would continue to call on the Port of NY/NJ at the same rate in both scenarios, but under the no build conditions, shippers would use vessels with lower TEU capacity and smaller keel to mast heights (KTMH). The no build scenario does show a 'shift' to smaller vessels relative to the build scenario, but at no loss to overall throughput. Past analysis conducted for the Comprehensive Port Improvement Program (CPIP) has shown that design draft restrictions, which also limit the size of ships that can access the Port, can significantly reduce overall throughput at the Port, especially when other ports are undergoing simultaneous improvements. Why height restrictions would not limit throughput, but draft restrictions would is unclear, and is a crucial element to understanding what long-term demand may be induced from raising the bridge.

Chapter 18 and Appendix I, which present the induced demand analyses, are simply too opaque to determine whether current estimates are legitimate and have been derived using a reasonable approach. Consequently, we developed an alternative projection of the overall change in cargo volumes that may result from the raising of the Bayonne Bridge. This estimate is modeled on the analysis of the effects of deepening the ship channel presented in the CPIP (which, like Appendix I, was authored by Halcrow). Although the primary focus of the CPIP is to evaluate various Port improvement strategies, it also provides a dramatically different projection of Port cargo volumes that can be expected to occur with and without the dredging project (CPIP page 20). We base our methodological approach on the assumption that in terms of affecting the access of vessels of various sizes, removing the channel depth restriction is conceptually similar to the air draft restriction imposed by the bridge.

Our analysis uses rough scaling of the CPIP estimates to account for 1) growth that is forecasted at the Port if accessibility is not limited by the bridge (e.g. due to economic or population changes), 2) the possibility that shippers can choose to use smaller vessels and continue to use the Port of NY/NJ even if the air draft restriction is not removed, and 3) the possibility that shippers can choose to switch ports if the air draft restriction is not removed.

Before proceeding, we acknowledge that this approach is inexact; the exact distribution of ships that are restricted by a shallower channel is different than for the lower bridge. In other words, the design draft and air draft restrictions are not equivalent. As noted in the Bayonne Bridge Air Draft Analysis, the 50 foot dredging program was meant to accommodate vessels up to capacities of 7,000 TEUs whereas eliminating the air draft restriction will accommodate vessels with capacities greater than 7,000 TEUs (Bayonne Bridge Air Draft Analysis, p. 2). This is because beam and length are expected to increase in future (smaller vessel) fleets to provide additional capacity, but the design draft will not substantially exceed the current maximum of 47.5 feet (CPIP, p. 31). Because different vessels are restricted access in the case of a shallow channel and a low bridge, it is likely that shippers' incentives to shift to smaller vessels versus change Ports vary somewhat with the particular costs and logistical challenges associated with the usable vessel classes.

Additionally, the nature of the restrictions is different in terms of the access they allow for a subset of ships that are only marginally restricted, and the resulting incentives for shippers to change shipping operations for those ‘marginal’ ships. For example, The Bayonne Bridge Draft Air Analysis (page 8) notes that some ships that are close to the access restrictions are able to gain access to the Port by traveling during certain tidal conditions, traveling heavy (e.g. by taking on ballast water or adding cargo), or by modifying or damaging equipment at the top of the ship (e.g. antennae or GPS units). Thus, when the channel depth is the restriction, marginal ships would likely be better able to access the Port by traveling during high tide and by traveling ‘light’ when entering and leaving the Port. When the bridge acts as the restriction, travel during low tide, traveling ‘heavy’, and modifying the ship height may allow some ships to pass. While in theory the difference of traveling ‘heavy’ or ‘light’ implies a different restriction on the amount of cargo that can be carried by each of these ‘marginal’ ships, there is no indication that the modeled vessel loading and unloading rates vary in the cargo modeling we rely on in the CPIP, and according to the Draft EA only 40% of the cargo on a vessel is loaded or unloaded at a call (pp10-10, 18-18, Appendix I page 9). Furthermore, the Draft Air Analysis indicates that these operational changes (including carrying extra cargo) are sub-optimal operations and add to shipping costs due to delivery delays and added fuel costs (page 8).

Therefore, while the exact nature of the restrictions varies in terms of the vessel classes that can access the Port and the incentives for ships for whom port entry is marginal, these differences are likely not so great that the magnitude of the relationship between the shippers’ incentives and the constraints varies substantially. Fundamentally, in both the shallow channel and the lower bridge cases, shippers have restricted options related to the use of larger ships and must overcome the costs and logistical challenges associated with bringing large volumes of cargo to the Port on smaller ships. So while the estimate we develop below is inexact, this analysis provides an estimate of the *magnitude* of effects that raising the bridge will have on Port cargo volumes if the baseline had been determined using methods similar to those used in the CPIP. Our estimate could be refined if the more detailed documentation of the original CPIP analysis were available, which would have allowed us to follow the data and logic behind the CPIP analysis; unfortunately the documentation for that analysis is unavailable at this time.[5]

In summary, our estimate illustrates the *magnitude* of the potential for significant cargo growth effects associated with raising the bridge. We find that these potential impacts are 1 – 2 orders of magnitude greater than the impact arrived at in Appendix I of the Draft EA. Given the controversy surrounding the question of cargo growth at the Port of NY/NJ as a result of the Bayonne Bridge project, our assessment illustrates that performing an analysis like the one used to evaluate dredging in the CPIP has the potential to provide insight on potential impacts and appropriate mitigations related to Port growth from the Bayonne Bridge project. Moreover, our analysis strongly suggests that even with the limited data reviewed, there is a potential for significant environmental effects that the Draft EA has not considered.

[5] Notably, the CPIP study refers repeatedly to the “Task E Technical Memorandum” to support its projections of changing volumes in response to dredging. At the time of writing, this memorandum was not available online.

Baseline development

The CPIP study illustrated the effect of different dredging programs at the Port of NY/NJ on total cargo movements through the Port, accounting for activities at competing ports. That analysis considered the position of the Port of NY/NJ relative to the other US ports based on four factors: size of hinterland, shipping costs, port costs, and inland distribution costs (CPIP, p. 13). Varying the accessibility of the ports by making different assumptions about dredging programs altered these costs and thus affected forecasted demand for Port of NY/NJ calls. These results are reproduced in Table 1 and show expected TEU throughput at the Port of NY/NJ in 2020, 2040, and 2060 for two dredging scenarios (45 and 50 foot) and two assumed actions at other ports (either competing ports remain as they are when the analysis was conducted or they dredge to 50 feet to accommodate larger Post-Panamax vessels).

Table 1. Forecasted container volumes through the Port of NY/NJ (million TEUs) by deepening program. From CPIP Table 3.6, p 20. These volumes reflect total Port volumes, including Terminals on the east and west sides of the bridge.

Deepening program	2020 (Forecasted)	2040 (Forecasted)	2060 (Forecasted)
Other ports remain at present accessibilities			
1: 45’ dredge	6.1	9.5	13.2
2: 50’ dredge	6.2	10.4	15.0
Other ports dredge			
3: 45’ dredge	3.6	3.7	3.4
4: 50’ dredge	5.6	8.5	11.3

The CPIP indicated that the “most realistic future situation” was Case 4, whereby the Port of NY/NJ is dredged to 50 feet while all competing ports also dredge to 50 feet to accommodate increasing ship sizes. This case is forecasted to result in 11.3 million TEUs moving through the Port of NY/NJ by 2060. However, analysis of these results also reveals an important element associated with Port accessibility – dredging has the potential to restrict demand for the Port.

In Case 3, where the other ports dredge to keep up with increasing ship sizes but the Port of NY/NJ is dredged only to 45 feet, Port of NY/NJ demand falls to 3.4 million TEUs, significantly trailing forecasted growth if the Port of NY/NJ is dredged to 50 feet. In fact, by 2060, if other Ports dredge, the Port of NY/NJ is forecasted to see a 5.6% *decrease* in TEUs if dredging is to 45 feet, this compared to the forecasted 102% TEU increase if dredging is to 50 feet. Additionally, Cases 1 and 2 illustrate that if the other ports do not dredge, the market share of the Port of NY/NJ increases. Contrary to the assertions in the Draft EA, the 2005 CPIP analysis presents an expectation that shippers desiring to use Post-Panamax vessels, are largely forecasted to call at ports that can accommodate them. This means that without the dredging project, future demand should decline.

The Draft EA argues that Port volumes remain the same as all cargo shifts to smaller vessels if the bridge is not raised. The CPIP also presents an expectation of a shift to smaller vessels when Port access is restricted (the 45 foot dredge). However, while that shift is expected to reduce the extent to which shippers change ports, it is not expected to occur at a magnitude that maintains the exact same cargo throughput (as indicated in Table 1), which is what is assumed in the analogous assessment of the air draft restriction in the Draft EA. Table 2 shows CPIP’s projection of the number of vessels that would call at the Port of NY/NJ under two dredging scenarios (45 feet and 50 feet) in 2020, 2040, and 2060. Under both scenarios, calls shift to larger vessels in future years, while the total number of calls is less in every 45 foot scenario. However, Table 2 also shows that in 2040 there are a greater number of smaller (2,000 – 3,999 TEU) ships in the 45 foot dredge scenario than in the 50 foot scenarios, and similarly in 2060 there are more moderately sized (4,000 – 4,999 and 5,000 – 5,999 TEU) ships in the 45 foot dredge scenario than in the 50 foot scenario. Taken together, these results suggest that if the same basic supply and demand principles and the same ability to shift vessel sizes apply to the Bayonne Bridge raising project, an estimate of the no action/no build alternative where the air draft restriction still exists, then shippers should both 'shift' to smaller vessels (relative to the build scenario) and route shipments through other ports in response to restricted Port access; this would result in lower TEU throughput in the baseline (no build) alternative than in the build alternative.

Table 2. Number of vessels calling the Port of NY/NJ under two dredging scenarios. From CPIP page 30.

Vessel class (1,000 TEUs)	2000	2020		2040		2060	
		45'	50'	45'	50'	45'	50'
< 2,000	558	60	60	35	35	43	43
2,000 - 3,999	1,685	779	779	660	426	302	302
4,000 - 4,999	416	691	691	435	435	375	135
5,000 - 5,999	-	229	229	484	484	635	479
6,000 - 7,999	-	83	229	97	484	101	497
> 8,000	-	83	229	88	481	92	911
TOTAL	2659	1925	2217	1799	2345	1548	2367

The CPIP results presented in Table 1 are useful for constructing an analogy for the Raise the Bridge alternative, which can be used to develop a rough estimate of an alternative baseline. Both measures – dredging and raising the bridge – seek to increase the range of acceptable KTMH that can access terminal facilities to the west of the Bayonne Bridge, thereby increasing the size of vessels that can access the port. Dredging reduces restrictions on design draft (the distance from the water surface to the keel) whereas raising the Bayonne Bridge seeks to reduce restrictions on air draft (the distance from the water surface to the mast).

The CPIP demonstrated that it is possible for practical considerations on Port accessibility, including the vertical clearance afforded vessels, to affect the amount of goods moved through the Port. In order to determine an estimate of the proportion of estimated growth that is attributable to raising the bridge, we first disaggregate the growth forecasted in the CPIP as it relates to the dredging scenario, and then we apply that growth to the Bayonne Bridge project.

Note that the CPIP analysis assumes that the Bayonne Bridge air draft restriction will be eliminated, although "as ships get bigger the height restriction of Bayonne Bridge will become an increasing concern for container ship access along the Kill van Kull channel" (CPIP page 67-68), and the air draft restriction is listed as a 'risk' related to the plans evaluated in the CPIP (CPIP page 14 of executive summary). Although the CPIP assumes that raising the bridge will occur, it also states that

> The potential air draft restriction in the future at the Bayonne Bridge is an issue for container terminals at Port Newark South, Port Elizabeth, and Howland Hook. All Scenarios [which evaluate various Port improvements, not including the deepened channel] would be affected. [CPIP page 393]

Additionally, the Bayonne Bridge Air Draft Analysis posited a relationship between KTMH and container vessel capacity (Bayonne Bridge Air Draft Analysis, p. 9): if design draft is constant but ship size is increasing, air draft will increase and the Bayonne Bridge will restrict access to the Port of NY/NJ. Thus, the CPIP values include vessels that would be allowed in only if the bridge is raised.

Our analysis of the growth in the dredging scenarios follows several steps:

1. **Determine the number of TEUs arriving and departing at the Port of NY/NJ for each vessel class for each dredging scenario.**

   Vessel classes are based on those used in the CPIP, which differ from the Draft EA. The TEU values equivalent to the increase in vessels were not provided in the CPIP report. To convert these values, TEU/vessel rates were derived from cargo at terminals west of bridge as shown in Table 18-4, p. 18-12 of the Draft EA. Average values were used across each vessel category in each of the build conditions and in each analysis year. The converted TEU/vessel values are summarized in Appendix A (Table A 1).

   The number of vessels arriving and departing in each dredge scenario is then converted to TEUs. This was achieved using the TEU/vessel rates calculated in Table A 1 and the vessel category and vessel counts reported in Table 2.[6] The result is the total number of TEUs moved through the Port under each dredging scenario in each future year (Table 3). In the bottom of Table 3, these totals are compared to the total TEUs provided in the CPIP Table 3.6, p. 20 for the scenario where other ports dredge. We note that the results show the same general trends although their absolute values differ. However, this difference is not crucial because the TEU values are used only to determine percentage growth rates later in the analysis, rather than the absolute growth rates.

Table 3. Estimated TEUs moved through the entire Port of NY/NJ under two dredging scenarios.

Vessel class (1,000 TEUs)	Estimated TEUs (1,000)	2020		2040		2060	
		45'	50'	45'	50'	45'	50'
< 2,000	1821	109,268	109,268	63,740	63,740	78,309	78,309
2,000 - 3,999	1821	1,418,669	1,418,669	1,201,953	775,806	549,985	549,985
4,000 - 4,999	2800	1,935,031	1,935,031	1,218,146	1,218,146	1,050,126	378,045
5,000 - 5,999	2862	655,422	655,422	1,385,260	1,385,260	1,817,438	1,370,949
6,000 - 7,999	3578	296,958	819,318	347,047	1,731,660	361,359	1,778,171
>8000	5324	441,892	1,219,196	468,512	2,560,844	489,808	4,850,164
	TOTAL	4,857,241	6,156,906	4,684,658	7,735,455	4,347,024	9,005,623
Total throughput from CPIP, p. 20 (TEUs)		3,600,000	5,600,000	3,700,000	8,500,000	3,400,000	11,300,000

2. **Evaluate the ‘No shift; case: Determine the minimum growth that would occur in the 45 foot dredging scenario (restricted access to the Port).** This minimum estimate

[6] A table showing vessel counts and TEUs together (for each dredge scenario) is contained in Appendix A (Table A 2).

assumes that shippers use the same number of each size of ship that can access the restricted (45 foot dredged) Port as they would use in the unrestricted (50 foot dredged) scenario. This growth would occur if shippers faced with restricted access to the Port choose to change ports but do not choose to shift to small ships (relative to the unrestricted case).

Using the data from Tables 2 and 3, we can develop a minimum estimate of the effect of reduced accessibility on Port volumes. This minimum growth estimate assumes that smaller vessels are not in greater use in the restricted access scenario, and that larger vessels enter the Port only to the extent allowed by the restricted access. For this estimate of growth in the 45 foot scenario, we use the distribution of smaller vessels (< 6,000 TEUs) from the 50 foot scenario (thus eliminating a shift to smaller vessels) and keep the distribution of larger vessels as assumed in the 45 foot case.[7] Vessel counts and TEUs in this minimum case estimate are summarized in Appendix A, Table A 3. Not allowing for greater use of smaller vessels creates a lower estimate of TEUs moving through the Port of NY/NJ than would be obtained if greater use of smaller vessels were allowed in the restricted case.

3. **Evaluate the 'Shift' case: Recall the growth estimate forecasted in the CPIP analysis for the 45 foot dredging scenario (restricted access to the Port).** This growth would occur if shippers react to the Port restriction by both choosing other ports and by shifting to the use of additional small vessels relative to the unrestricted case.

   This estimate is simply obtained from the CPIP growth estimates shown in Table 1. This growth estimate is greater than the minimum estimate arrived at above.

4. **Evaluate the 'Maximum' possible Port growth: Recall the maximum growth that would occur – this occurs in the 50 foot dredging case (unrestricted access to the Port). This is the maximum potential growth that would occur at the Port without a restriction on Port accessibility.** This case obviates the need to change ports or shift the number of small ships in use – shippers have free access to the Port of NY/NJ. This estimate fully accounts for increased demand for the Port due to overall growth in freight volumes unhindered by restrictions to Port access, e.g. from economic and population growth.

   This estimate is simply based on the growth forecasted in the unrestricted (50 foot dredging) scenario. This results in the highest estimate of TEUs moving through the Port of NY/NJ.

5. **Of the maximum possible growth that is forecasted to occur (in the unrestricted case), determine the portion that would occur in the restricted case due to the shift to small vessels rather than changing ports.**

[7] Only vessels < 6,000 TEUs are used in greater numbers in the 45 foot dredging case. Fewer large vessels are in use in the 45 foot dredging case in 2040 and 2060 due to restrictions in Port access.

The portion of maximum possible growth that would occur in the restricted access case due to a shift to smaller vessels is estimated based on the values above. Table 4 summarizes the values obtained in Steps 2 – 4 above for both CPIP dredging scenarios for each year of analysis. For each Port restricted (45 foot dredging) scenario, there are two columns in the first row. The first column contains TEU values assuming the minimum growth case with increased use of other ports but no increased use of smaller vessels in the reduced accessibility scenario, as described in Step 2 ("No shift"). The second column contains TEU values assuming that shippers increase their use of other ports and also increase the use of smaller vessels in the reduced accessibility scenario, as described in Step 3 ("Shift"). The third column then shows the TEUs in the unrestricted access (50 foot dredging) scenario, representing growth in the maximum Port accessibility case, as described in Step 4 ("50'").

To determine the share of maximum possible growth that is attributable to the shift to smaller vessels in the restricted case, the TEUs attributable to the shift to smaller vessels are calculated as the difference between the "Shift" and "No shift" scenarios, and are shown for each year on the second row. The final row calculates the percentage of maximum possible growth that is attributable to the shift to smaller vessels relative to the 'No shift' case. In other words, the final row represents the share of the maximum possible Port growth that can be achieved simply through shifting to smaller vessels if access to the Port is restricted for larger vessels.

Table 4. Derived TEUs under two dredging scenarios assuming both a shift and no shift to smaller vessels. Calculated based on data from CPIP, p. 30.

	2020			2040			2060		
	No shift (45')	Shift (45')	Max (50')	No shift (45')	Shift (45')	Max (50')	No shift (45')	Shift (45')	Max (50')
TEUs	4,857,241	4,857,241	6,156,906	4,258,511	4,684,658	7,735,455	3,228,455	4,347,024	9,005,623
TEUs attributable to shift			-			426,147			1,118,569
% of maximum growth attributable to shift to smaller vessels	0.00%			12.26%			19.36%		

6. Apply logic used in Steps 1 – 5 to the Bayonne Bridge project.

We then apply this logic to estimate the effect of raising the Bayonne Bridge on cargo volumes moved through the Port, assuming that incentives to increase the use of smaller vessels are similar[8] for each restriction in Port accessibility (lack of dredging and lack of bridge raising). First, we obtain the number of vessels and TEUs by vessel class for 2020 and 2035 for the restricted (no bridge raising) and unrestricted (bridge raising) cases (from p. 18-12 of the Draft EA), similar to Step 1 above. Note that these values are for terminals west of the bridge only. These results are shown in Appendix A (Table A 4).

Table 5 summarizes the application of Steps 2 – 5 to the Bayonne Bridge project. The table shows TEU volumes for the minimum growth forecasted in the restricted case under

[8] As noted above, this assumption is conceptually similar but inexact, providing an indication of the *magnitude* of effects, though likely not the exact effects.

a “No shift” scenario. As in Step 2 that this is calculated assuming that shippers choose to change ports but maintain the distribution of smaller vessels as in the unrestricted scenario (in this case, the restriction is bridge raising and smaller vessels are < 7,000 TEUs) while eliminating vessels that cannot access the Port in the restricted access scenario (in this case, vessels with capacity greater than 7,000 TEUs that cannot enter with the current bridge height).

The variable *x* in Table 5 represents the “Shift” value, or the expected TEUs in the case where the bridge is not raised, shippers choose other ports, and also shift their fleet distributions to smaller vessels in response to the Port restriction (analogous to Step 3). The “Max” value reflects the unrestricted (bridge raising) TEU volumes, as in Step 4. Note that the Draft EA assumes that the “Max” and “Shift” volumes are equal, but we have shown that the CPIP analysis supports the derivation of a TEU volume that is lower for “Shift” than “Max.”

Finally, we seek to solve for the “Shift” value *x* using the portion of the maximum possible growth that is attributable to a shift in vessels – we use the value derived for the dredging case, as determined in Step 5. Information in the CPIP (as shown in Table 4) is provided for 2020, 2040 and 2060. We can translate this information to 2035 (the year of interest in the Draft EA) using linear interpolation between 2020 and 2040. Thus the percentage increase in the maximum possible growth attributable to the shift to smaller vessels in 2035 in the port dredging case is 9.2%.[9] To solve for *x* in Table 5, we equate the percentage increase in maximum possible growth relative to the minimum case of “No shift” attributable to shifting fleet distributions with 9.2%. The resulting growth of 7,401,512 TEUs west of the bridge is our estimate of baseline cargo volume that would occur if the bridge is not raised.[10] **The incremental TEU growth attributable to the bridge in 2035 is therefore 10,647,800 – 7,401,512 = 3,246,288 TEUs**. Relative to 2000, without the bridge raising growth west of the Port would be 41%[11] and with the bridge raising growth would be 103%.[12] Overall, the unrestricted scenario (bridge raising) yields forecasted cargo volumes that are 44% greater than the restricted scenario (no bridge raising) at terminals west of the Port. Put another way, cargo volumes in the restricted case are 30% lower than in the unrestricted case at terminals west of the Port.

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[9] Note that in 2020 no shift is shown. However, extrapolating values from the 2040 and 2060 data yields a similar value of 10%, resulting in a change in the final TEU projection of approximately 0.4%. As this estimate is provided as an approximation of the potential magnitude of the effects rather than an exact projection, that magnitude is not greatly affected by the choice of interpolation versus extrapolation.

[10] Solving (x –3,426,728)/3,575,010 = 0.9195.

[11] (7,401,512 – 5,249,759)/5,249,759 = 41%

[12] (10,647,800 – 5,249,759)/5,249,749 = 103%.

Table 5. TEUs under two bridge raising scenarios assuming both a shift and no shift to smaller vessels. Calculated based on data from Chapter 18 of the Draft EA, p. 18-12. Values shown are for cargo movements west of the bridge.

	2035		
	No shift (No raise)	**Shift (No raise)**	**Max (Raise bridge)**
TEUs	7,072,790	x	10,647,800
TEUs attributable to shift	x - 7,072,790		
% of maximum growth attributable to shift to smaller vessels	(x - 7,072,790)/3,575,010		

For context about the potential magnitude of the shifts that may result from the Panama Canal expansion, we note that the Bayonne Bridge Draft Air Analysis describes uncertainty surrounding the degree to which the expansion of the Panama Canal will lead to an increase in goods moving from the Far East to the US East Coast via ship instead of via US West Coast ports and overland rail (page 14). This 'Panama bump' is therefore excluded from the projections used in the Draft Air Analysis. However, a sensitivity analysis in Appendix B of that document varies the cargo projections by up to 50 % in order to account for this uncertainty. This value is of a similar magnitude to the estimated differences in growth derived above.

In the remainder of our analysis, we assess the potential impacts of the additional of cargo moving through the entire Port of NY/NJ for 2035 if the bridge is raised (3,246,288 TEUs). As noted earlier, this estimate is inexact, so the exact values used are of less value than their magnitude. The estimated cargo volumes west of the bridge in the unrestricted case are 44% higher than in the restricted case, which translates to 34% Port-wide if we conservatively assume that 20% of Port volumes move through terminals east of the bridge in 2035 (2,129,560 TEUs) and that those terminals experience no change in cargo volumes. A 34% increase in Port-wide cargo volumes in the unrestricted case (or a 25% reduction in Port-wide cargo volumes in the restricted case), is one to two orders of magnitude greater than the 0.7% Port-wide difference arrived at in the Draft EA's induced demand analysis. The magnitude of this potential growth effect of the project is directly relevant to the need to reevaluate impacts and potentially, project mitigations.

EFFECTS OF CARGO GROWTH ON TRUCK AND RAIL TRAFFIC LEAVING THE PORT

Recall that the Port indicated a 0.7% increase in cargo and deemed this insignificant relative to the presented forecasted cargo in 2035. Following the evaluation of the change in cargo volumes, Chapter 18 of the Draft EA translates the additional cargo volumes into truck trips and rail trips leaving the ports. This analysis relies on a number of critical oversimplifications. Below we enumerate several means for providing more detailed estimates of several pieces of the analysis. These estimates are based on documents that support the analysis in the Draft EA. We then use this added detail to translate the additional cargo volumes into truck and rail trips leaving the Port.

Reevaluation of Draft EA Assumptions About Mode Split of Cargo Leaving the Port

1. **Share of cargo at each terminal west of the Bayonne Bridge.** The share of cargo volumes traveling west of the bridge seems to be assumed constant over time at 80% (p 18-15 – 18-16 of the Draft EA). This seems to contradict historic trends that indicate that cargo growth west of the bridge is greater than the rest of the Port of NY/NJ due to the increasing share of container vessels (p 18-4, 18-11 of the Draft EA). The Draft EA also seems to assume that the induced freight volumes that travel west of the bridge are then divided evenly between all three terminals (Howland Hook, Elizabeth, and Newark) (Draft EA, p. 18-17). Given the fact that 'the Port-Newark-Elizabeth Marine Terminal complex is the largest and busiest cargo facility in the Port of New York and New Jersey" (Draft EA, p. 1-3), this seems unlikely, particularly when Table 2 of the Bayonne Bridge Draft Air Analysis indicates that the assumed available annual throughput in TEUs of the Port Newark/Elizabeth is 8,138,750 while at Howland Hook it is 1,785,000. Finally, according to data at http://www.panynj.gov/port/containerized-cargo.html, Howland Hook (the New York Container Terminal) has 9 cranes and 3,000 feet of ship berth, the Port Newark Container Terminal has 9 cranes and 4,400 feet of ship berth, and Port Elizabeth (Maher and APM terminals combined) has 31 cranes and over 16,000 feet of ship berth.

   Realistically, it is more likely that the majority of induced cargo volumes would be unloaded at the Port Elizabeth Terminals, unless substantial changes in the share of capacity (or hitting capacity limits) at these terminals is expected. To provide an estimate of the share of containers moved through each terminal, in the absence of detailed projections from a more recent source we rely on the CPIP (page 139), which provides baseline values for the share of each cargo type moved through each terminal through 2060 (see Table 6.) These values may change marginally with reconfigurations of each Terminal, but reflect the general capacity of the land at each Terminal, regardless of future configurations.

   Table 6: Share of container cargo forecasted at each Port of NY/NJ Terminal. From CPIP page 139.

Terminal	2000	2020	2060
Newark	12.3%	14.4%	14.4%
Elizabeth	61.5%	63.4%	63.4%
Howland Hook	15.1%	11.3%	11.3%
Terminals East of the bridge	11.1%	11.0%	11.0%

2. **Truck/Rail mode split of cargo leaving each terminal.**[13] The induced freight traffic is assumed to travel by truck 20% of the time because "typically, 80 percent of cargo is transported by rail and 20 percent by truck" (Draft EA p.18-15, also assumed on 18-16). This directly conflicts with information provided elsewhere, which indicates that 85% of container cargo leaving the port terminals is transported by truck, while 14% leaves by rail and 1% by barge (CPIP page 107).[14] Chapter 18 seems to gloss over the logic presented in other supporting documents, which indicate that the mode split is a function of the induced cargo's inland origin and destination, and because the induced cargo is assumed to arrive and depart from more distant locations, it may have a larger rail share than the overall mode split of all cargo leaving the Port (e.g. as described in the CPIP). The mode split should also be examined at a terminal specific level (as each terminal may have different rail and truck access). Furthermore, if the concern is local truck traffic leaving the Port rather than regional or national truck mileage, it should also be examined in terms of cargo leaving the Port rather than the mode via which cargo leaves the region. Thus, we discuss the mode split in the context of three factors:
    a. **Mode used to transport cargo to its origin/destination, where induced cargo may have an atypical origin/destination profile:**
    In several places the induced cargo is described as coming from areas farther than 260 miles from the Port (p. 18-14, Appendix I page 4), as well as between 260 and 400 miles from the Port (Bayonne Bridge Air Draft Analysis, Appendix E, page 1). In one place, cargo traveling from farther than 260 miles is described as 'primarily transported by rail' (Appendix I page 4). However, in a number of places, 400 miles is indicated as distance where cargo is transported by rail (CPIP, Executive Summary page 7, CPIP page 114, Bayonne Bridge Air Draft Analysis Appendix E page 1-2). Elsewhere in the CPIP the 400 mile distance is reduced in aspirational assessments of 'enhanced' rail scenarios, but no binding actions that will ensure these shifts are known at this time. The analysis of the cost of switching ports provided in the Bayonne Bridge Air Draft Analysis relies on estimated truck mileage (Bayonne Bridge Air Draft Analysis, Appendix E.) Because the EA defines the distance to the edge of the primary hinterland as 260 miles, and because most sources cite 400 miles as the distance for rail to be competitive, it seems likely that significantly less than 80% of cargo shifting will travel by rail.
    b. **Mode split at each Terminal:** Each Port terminal has different access to roads and rail, so the mode split leaving each terminal can be expected to vary. The CPIP provides mode shares by terminal for an 'enhanced' scenario which involves reconfiguring the areas at each terminal (page 110). Because this does not reflect current or committed future conditions (and mode splits for current and future conditions were unavailable), we do not alter the Draft EA assumption that mode splits are uniform for all three terminals west of the bridge.

[13] Similar concerns are raised by EPA personnel, as gleaned through a document made available through a Freedom of Information Act request: an email from Formosa on 12-12-12. CEQ also raises a similar concern in a 11-26-12 document of comments and responses to EPA and CEQ comments.

[14] Aspirational mode shares that increase the rail portion are also provided in the CPIP, although there do not appear to be committed actions toward achieving these shares.

c. **Cargo that leaves the region by rail leaves the Port by truck:** Cargo can be put on trains at on-dock rail yards or near-dock rail yards that are located on the Port property, in which case the mode leaving the Port is the same as the mode leaving the region. However, some cargo may leave the Port by truck and travel to off-site intermodal yards or warehouses where it is transferred to trains. In this case, the cargo leaves the Port on trucks but leaves the region on trains, so it will still affect truck traffic in the communities near the Port. In the discussion in the Draft EA and other documents, it is difficult to determine whether the mode splits discussed above are defined leaving the Port or the region. However, from the text in the CPIP it is clear that some rail facilities are on-dock while others are not (e.g. CPIP pp 192-193, with additional descriptions in Volume 1 Appendix C). There are other indications that some traffic that leaves the Port by truck goes on to leave the region by rail. For example, in the CPIP, the analysis runs through an example of truck versus rail costs, and notes that for inland rail terminals, local drayage will be about 20 miles (page 117). From surveys of Port truck drivers, it seems that approximately 6% of trucks that leave the Port travel to rail yards off-site (Port Truck Origin-Destination Survey, page II-7), while many more go to warehouses, where freight may leave via truck or rail. Thus, the use of rail/truck mode splits may underestimate truck shares near the Port, if the splits used are based on mode splits leaving the region. The extent to which this occurs in our estimates is unknown.

Overall, we conclude that it is unlikely that as little as 20% of the induced container cargo will leave the Port by truck. At the same time, it is unlikely that as many as 85% of induced cargo will leave by truck. Without an accurate estimate of the mode split of the induced cargo, we can use these estimates as a minimum and maximum, so in our analysis we use a range to reflect this uncertainty, assuming that anywhere between 20% and 85% of the induced cargo will leave the Port by truck.

3. **Timing of truck traffic leaving the Port**. In estimating the impacts of induced demand at the port, the EA divides the induced annual truck trips by 52 weeks, 5 days per week, and 10 hours per day to arrive at an hourly estimate of truck trips (Appendix I, page 15). Elsewhere in the document, a 50 week year is assumed (10-9), presumably to account for holidays throughout the year. Assuming a 50 week year results in peak travel estimates that are 4% higher than those obtained using a 52 week year. While this is a minor difference, we note that the Draft EA assumption of uniform travel throughout the day (i.e. a lack of a peak) is counterintuitive. Trucks are more likely to time their arrivals and departures such that they can take advantage of off-peak flows in general commuter traffic or other logistical constraints related to pickups and deliveries. This is reflected in the 2005 CPIP with the use of a ‘peaking factor’ related to moving cargo from the yard to the gate (CPIP page 47) as well as for truck traffic (CPIP page 151). Similarly, for the Ports of LA/Long Beach, the model used to estimate truck trip generation model

(QuickTrip), accounts for peak activities, modeling traffic for the day and the peak hour.[15]

In contrast, the Draft EA simply states that the Port strives to avoid valleys and peaks by scheduling departures and describes relatively constant activity since movement of freight from the Port occurs over periods of several days for a given vessel's shipments. While this may indicate that any tendency toward peaking is reduced (and it seems to have been implemented after the CPIP's release), without information about actual/observed/scheduled peak truck or rail travel from the Port terminals, there is no way to verify whether peaking does or does not occur.

Hourly truck counts on routes to and from the port, or at the port gates, might provide more insight on traffic patterns. If peaking does, in fact, occur, then peak emissions from truck traffic entering and leaving the Port would likely be higher, resulting in greater health risks in the communities near the Port.

Estimated Effects of Port Growth on Truck Travel

The overall effect of the assumptions developed above and their cumulative effects on estimated truck traffic are summarized using the estimate Port-wide growth reflected in the Draft EA in Table 7 and using our alternative estimate of Port growth west of the bridge in Table 8. Consistent with the preceding discussion, we were unable to account for any truck traffic peaking that may occur during the day. Additionally, we retained most of the rail related assumptions (except for the truck/rail split) presented in the Draft EA (see page 18-17), as local truck traffic is the primary concern in communities surrounding the Port. We also retained the conversion of TEUs to containers used in the Draft EA, which assumes that the TEU to container ratio is 1.7 and then multiplies by 1.6 to account for the fact that some drivers arrive and depart with a container versus with empties (page 18-15.)

The values in the first four lines of each table reflect the accumulation of the assumptions about how cargo added from the project translates to peak truck trips and rail traffic leaving the Port (Table 7) or terminals west of the bridge (Table 8) (corresponding the location of the Port growth estimated in each case). The final line in Table 7 shows how using the induced demand estimate from the Draft EA (0.7% growth) with the Draft EA assumptions about cargo mode splits on the left and our modified assumptions related to modes on the right; using our mode split assumptions yields an estimate of truck trips as much as 10 times larger at the Port of Elizabeth. Similarly, the final line in Table 8 shows the effect of using our alternative Port growth estimate with the Draft EA mode split assumptions on the right and with our modified mode split assumptions on the left. Overall, using our estimated Port growth projection yields estimates of peak truck trips leaving the Elizabeth Terminal range from 78 – 739 trips/hour, while at Newark the estimated range is 40 – 168 peak truck trips/hour and at Howland Hook it is 31 – 132 peak truck trips/hour.

port cargo growth estimates are inexact and should be interpreted in terms of their overall magnitude.

To put these estimates in context, we can compare these values to overall Port truck traffic for terminals west of the bridge. We estimate that approximately 41,000 one way truck trips/day

[15]Page 3.10-21, Southern California International Gateway Project Recirculated Draft Environmental Impact Report, 9/2012. Los Angeles Harbor Department. http://www.portoflosangeles.org/EIR/SCIG/RDEIR/rdeir_scig.asp

travel to and from the port terminals west of the bridge in 2035. The estimated truck trips that result from the project vary widely with the assumptions about mode splits and, more importantly, changes in cargo volumes. The estimates above can be restated in terms of daily trips, yielding 54 truck trips/day from all three terminals using the Draft EA assumptions. Using SSR mode splits and Draft EA cargo volumes, the estimate ranges from 63 – 268 truck trips/day. Using Draft EA mode splits and SSR cargo volumes, the estimate is 2,340 truck trips/day. Using SSR mode split assumptions and SSR cargo volumes, the estimate ranges from 2,450 – 10,390 truck trips/day.

Table 9 summarizes the estimated findings of Tables 7 and 8, showing estimated changes in truck and train trips that are projected to occur from the project using each combination of mode split and cargo volume assumptions. These values are used to assess potential air quality impacts in the section that follows. Recall from our earlier discussion that values that rely on the SSR

Table 7: Summary of cargo growth mode split assumptions and their effect on estimated 2035 truck and rail travel from each terminal using Draft EA Port-wide cargo growth projections. Terminals are abbreviated as E = Elizabeth, N = Newark, HH = Howland Hook.

	Draft EA		SSR Revised	
	Assumption	**Estimated share of all port cargo growth**	**Assumption**	**Estimated share of all port cargo growth**
Mode Split assumption: Share of cargo at each terminal west of Bridge	80% * 33% at each terminal	26.6%: E 26.6%: N 26.6%: HH	63.4%: E 14.4%: N 11.3%: HH	63.4%: E 14.4%: N 11.3%: HH
Mode Split assumption: Truck share at each terminal	20% truck at each terminal	Truck share: 5.3%: E 5.3%: N 5.3%: HH	20 - 85% truck at each terminal	Truck share: 12.7–53.9%: E 2.9%-12.2: N 2.3%-9.6: HH
Mode Split assumption: Timing of truck leaving the port	Uniformly divided over 10hrs/day, 5 days/week, 52 weeks/year. This yields 0.038% of annual TEUs traveling in a peak hour	Truck peak hour: 0.00205%: E 0.00205%: N 0.00205%: HH	Uniformly divided over 10 hrs/day, 5 days/week, 50 weeks/year. This yields 0.040% of annual TEUs traveling in a peak hour, although it is likely higher if there is any degree of peaking throughout the day.	Truck peak hour: 0.0051–0.022% E 0.0012-0.0049%: N 0.0009–0.0038%: HH
Mode Split assumption: Rail travel from terminals west of the bridge	80% of cargo arriving west of the bridge leaves terminals as rail, 365 days/year, 272 containers/train	Train peak (trains/day): 0.064% of annual cargo increases leaving from E, N, HH combined	15 - 80% of cargo arriving west of the bridge leaves terminals as rail, 272 containers/train	Train peak (trains/day): 0.0012 – 0.064% of annual cargo increases leaving from E, N, HH combined
Port Growth Assumption: Additional traffic due to the project, using Draft EA estimate of project growth due to the project	**92,400 additional TEUs/year in the unrestricted case, at the entire Port. Equivalent to 0.7% less cargo Port-wide in the restricted case.**	**Peak truck trips[16]/hr: 1.8: E 1.8: N 1.8: HH Trains/day: 0.6 (E + N + HH combined)**	**92,400 additional TEUs/year in the unrestricted case, at the entire Port. Equivalent to 0.7% less cargo in the restricted case.**	**Peak truck trips[17]/hr: 4.4-18.8 E 1.0-4.3: N 0.8–3.3: HH Trains/day: 0.1– 0.6 (E + N + HH combined)**

[16] TEUs are converted to truck trips assuming that the TEU to container ratio is 1.7 and then multiplying by 1.6 to account for the fact that some drivers arrive and depart with a container versus with empties (p 18-15 of Draft EA.)

Table 8: Summary of cargo growth mode split assumptions and their effect on estimated 2035 truck and rail travel from each terminal using the SSR alternative cargo growth projections, which occur west of the bridge only. Terminals are abbreviated as E = Elizabeth, N = Newark, and HH = Howland Hook.

	Draft EA		SSR Revised	
	Assumption	**Estimated share of all port cargo growth**	**Assumption**	**Estimated share of all port cargo growth**
Mode Split assumption: Share of cargo at each terminal west of Bridge	33% at each terminal (Excludes the 80% term because all cargo is already west of the bridge)	33%: E 33%: N 33%: HH	63.4/89.1 : E 14.4/89.1: N 11.3/89.1: HH (Scaling to account for the share of only cargo at terminals west of the bridge)	71.2% E 16.2%: N 12.7%: HH
Mode Split assumption: Truck share at each terminal	20% truck at each terminal	Truck share: 6.6%: E 6.6%: N 6.6%: HH	20 - 85% truck at each terminal	Truck share: 14.2–60.5%: E 3.2-13.7%: N 2.5-10.8%: HH
Mode Split assumption: Timing of truck leaving the port	Uniformly divided over 10hrs/day, 5 days/week, 52 weeks/year. This yields 0.038% of annual TEUs traveling in a peak hour	Truck peak hour: 0.0025% E 0.0025%: N 0.0025%: HH	Uniformly divided over 10 hrs/day, 5 days/week, 50 weeks/year. This yields 0.040% of annual TEUs traveling in a peak hour, although it is likely higher if there is any degree of peaking throughout the day.	Truck peak hour: 0.0057–0.024% E 0.0013-0.0055%: N 0.0010–0.0043%: HH
Mode Split assumption: Rail travel from terminals west of the bridge	80% of cargo arriving west of the bridge leaves terminals as rail, 365 days/year, 272 containers/train	Train peak (trains/day): 0.081% of annual cargo increases leaving from E, N, HH combined	15 - 80% of cargo arriving west of the bridge leaves terminals as rail, 272 containers/train	Train peak (trains/day): 0.0015 – 0.081% of annual cargo increases leaving from E, N, HH combined
Port Growth Assumption: Additional traffic due to the project, using SSR alternative estimate of project growth due to the project	**3,246,288 TEUs/year in the unrestricted case, at locations west of the bridge. Equivalent to 25% less cargo Port-wide in the restricted case.**	**Peak truck trips[17]/hr:** **78: E** **78: N** **78: HH** **Trains/day: 26.2** **(E + N + HH combined)**	**3,246,288 TEUs/year in the unrestricted case, at locations west of the bridge. Equivalent to 25% less cargo Port-wide in the restricted case.**	**Peak truck trips[18]/hr:** **174 – 739: E** **40 - 168: N** **31 - 132: HH** **Trains/day:** **4.9 - 26.2** **(E + N + HH combined)**

[17] TEUs are converted to truck trips assuming that the TEU to container ratio is 1.7 and then multiplying by 1.6 to account for the fact that some drivers arrive and depart with a container versus with empties (p 18-15 of Draft EA.)

port cargo growth estimates are inexact and should be interpreted in terms of their overall magnitude.

To put these estimates in context, we can compare these values to overall Port truck traffic for terminals west of the bridge. We estimate that approximately 41,000 one way truck trips/day travel to and from the port terminals west of the bridge in 2035. [18] The estimated truck trips that result from the project vary widely with the assumptions about mode splits and, more importantly, changes in cargo volumes. The estimates above can be restated in terms of daily trips, yielding 54 truck trips/day from all three terminals using the Draft EA assumptions. Using SSR mode splits and Draft EA cargo volumes, the estimate ranges from 63 – 268 truck trips/day. Using Draft EA mode splits and SSR cargo volumes, the estimate is 2,340 truck trips/day. Using SSR mode split assumptions and SSR cargo volumes, the estimate ranges from 2,450 – 10,390 truck trips/day.

Table 9: Summary of effects on mode split and cargo growth assumptions on 2035 cargo flows at the Port.

Scenario	Additional Port-wide cargo in the unrestricted case (TEUs)	Decrease in Port-wide cargo in the restricted case (%)	Additional peak truck trips that result from the project (truck trips/hr)[19]	Additional train trips that result from the project (trains/day)
Draft EA mode splits, Draft EA cargo growth	92,400	0.7	1.8: Elizabeth 1.8: Newark 1.8: Howland Hook	0.6 (from all locations west of the bridge)
SSR mode splits, Draft EA cargo volumes	92,400	0.7	4.4 – 18.8: Elizabeth 1.0-4.3: Newark 0.8 – 3.3: Howland Hook	0.1 – 0.6 (from all locations west of the bridge)
Draft EA mode splits, SSR cargo volumes	3,246,288	25	78: Elizabeth 78: Newark 78: Howland Hook	26.2 (from all locations west of the bridge)
SSR mode splits, SSR cargo volumes	3,246,288	25	174 - 739: Elizabeth 40 - 168: Newark 31 - 132: Howland Hook	4.9 -26.2 (from all locations west of the bridge)

[18] Based on total daily truck trips inferred from the base case in the CPIP pp 161, 172. In 2020 we estimate that the total number of one way truck trips from all three terminals (counting trucks using Doremus Ave, Port Street NW, and North Ave for Elizabeth/Newark, and Gulf and Goethels Roads for Howland Hook) equals 28,000. In 2040 the value is 45,500. Linearly interpolating gives a value of 41,125 truck trips in 2035.

[19] To convert hourly truck trips to daily truck trips we can multiply by 10 since the assumption about truck timing is that truck trips are evenly split over the 10 hour work day. To convert to years, estimates using the Draft EA mode splits can be multiplied by 10*5*52, and estimates using the SSR mode splits can be multiplied by 10*5*50.

POTENTIAL AIR QUALITY IMPACTS OF PROJECT-RELATED PORT GROWTH ON COMMUNITIES NEAR THE PORT

In several places the Draft EA indicates that increases in port cargo are not 'substantial' or 'significant' or are 'negligible.' However, no criteria are presented to support this threshold assertion, so it is unclear what level of change would be deemed 'significant.' The effects of changes in truck and rail trips per day are presented as the marginal change without reference to their share of total traffic (e.g., the project will result in 54 truck trips per day west of the bridge, but the total number of truck trips associated with the west of bridge Port area is not provided), only the overall magnitude of induced demand (0.7% of TEUs moving through terminals west of the bridge) is provided.

In terms of assessing the impacts of that change, pages 18-17 of the Draft EA states that there is no effect of increased travel from the port because the Port terminals west of the bridge are within areas classified as environmental justice communities, but much of the area is industrial and has easy access to highways and rail, so the Draft EA asserts that the small number of additional trips resulting from induced demand 'would avoid residential areas and other sensitive land uses, thereby avoiding adverse impacts in those areas.' No maps are provided, nor are distances between areas with changing activities and the nearest sensitive land uses, and traffic, air quality, and noise effects are not quantified in Chapter 18 or the other Draft EA chapters related to these topics.

The lack of evaluation of impacts seems to be inconsistent with the Response to Scoping Comments in the NEPA Workplan, in which the Coast Guard makes a number of statements to reassure concerned commenters that these indirect impacts at the port terminals west of the bridge will be evaluated, without indicating the implied threshold of significance that seems to guide the EA itself:

- "*Any* increase, *and the impacts associated with that increase*, that may occur due to the diversion of cargo from other ports will be documented in the EA" [page 21 of Response to Scoping Comments in NEPA Workplan, emphasis added].
- "The EA will include *any* communities that are *potentially adversely affected* by operation and/or construction of the project to determine if these effects are disproportionate and high to any low-income and minority communities" [page 25 of the Response to Scoping Comments in NEPA Workplan, emphasis added].
- "To the extent that the proposed action would increase freight flows at the marine terminals west of the Bayonne Bridge over the No Action Alternative, the EA will document this *and any potential adverse effects* from the processing of this additional cargo" [page 27 of the Response to Scoping Comments in NEPA Workplan, emphasis added].
- "The EA will document the number of containers estimated to be delivered by the categories of ships with and without the project *and assess the potential environmental effects of these two conditions*." [page 28 of the Response to Scoping Comments in NEPA Workplan, emphasis added]

If the changes in Port cargo volumes are deemed significant (as indicated in the analysis above), it becomes important to evaluate the impacts of Port activities. The potential project effects established above can be used to provide a rough estimate of some impacts. In this section we explore the project's potential effects on air pollution in communities near the Port. [20]

Air pollution estimates

The effect of additional truck emissions on the surrounding local community is a function of the current background pollution levels and any additional pollutants generated by the proposed project. The additional pollutants generated by the project are caused by induced truck, marine vessel and rail traffic as well as cargo handling equipment (e.g., cranes, forklifts, straddle carriers (CPIP, pg 297) that results from potential additional cargo movements if the bridge is raised (as discussed above). The vast majority of the generated pollutants, HC, NO and PM, are by-products of diesel combustion. These pollutants vary in time (e.g. seasons, throughout the day) and space (e.g. downwind of areas with high levels of emissions). For example, all modes of cargo have "…peaks and troughs in the external traffic flow due to industry preferences and opening times of terminals (CPIP, pg 274)."

Air pollution emissions can be estimated by combining information about the emissions factors for a piece of equipment (how much it emits when in use) with information about its use (e.g. distance traveled, speed or intensity of use, number of vehicles, etc.) We have derived an approximate estimate of the additional pollutants for NO_x, PM_{10}, and $PM_{2.5}$ generated at the Ports and from cargo handling activities at the port, marine vessel emissions, and from truck travel moving through Port communities under the varying estimates of changes in induced traffic presented in port cargo growth estimates are inexact and should be interpreted in terms of their overall magnitude.

To put these estimates in context, we can compare these values to overall Port truck traffic for terminals west of the bridge. We estimate that approximately 41,000 one way truck trips/day travel to and from the port terminals west of the bridge in 2035. The estimated truck trips that result from the project vary widely with the assumptions about mode splits and, more importantly, changes in cargo volumes. The estimates above can be restated in terms of daily trips, yielding 54 truck trips/day from all three terminals using the Draft EA assumptions. Using SSR mode splits and Draft EA cargo volumes, the estimate ranges from 63 – 268 truck trips/day. Using Draft EA mode splits and SSR cargo volumes, the estimate is 2,340 truck trips/day. Using SSR mode split assumptions and SSR cargo volumes, the estimate ranges from 2,450 – 10,390 truck trips/day.

Table 9 above.[21] These pollutants provide a representative profile for the potential impacts due to induced traffic. Emissions estimates were calculated using standard methods. However, since there was no analysis of changes in traffic due to induced traffic in the Draft EA, most of the parameters used in this analysis were gathered from other sources, including emissions factors

[20] Similar concerns about evaluating local impacts of Port growth west of the bridge are raised by EPA personnel, as gleaned through a document made available through a Freedom of Information Act request: 10-19-12 EPA comments on methodology. The Coast Guard also raises similar concerns about evaluating impacts on environmental justice communities, communities around the Port, and a lack of information about change in cargo volumes that will result from the project in a letter dated 8-31-12.

[21] Due to time restrictions we were unable to estimate emissions from rail activities, which would also increase with cargo volume growth. Including this emissions source would result in a larger emissions estimate.

from Mobile6.1[22] and recommended by NY DOT, directional flows for truck traffic from CPIP and cargo handling activities from the 2008 multi-facility port emissions study. The emissions for NOx, PM_{10} and $PM_{2.5}$ were estimated to provide a sense of how changes in induced flow estimates could alter emissions estimates. Trucks are assumed to generate emissions from both on-road travel (including idling emissions, for example, at port entrances) and travel and idle generated on-terminal. These trucks are heavy-duty diesel vehicles (HDDVs) that travel to and from the facilities within the marine terminals (e.g., a truck that calls at a marine terminal to pick up or drop off a container). In addition, the emissions from cargo handling equipment and marine vessels are estimated based on the additional TEUs that may result from the project.

Trucks: On-road emissions. Emissions are estimated only for on-road truck travel in Port communities; these estimates do not include travel beyond the Port vicinity. Trucks are first distributed to main travel corridors using directional splits from the CPIP study (pg 161-172 CPIP). With the exception of Howland Hook, truck volumes for each terminal facility are assumed to travel through the impacted communities using three major routes: Doremus Ave, Port St, and North Ave[23]. For Howland Hook, based on the information given, trucks are evenly split between those traveling westbound and those traveling north/eastbound using Gulf and Goethals routes; only the westbound volumes are assumed to travel directly through the impacted communities. Trucks are also split into heavy-duty diesel vehicles class 8a and 8b. Each class is assumed to follow the same routing patterns. Each truck class by route is then multiplied by 1.5 miles to estimate daily truck VMT/day (we assume that trucks travel 1.5 miles through Port communities). Idle for the on-road trucks is derived by assuming that approximately 25% are short idles (short idles are defined as less than 15 minutes; 15 min is used to estimate emissions), and 75% are extended idle (an average of 2hrs is used) based on pg 78-79 of the 2008 multi-facility emissions study. Emissions factors are based on 2035 values in Mobile6.1 and assembled by county from the NYDOT.

Trucks: On-terminal activities. Emissions from trucks traveling in the Port are also estimated. Once trucks enter the terminal facility, their emissions are tracked separately. Using the number of trucks entered from port cargo growth estimates are inexact and should be interpreted in terms of their overall magnitude.

To put these estimates in context, we can compare these values to overall Port truck traffic for terminals west of the bridge. We estimate that approximately 41,000 one way truck trips/day travel to and from the port terminals west of the bridge in 2035. The estimated truck trips that result from the project vary widely with the assumptions about mode splits and, more importantly, changes in cargo volumes. The estimates above can be restated in terms of daily trips, yielding 54 truck trips/day from all three terminals using the Draft EA assumptions. Using SSR mode splits and Draft EA cargo volumes, the estimate ranges from 63 – 268 truck trips/day. Using Draft EA mode splits and SSR cargo volumes, the estimate is 2,340 truck trips/day. Using

[22] EPA's MOBILE6 vehicle emissions modeling software is available at http://www.epa.gov/otaq/m6.htm

[23] The Port Truck Origin-Destination Study found that 1% of drivers coming to/from Port Newark and Elizabeth travel to/from Route 22 via North Avenue. The exact route is unknown, but it is likely located in close proximity to residential areas. Additionally, 22-23% of drivers travel to and from route 1-9 via North Ave, which (although the exact route is unknown) also may bring them into close proximity to residential land uses. The other Doremus Ave, Port St, and North Ave. routes used appear to take drivers onto highways before entering neighborhoods, but the highways themselves are located in Port communities.

SSR mode split assumptions and SSR cargo volumes, the estimate ranges from 2,450 – 10,390 truck trips/day.

Table 9, the on-terminal idle times and VMT are calculated using the on-terminal operating characteristics provided in the 2008 multi-facility emissions inventory (p81). As with the on-road emissions, trucks are divided into HDDV8a, HDDV8b (using the proportions from Table 3.20, pg 81, 2008 multi-facility emissions study). The on-terminal VMT is equal to trucks multiplied by the derived VMT/truck. This value was assumed to be approximately the same as measured in the 2008 multi-facility emissions study (pg 81). Based on the draft EA, there is no reason to assume that any terminal efficiencies aimed at reducing idles or on-terminal travel have been introduced. The idle is calculated using the same method as on-road, but using idling rates from the 2008 multi-facility emissions study. Emissions factors are based on 2035 values in Mobile6.1 and assembled by county by the NYDOT.

Cargo handling activities. Emissions from cargo handling activities in Port terminals are estimated. The emissions from cargo handling are derived using the distribution of equipment types and use characteristics profiled in the 2008 multi-facility emissions study. The estimates for emissions represent 80% of the on-terminal cargo handling equipment. The remaining 20% are various ancillary equipment items that are not used extensively (e.g., a portable lightset). For these emissions, rates of equipment emissions were estimated using a ratio of total counts of equipment type divided total pollutants as measured in the 2008 multi-facility emissions study. This estimate should be considered as an order of magnitude estimate. However, since the draft EA did not estimate any change in the cargo handling equipment inventory (e.g., age, horsepower, duration of use, count), we assume that the equipment distribution represented in the 2008 multi-facility study can be applied here. If the Port intends on using cargo handling equipment that generates less emissions (e.g., newer models, lower polluting fuels, less in-use duration times), these efficiencies would not be represented in these estimates.

Marine vessels. Emissions from marine vessels carrying additional cargo are estimated. Using Table 11-6 and Appendix D in the Draft EA, it is possible to replicate the estimates of the change in emissions from marine vessels that are estimated in the Draft EA. Note that like the Draft EA, our estimates include only emissions from main engines of containerships, not emissions from tugboats or auxiliary engines. We can then estimate the change in emissions that would result from the project if the modified cargo volume estimates described above were used instead (0.7% and 25% reductions in the no build scenario). Note that our analysis includes main engines only, as assessed in the Draft EA.

First, we note that the table on the bottom of Page D-3 in Appendix D of the Draft EA shows the main engine emissions in tons per year for the build scenario for each year. These values are based on 2008 emissions from main engines. For each year forecasted, they are adjusted to account for emissions controls and expected levels of growth (identical in the build and no build scenarios in the Draft EA air quality analysis). The values in Table 11-6, which represent emissions reductions that are expected to occur in the build scenario (relative to the no build) are then estimated by accounting for the percent difference in fuel usage in the two scenarios. These fuel use estimates are a function of the expected cargo volumes, vessel fleet, and vessel travel characteristics, and are estimated using the forecasted fuel consumption values shown on the tables on page D-2 of Appendix D of the Draft EA.

We are able to replicate the values in Table 11-6 using the same method. We can then scale the fuel consumption values for 2035 based on the two cargo volume estimates described above (0.7% and 25% reductions in the no build scenario). This allows us to determine the percent difference in fuel usage that would be expected using these two estimates of changes in cargo volumes. Using this percent difference, we can then determine the change in emissions from marine vessels' main engines that would result from the modified cargo volume estimates. These values, and the intermediate values used to calculate them, are shown in Table 10. Note that emissions reductions are smaller when assuming the induced demand estimates from Chapter 18 of the Draft EA (when compared to the analysis presented in the Draft EA's air quality chapter), and the emissions in the build scenario actually *increase* when assuming the more substantial alternative baseline changes in cargo volumes estimated earlier in this document.

Summary of Air Quality Impacts

Table 11 summarizes the additional emissions that may result from the project for each cargo volume increase scenario, for each emissions source. Because our focus is on localized effects of the increasing cargo volumes, note that the emissions from trucks are only estimated for on-terminal activities and for truck travel for a distance of 1.5 miles from the Port, and only along routes that are in Port communities. So while they appear small relative to other emissions shown, they occur in a small area and in very close proximity to communities that are already burdened by elevated levels of pollution and health risks. Additionally, note that emissions from locomotives and harbor craft are not included in our estimates.

Table 10: Changes in 2035 emissions from marine vessels that would result from the project for various changes in cargo volumes.

2035 emissions reductions in build scenario	Assumed reduction in cargo volumes in no-build case (%)	2035 fuel consumption in the no-build scenario (metric tons/ nautical mile)	Change in fuel use in build case relative to no-build case (%)	Change in emissions in build scenario (relative to no-build) (tons/year)					
				NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
Draft EA air quality analysis (Table 11-6 replication)	0%	78.7	-4.9%	-18.5	-5.1	-9.5	-1.1	-0.9	-2.6
Assuming Draft EA Chapter 18 induced demand estimate	0.7%	78.1	-4.3%	-16.0	-4.4	-8.2	-1.0	-0.8	-2.3
Assuming our alternative baseline cargo volume	25%	59.0	26.8%	100.5	27.4	51.7	6.1	4.9	14.3

Table 11: Summary of potential pollution emissions associated with increased Port activities from the project. Emissions are shown in tons per year.

	NO_x			PM_{10}			$PM_{2.5}$		
	SSR mode splits, Draft EA cargo volume	Draft EA mode splits, SSR cargo volume	SSR mode splits, SSR cargo volume	SSR mode splits, Draft EA cargo volume	Draft EA mode splits, SSR cargo volume	SSR mode splits, SSR cargo volume	SSR mode splits, Draft EA cargo volume	Draft EA mode splits, SSR cargo volume	SSR mode splits, SSR cargo volume
Trucks (on-terminal and on-road in Port communities only)	0.04-0.16	1.47	1.5-6.3	0.03-0.12	1.1	1.1-4.8	0.03-0.11	1.0	1.0-4.3
Cargo handling	15	538		1.0	34		1	33	
Marine Vessels (container ships only)	-16	101		-1.0	6.1		-0.8	4.9	
Rail traffic	Not estimated								
TOTAL	**-0.6 - -0.5**	**640**	**640-645**	**0.007 - 0.09**	**42**	**42-45**	**0.17-0.26**	**39**	**39-42**

Magnitude of Project Emissions Relative to Other Emissions

To place the emissions quantities that may result from the project into context, we can compare them to overall emissions from Port activities in the area. Because the Draft EA assumes no future emissions impact, it does not provide an estimate of emissions associated with Port activities for 2035 (with the exception of marine vessels). However, we can use the Port Authority's 2008 emissions inventory. Note that the inventory includes all PANYNJ activities, which occur at the Port itself as well as well beyond the boundaries of the Port (as far as the boundaries of the New York/Northern New Jersey/Long Island Non-Attainment Area). Thus, the estimates of PANYNJ emissions are likely to be somewhat larger than the Port-related emissions that occur at Port terminals and in the communities adjacent to the Port.

To hone in on a closer estimate of the Port-related emissions that occur in the communities that are near Port terminals west of the bridge, we focus on the estimates of 2008 PANYNJ emissions for Essex County in Table 12 (which contains Newark Terminal and the City of Newark), Union County in Table 13 (which contains Elizabeth Terminal and the City of Elizabeth), and Richmond County in Table 14 (which contains Howland Hook Terminal and Staten Island). Note that future PANYNJ emissions may be higher as Port activities increase, or they may be lower if emissions control technologies outpace growth activities.

Recall from the preceding section that the estimated NO_x emissions at the Port and in nearby communities from the project range from -0.6 to 645 tons per year, while emissions for PM_{10} and $PM_{2.5}$ range from 0.01 – 45 and 0.2 - 42 tons/year, respectively. The high end of these values are roughly one order of magnitude less than the overall 2008 Port of NY/NJ emissions in the three counties that encompass the Port terminals, indicating a substantial change in emissions from

Port activities. Overall, the estimated 2035 emissions caused by the project from trucks, cargo handling, and ocean going vessels (as shown in Table 11) are equivalent to 0 – 14% of 2008 NOx and PM_{10} emissions and 0 – 12% of 2008 $PM_{2.5}$ emissions from Port activities in Essex, Union, and Richmond counties. Note that our estimates do not include rail or harbor craft emissions, which, when combined, make up 9.3% of 2008 Port NOx emissions in Essex, Union, and Richmond Counties, and 6.9% and 5.6% of 2008 PM_{10} and $PM_{2.5}$ emissions in those areas. Breaking apart these estimates by emission source, the estimated 2035 emissions that are expected to result from the project from increased cargo handling are equivalent to 2 to 55% of 2008 NOx, PM_{10}, and $PM_{2.5}$ emissions from Port activities in Essex, Union, and Richmond counties. For ocean going vessels, the project's 2035 emissions are -1% to 5% of NOx and -1% to 3% of PM_{10}, and $PM_{2.5}$ emissions from the Port.

We also compare PANYNJ emissions to stationary sources in the immediate area. A 2012 study of cumulative impacts for the proposed Hess Newark Energy Center indicates that eight facilities (selected for analysis by NJDEP) located around the Ironbound area of Newark emit over 3,800 tons per year of NO_2.[24] Project emissions of -0.6 to 645 tons per year are 0 to 17% of the total emissions from those eight facilities.

Table 12: Union County, NJ: Emissions from PANYNJ activities (2008). Emissions are shown in tons/year.

	NOx	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO**	**SO_2**
Cargo Handling Equipment	656	42	41	62	219	9.3
Heavy Duty Diesel Vehicles	534	13.9	122.8	23.9	162.8	0.3
Railroad Locomotives	29.6	1.1	1.0	2.3	5.1	0.4
Ocean-Going Vessels	732	78	62	24	60	883
Harbor Craft	113.5	6.2	6.0	4.4	12.8	2.4
Total PANYNJ emissions	**2,064**	**141**	**123**	**117**	**460**	**896**

[24] Estimated from Attachment A in "Protocol for Cumulative Impact Modeling for NO2 1-hour Average Impacts; PI#08857, BOP110001; Newark, Essex County, NJ, Arcadis US, Inc, February 23, 2012.

Table 13: Essex County, NJ: Emissions from PANYNJ activities (2008). Emissions are shown in tons/year.

	NOx	PM_{10}	$PM_{2.5}$	VOC	CO	SO_2
Cargo Handling Equipment	190	12	11	14	77	4.4
Heavy Duty Diesel Vehicles	501	12.4	11.4	23.1	123	0.5
Railroad Locomotives	94.1	4.0	3.7	9.0	17.1	1.4
Ocean-Going Vessels	368	38	30	13	31	412
Harbor Craft	72.7	4.0	3.8	2.8	8.2	1.6
Total PANYNJ emissions	**1,225**	**70**	**60**	**62**	**257**	**420**

Table 14: Richmond County, NY: Emissions from PANYNJ activities (2008). Emissions are shown in tons/year.

	NOx	PM_{10}	$PM_{2.5}$	VOC	CO	SO_2
Cargo Handling Equipment	129	8	8	9	38	3.1
Heavy Duty Diesel Vehicles	283	7.7	7.1	11.8	91.5	0.1
Railroad Locomotives	19.2	0.8	0.8	1.9	3.5	0.3
Ocean-Going Vessels	791	80	64	30	69	836
Harbor Craft	101.5	5.5	5.4	3.9	11.4	2.2
Total PANYNJ emissions	**1,324**	**102**	**85**	**57**	**213**	**841**

Additionally, our estimated emissions only include activities at the Port terminal and in the nearby communities (rather than the entire county). As a result the comparison above is primarily useful for understanding the magnitude of marine and cargo emissions and we have not used it to compare truck emissions. Our emissions estimates from truck activities, which range from 0.04 to 6.3, 0.03 – 4.8, and 0.3 – 4.3 tons per year for NOx, PM_{10}, and $PM_{2.5}$ respectively, only include truck traffic at the Port terminal and in the area immediately adjacent to the Port, and so represent effects for a smaller geographic area than the heavy duty diesel vehicle emissions estimates presented in Tables 12 - 14. However, the 2009 NJDEP Port Air Quality Study, which focuses on emissions from Port roads, indicates that $PM_{2.5}$ emissions from Port roads[25] are currently equal to 3.2 tons per year, while emissions from trucks idling and on

[25] Described as 'between the port and the N.J. Turnpike' on page 5 of the NJDEP report.

terminal are 11.9 and 1.29 tpy respectively, totaling 16.4 tpy from trucks at the Port and in nearby communities. This value is about one order of magnitude greater than the high end of our 2035 estimate of emissions from trucks at the Port and in nearby communities. Overall, the estimated 2035 emissions that are expected to result from the project from truck travel at the Port terminals and in nearby communities are equivalent to 0 to 38% of 2008 $PM_{2.5}$ emissions from Port activities at the terminals and in nearby communities.

In summary, the estimated 2035 NOx and PM emissions that are expected to result from the project are not insignificant when compared with current Port-related emissions in the area. The 2035 emissions from cargo handling, truck movements, and ocean going vessels that will increase due to the project are estimated to range from 2-55%, 0 – 38%, and -1 – 5% of current Port related emissions in the area for those sources, respectively. Note that for each of the ranges, the low end of each estimate uses the Draft EA cargo volume estimates.

POTENTIAL CUMULATIVE IMPACTS AND ENVIRONMENTAL JUSTICE CONCERNS RESULTING FROM PROJECT-RELATED PORT GROWTH

The preceding exercise demonstrates that the impacts of the Bayonne Bridge project depend directly on the extent to which cargo volumes increase as a result of the raising the height of the bridge. In this section we discuss existing air quality and health concerns and the demographic characteristics of the communities around the Port, which would be expected to experience the majority of the effects from increased Port emissions and truck emissions.

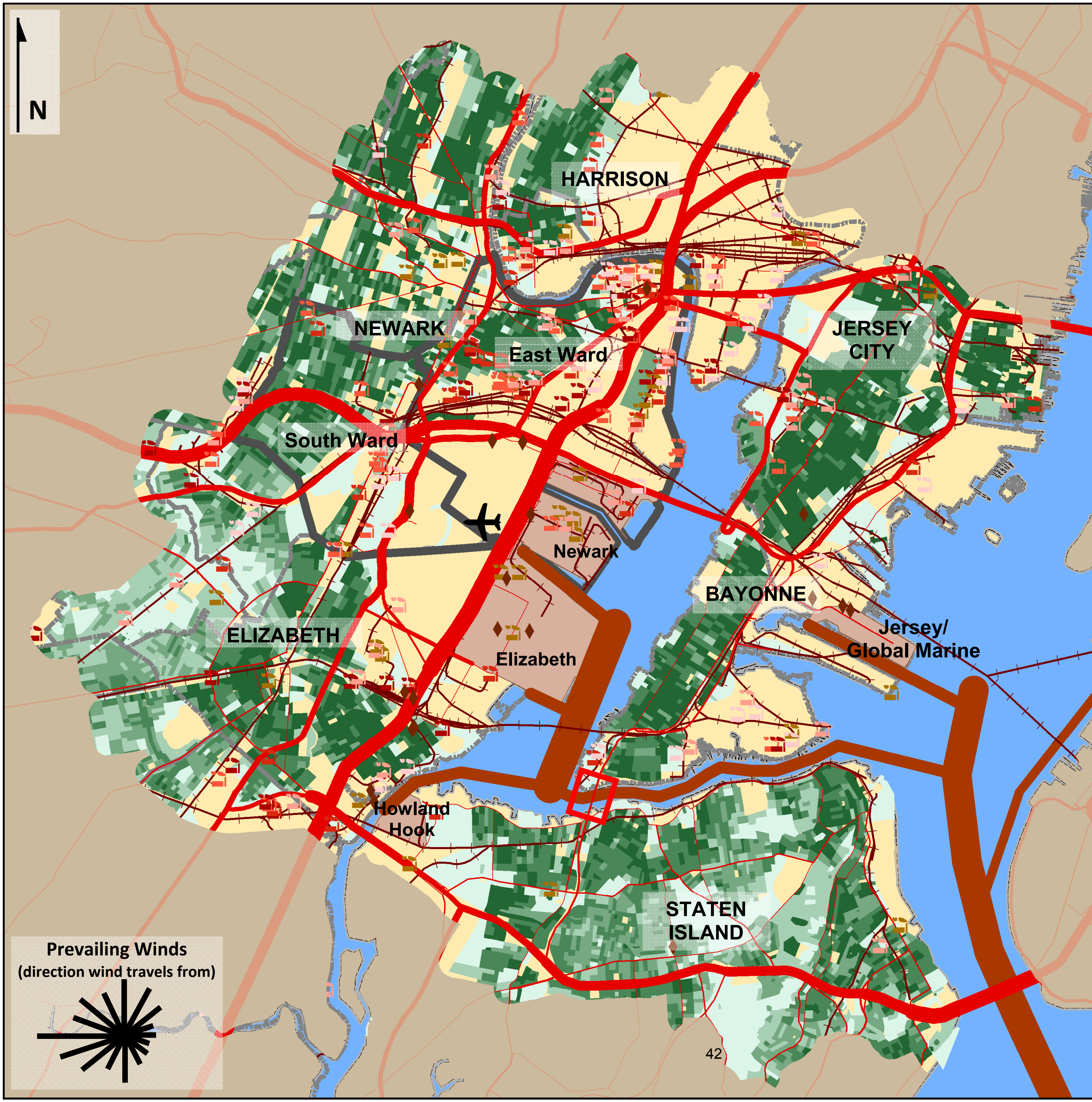
We note that according to the Draft EA, the project area is in maintenance for CO, attainment for annual NO_2, marginal non attainment for 8-hour ozone, recently achieved attainment for annual $PM_{2.5}$ (but the standard also recently changed), and seems to be in progress towards attainment for 24-hr $PM_{2.5}$ and 1-hr ozone although both of those statuses may not be official yet. There is not enough information to determine the area's status for 1-hr NO_2 or 1-hr SO_2. Since NO_x is an ozone precursor and $PM_{2.5}$ attainment has not been achieved, these pollutants may be of particular concern in the Port area.

Port Area Pollution Emissions

The area surrounding the Port of NY/NJ has a substantial number of stationary and mobile sources of air pollution in close proximity to residents (Figure 1). The East Ward (Ironbound) community in Newark and the southeastern portion of Elizabeth have a particularly high density of residents in proximity to stationary pollution sources, and many roads with heavy truck traffic.

Even in the baseline (no-project) case, truck and rail traffic can be expected to increase with Port growth. Although the Draft EA analysis finds additional increases in Port cargo volumes associated with the project, it indicates that those increases are insignificant (without providing the criteria used to make that determination) and does not evaluate the impacts of that Port growth. However, as we show above, to the extent that the project increases Port cargo volumes, emissions at the Ports and from trucks and trains leaving the Port will increase pollutant loads in the areas near the Ports even more than in the baseline case. This traffic is of particular concern as it passes in close proximity to residents. Additionally, recent research indicates that the toxicity of PM varies by source, and that vehicular exhaust is one type of PM that may have greater health effects.[26] Although the specific routes of truck traffic are not known, increased truck volumes due to the project will add to the already elevated truck volumes on roadways near the Port (Figure 2). Note that the potential magnitude of the additional trucks induced by the project are substantial when compared with the current truck volumes on corridors leaving the Port. Furthermore, note that Figure 2 shows the additional truck traffic from the project in comparison to current truck traffic, whereas the baseline levels of future traffic will be greater.

[26] See Wexler, A. and K. Pinkerton, Toxicity of Source-Oriented Ambient Submicron Particulate Matter, Contract Number 06-0331, May 2012, Prepared for the California Air Resources Board, the California Environmental Protection Agency, and the Electric Power Research Institute. http://www.arb.ca.gov/research/apr/past/06-331.pdf



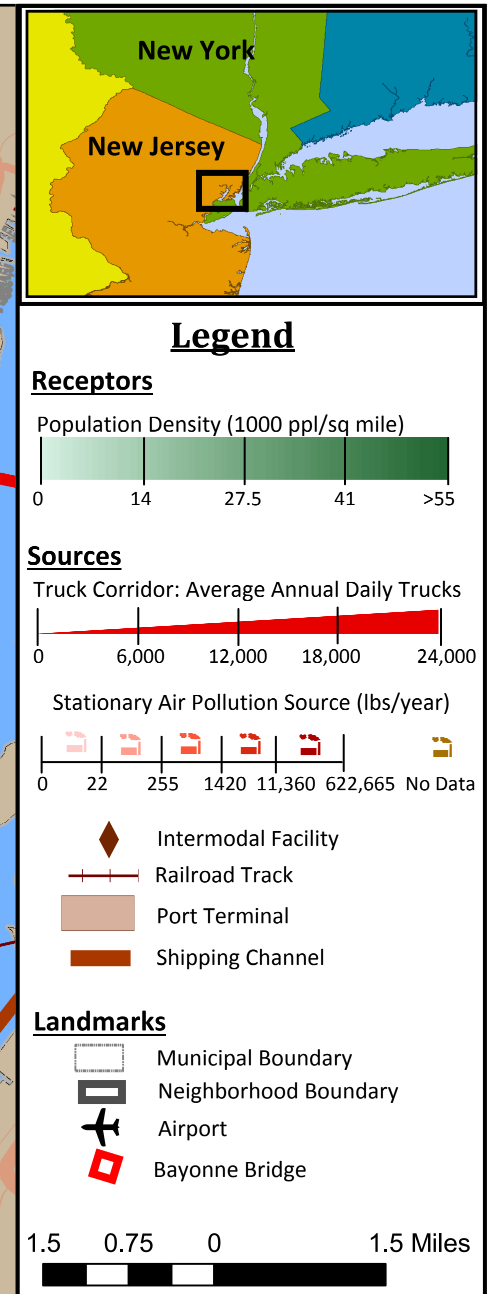


Figure 1:
Port of NY/NJ Area

Population Density

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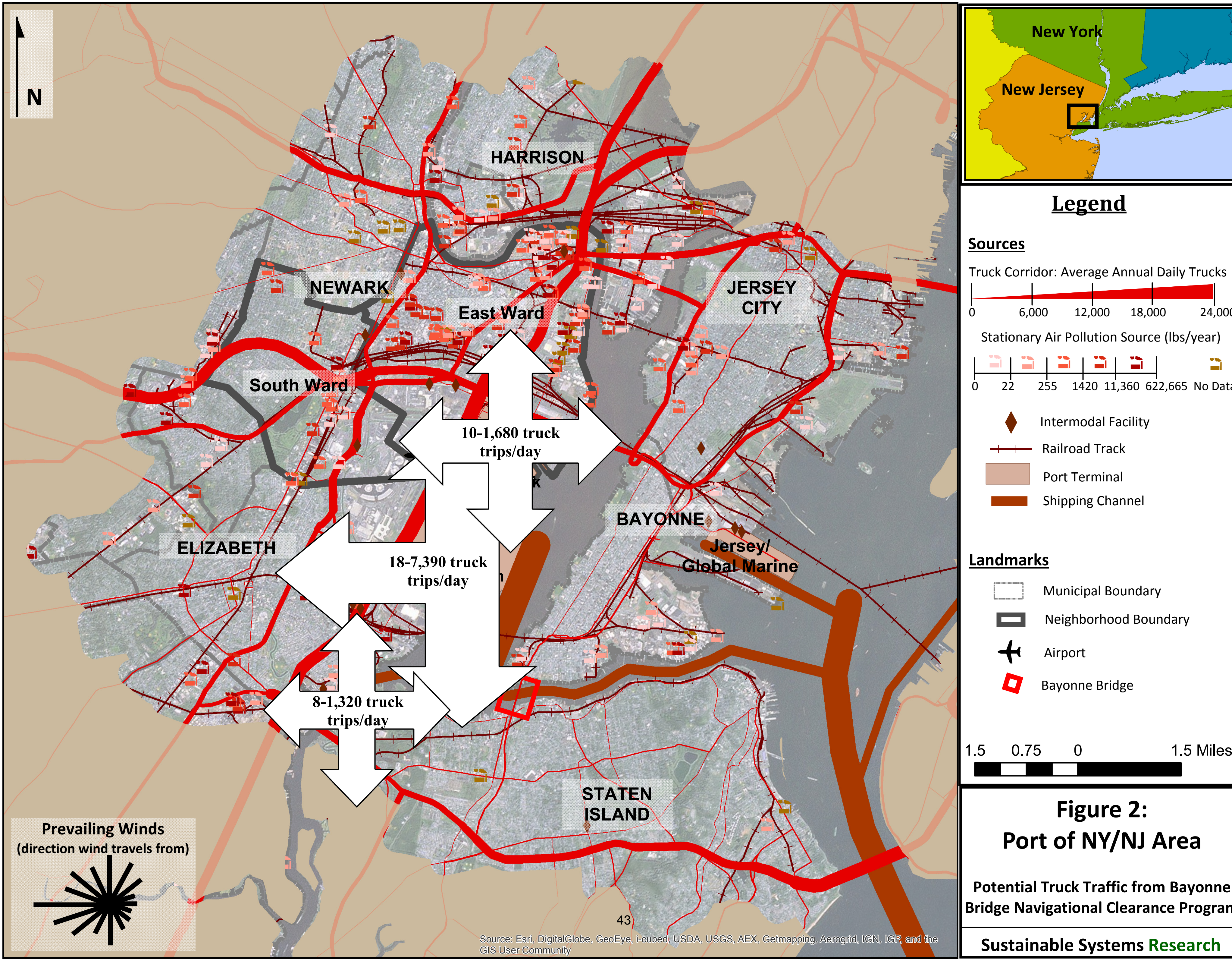

Figure 2: Port of NY/NJ Area

Potential Truck Traffic from Bayonne Bridge Navigational Clearance Program

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Appendix B provides more detailed maps of pollution sources in Elizabeth, Newark (East and South Ward), and Staten Island. These maps include aerial imagery, 100m and 300m buffer areas around truck routes, and the names of stationary pollution sources in the more detailed views.

Health Risks from Air Pollution in the Port Area

According to the 2009 NJDEP Port Air Quality Study, $PM_{2.5}$ and SO_2 emissions from Port activities at the Elizabeth and Newark Terminals currently result in elevated health risks in the communities surrounding the Port:

> The cancer risk predicted at residences in Elizabeth, Newark, Staten Island, and Jersey City is lower [than Bayonne] (between 10 and 100 in a million), but high enough to justify long term efforts to further reduce cancer risk. (p3)

In Elizabeth the increased risk from Port activities is predicted to be 42 in a million; for Newark and Staten Island the risks are 30 and 63 in a million respectively. The document also indicates that for risks between 10 and 100 in a million, the NJDEP suggests implementing 'a long-term risk mitigation strategy' (p11). The majority of the current risks are described as coming from marine vessels and cargo handling equipment, rather than trucks or rail. The 2011 NJDEP Future Port Air Quality Study projects these health risks into 2015, finding that the diesel exhaust cancer risk in 2015 is expected to be lower; 6 in a million in Elizabeth, 9 in a million in Newark, and 42 in a million in Staten Island. The 2015 projections predict that the majority of the risks will be attributable to rail and marine vessels, rather than cargo handling equipment or trucks, although it only examines truck activities at the terminal and on the approach roads to the terminals (not on most local roads or highways). However, note that these studies only include emissions from Port activities, so the overall cancer risks (accounting for all emissions sources in the area) are expected to be higher.

To get an indication of these cumulative risks, we can examine EPA's estimated health risks associated with all sources of air pollution from the National-Scale Air Toxics Assessments (NATA)[27]. Because these estimates are generated across the country, they are more spatially coarse than a detailed assessment of the region would be so they provide a risk value that is averaged over the census block (and so may overlook elevated risks in the immediate vicinity of pollution sources). These data should not be used to assess the acceptability of local risk levels, but can be used to identify areas where risks should be evaluated more closely using more refined analysis. Nonetheless, they provide an indication of the potential cumulative risks from (non-diesel PM) air toxics sources. The NATA data indicate elevated risks in the Port area. Figures 3 through 5 show NATA estimates of cancer risks, neurological risks, and respiratory risks associated with air pollution in the region. Cancer risks that exceed 100 in a million appear in Newark, Elizabeth, Staten Island, Jersey City, and in Bayonne. The East Ward and the area around Howland Hook appear to have particularly elevated cancer risks. Similar patterns appear for neurological and respiratory risks, which are shown as hazard indices. Appendix B provides more detailed maps of NATA data in Elizabeth, Newark (East and South Ward), and Staten Island.

Note that although NATA non-cancer risk assessments account for emissions of diesel particulates, NATA cancer risk assessments do not include diesel particulates (which are in part

[27] 2005 NATA data and documentation are available at http://www.epa.gov/ttn/atw/nata2005/tables.html

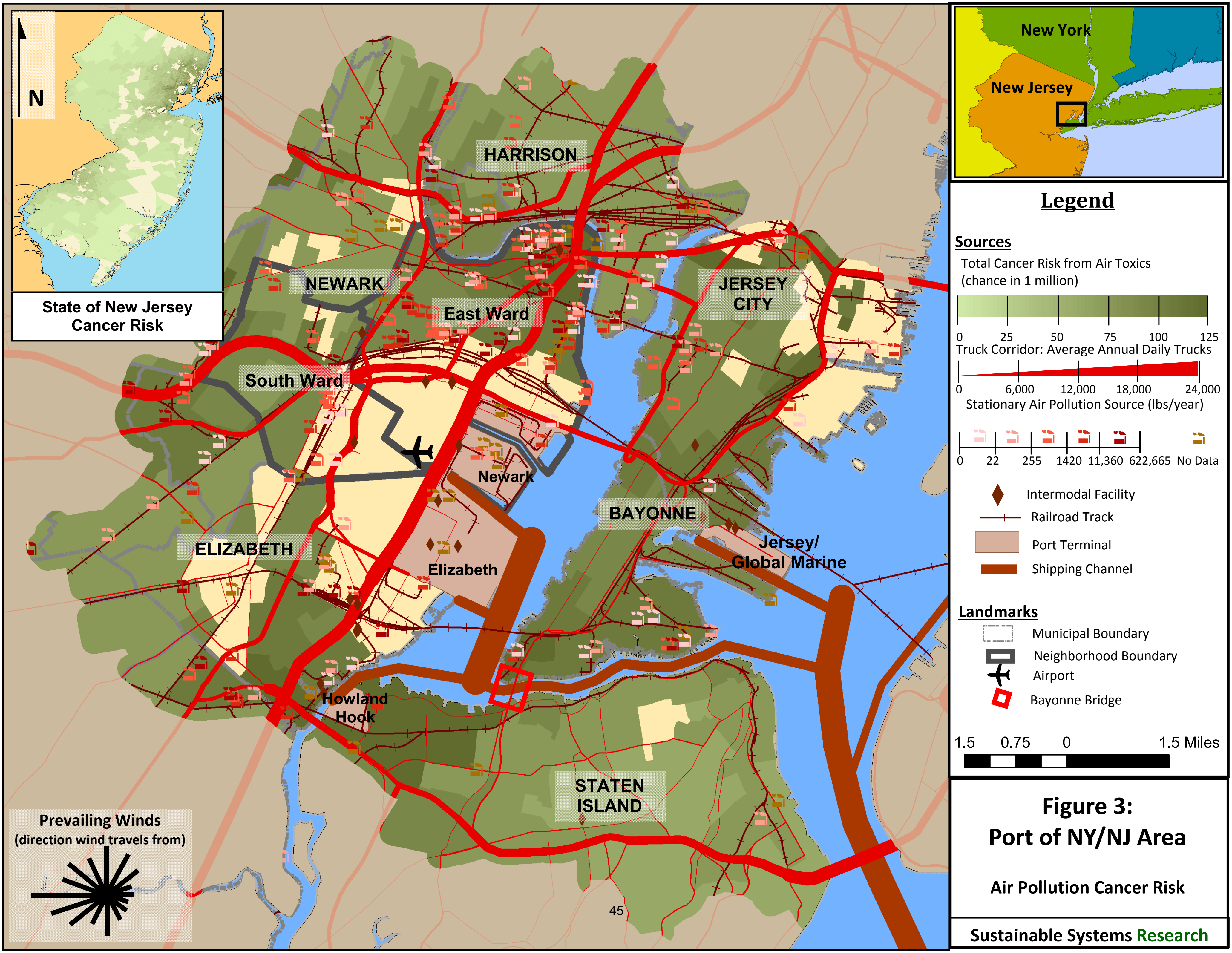

Figure 3:
Port of NY/NJ Area

Air Pollution Cancer Risk

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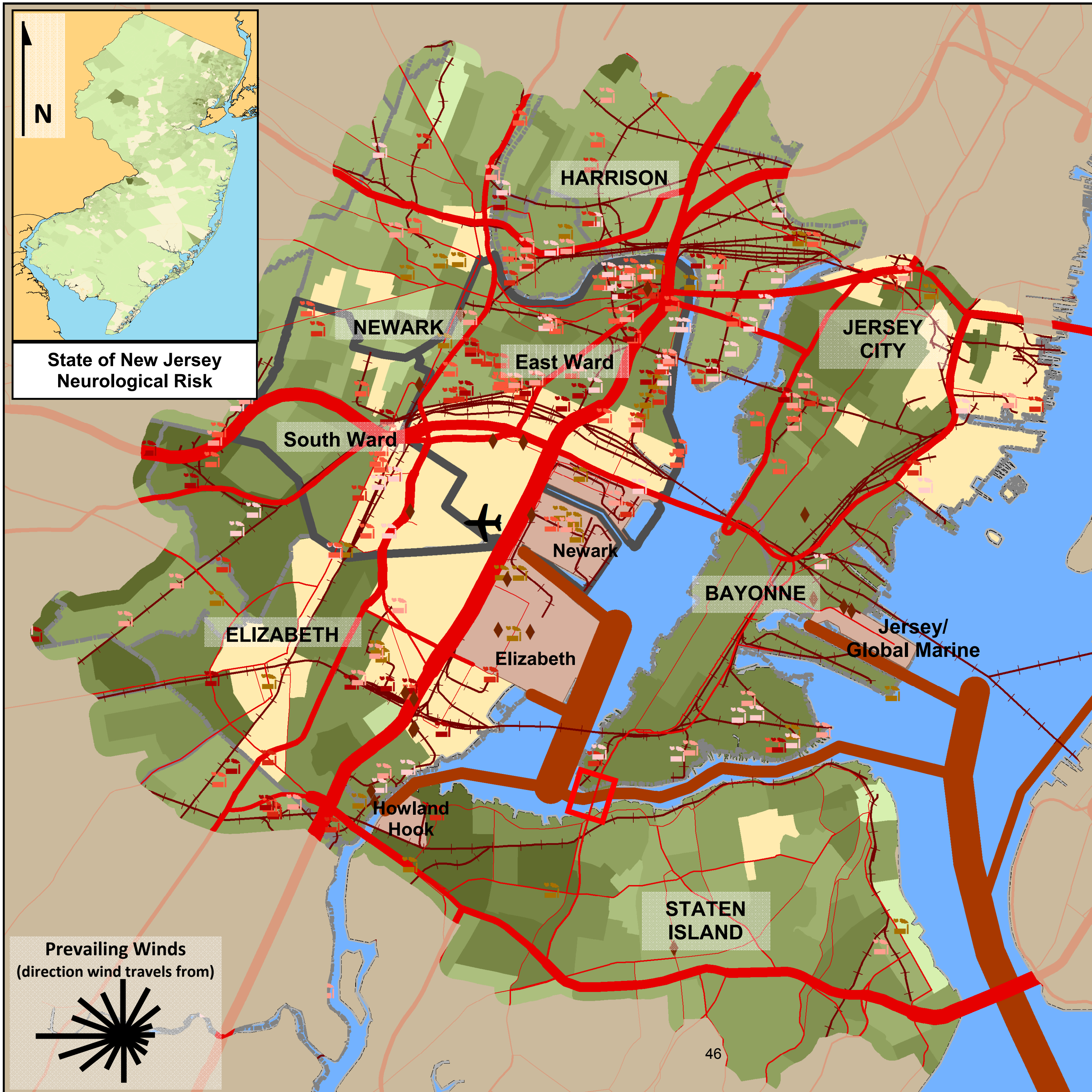

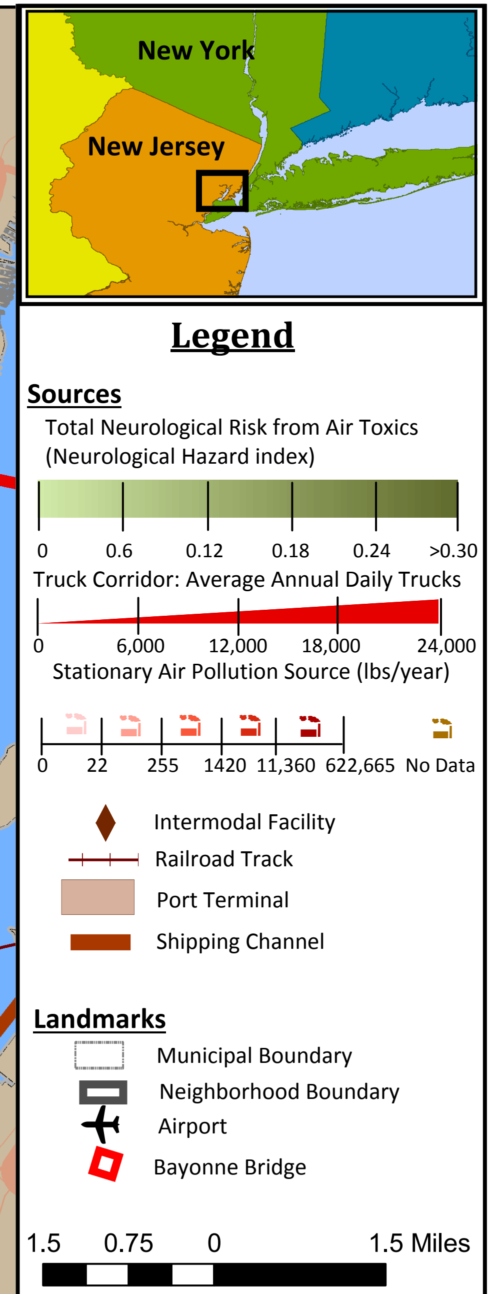

Figure 4:
Port of NY/NJ Area

Air Pollution Neurological Risk

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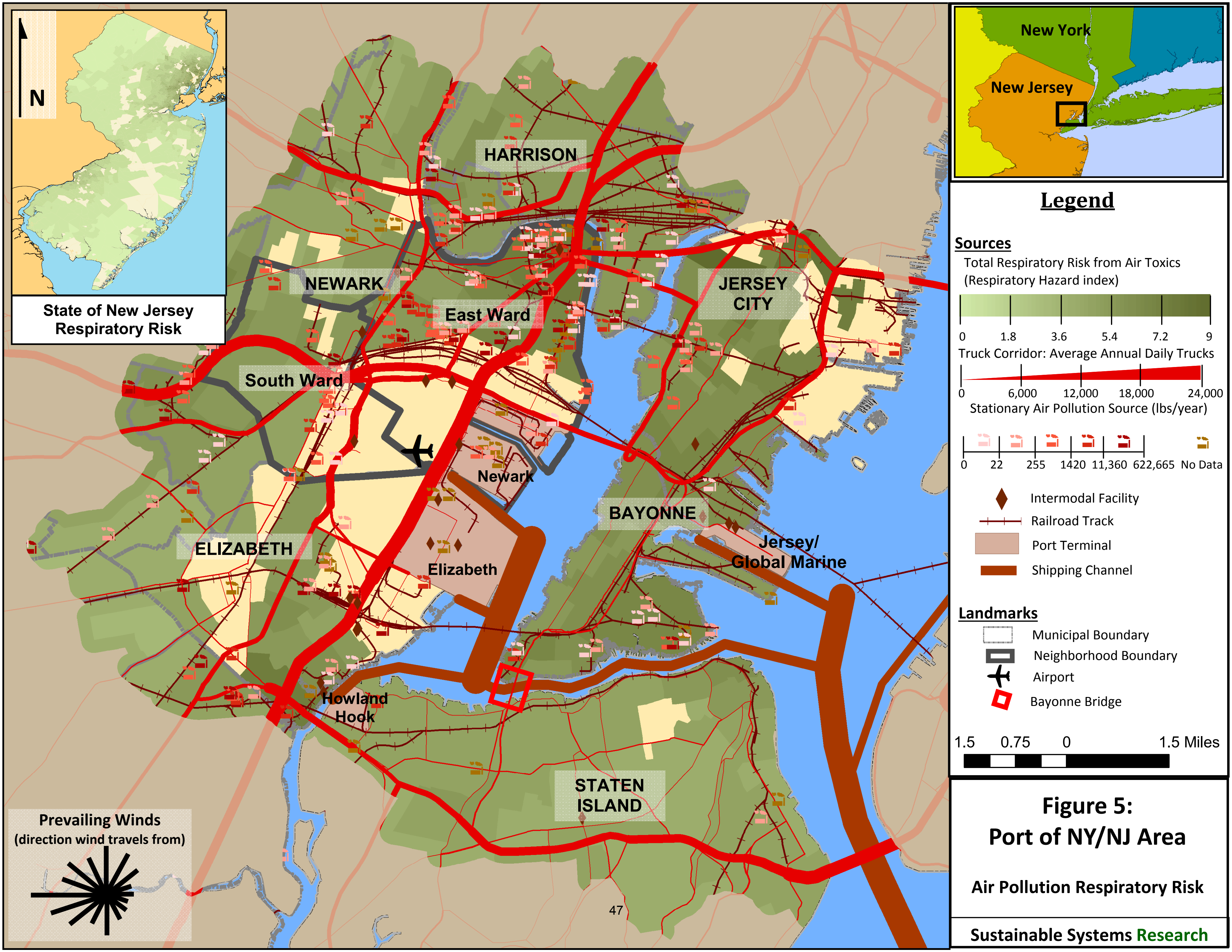
State of New Jersey Respiratory Risk
N
HARRISON
NEWARK
East Ward
South Ward
JERSEY CITY
Newark
BAYONNE
Jersey/ Global Marine
ELIZABETH
Elizabeth
Howland Hook
STATEN ISLAND
Prevailing Winds
(direction wind travels from)
New York
New Jersey
Legend
Sources
Total Respiratory Risk from Air Toxics
(Respiratory Hazard index)
0 1.8 3.6 5.4 7.2 9
Truck Corridor: Average Annual Daily Trucks
0 6,000 12,000 18,000 24,000
Stationary Air Pollution Source (lbs/year)
0 22 255 1420 11,360 622,665 No Data
Intermodal Facility
Railroad Track
Port Terminal
Shipping Channel
Landmarks
Municipal Boundary
Neighborhood Boundary
Airport
Bayonne Bridge
1.5 0.75 0 1.5 Miles
Figure 5:
Port of NY/NJ Area
Air Pollution Respiratory Risk
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related to heavy duty truck movements). NJDEP has estimated those risks as 470 in a million and 454 in a million for Essex and Union counties.[28] These risks are in addition to the air toxic cancer risks shown in NATA data, although they are county-wide, and are not estimated specifically at the Port area.

Overall, NATA data indicates that the cancer risks from non-diesel air pollution in the Port area may exceed 100 in a million; combining those estimates with NJDEP's county-level diesel risks yields estimated cancer risks that may exceed 500 in a million in the communities around the Port (assuming that county level estimates are applicable in the Port area). Furthermore, these health risk analyses aggregate risks in large areas; in areas that are downwind and in closer proximity to pollution sources, the risks may be greater. Port activities will increase in the baseline scenario and to an even greater extent in the project scenario. As a result, communities in close proximity to Port activities will experience greater emissions in the project scenario than in the no-project scenario; these emissions will add to the elevated pollution levels that they will experience from other sources.

Demographics of Port Communities And Environmental Justice Concerns

Next, we examine the types of residents living in Port communities, with an eye toward particularly sensitive groups and environmental justice concerns. Figure 6 shows the locations of schools and hospitals in the Port area. As expected, these are distributed throughout the region, with an area of higher density of schools and hospitals in Newark to the west of a number of stationary and mobile pollution sources.

Similarly, we can examine the location of young and old residents (Figures 7 and 8). There are a number of areas with high concentrations of children in Newark and southeast Elizabeth. The East Ward (Ironbound) area of Newark has areas with high concentrations of elderly residents.

In terms of environmental justice communities, Figure 9 shows the percent of minority (defined here as Black, Asian, other non-White races, and Hispanic) residents in each area. For reference, in the state of New Jersey there are 41% minority residents and 51% for the New York/New Jersey metropolitan area (see Appendix B). In contrast, the overall share in the Port area shown in Figure 9 is 74%. The share of minorities in Newark is particularly high. The share of families living in poverty is shown in Figure 10[29]. On average, 10% of families in the state of New Jersey and in the NY/NJ metropolitan area live in poverty. In contrast, the overall Port area shown has 16% of families living in poverty, with particularly high poverty levels in Newark and in the area immediately adjacent to the Port Newark Terminal.

Appendix B provides more detailed maps for Elizabeth, Newark (East and South Ward), and Staten Island. These maps include the names of schools in the detailed views. It also provides an analysis of the demographics of residents living in close proximity to various pollution sources in the Port area, as well as overall demographics of the Port area in relation to the region.

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[28] NJDEP's diesel particulate risk analysis is summarized at http://www.nj.gov/dep/airtoxics/diesemis.htm. This study uses a unit risk factor of 3 x 10^{-4} (equivalent to 0.0033 ug/m^3 resulting in a 1 in a million cancer risk) from the California Air Resources Board. The unit risk factor is combined with diesel PM concentrations from NATA. The same unit risk factor is used in NJDEP's 2011 Port Air Quality Study.

[29] Note that Figure 10 shows a large block group that surrounds the airport that has very high poverty levels. This area is not shown in the other maps because the poverty data are available in block groups, which are larger areas than the block level data that is used in the other maps. This block group has very few 'families' living in households relative to its population. The families living in this block group are all living in poverty.

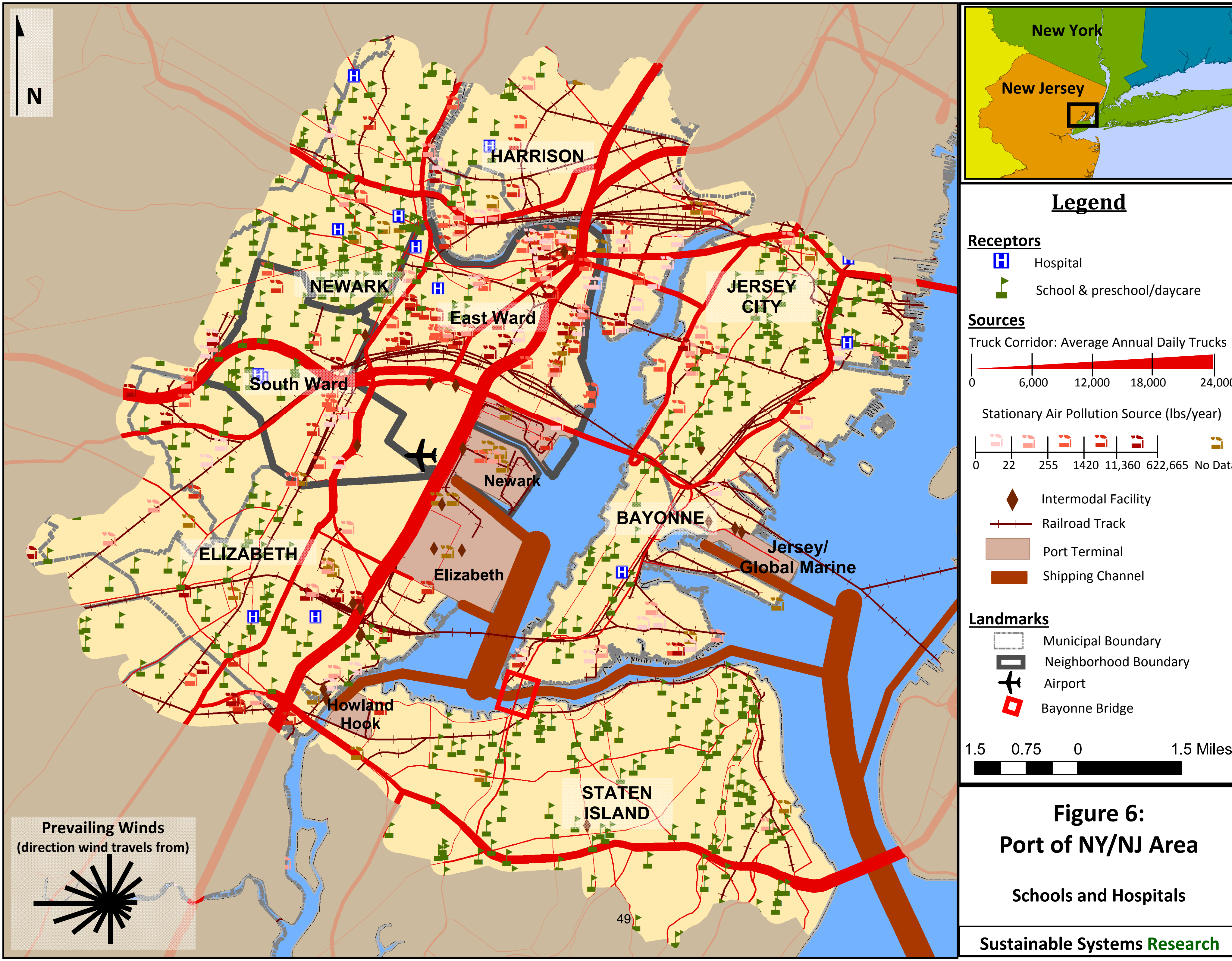

Figure 6:
Port of NY/NJ Area

Schools and Hospitals

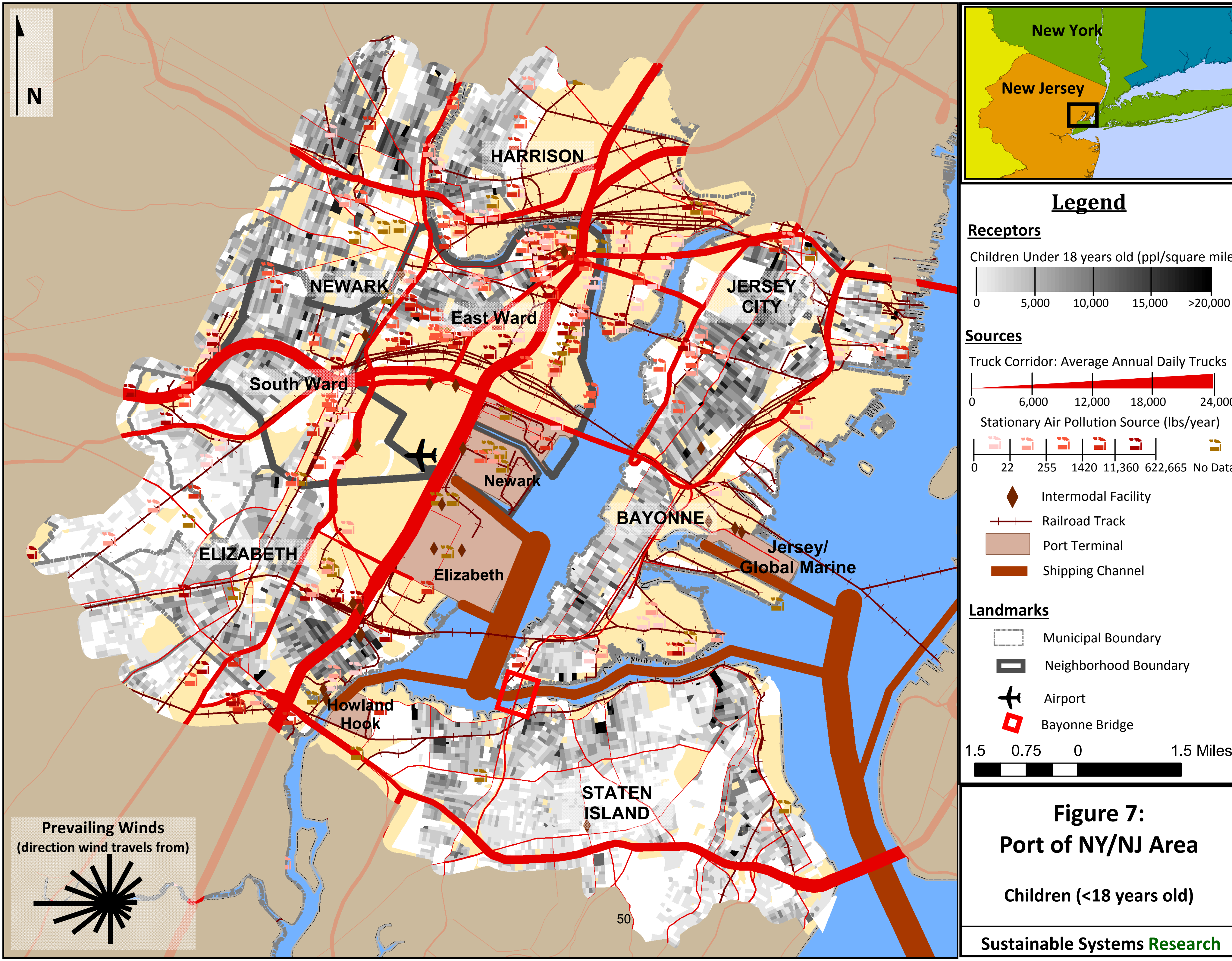

Figure 7:
Port of NY/NJ Area

Children (<18 years old)

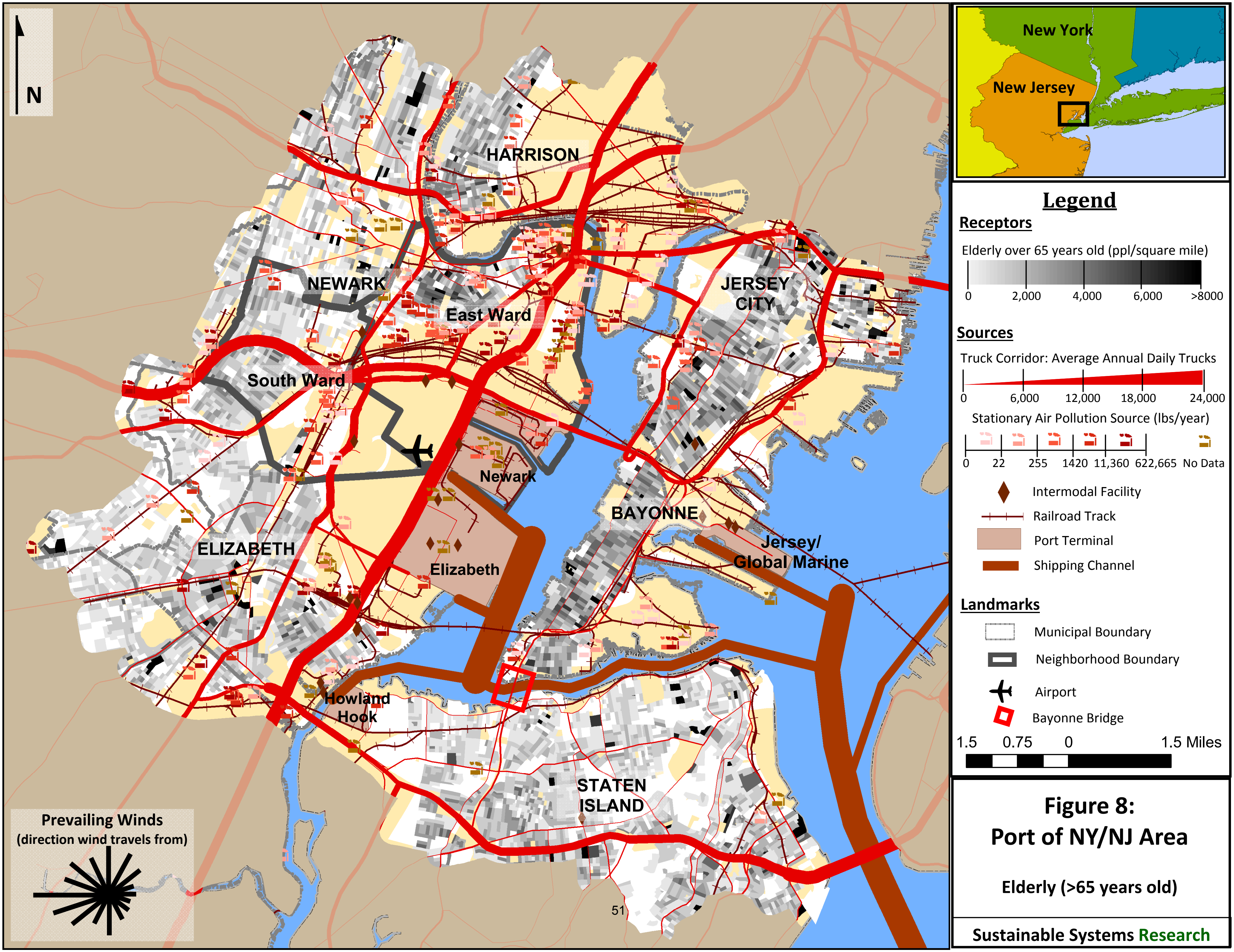

Figure 8:
Port of NY/NJ Area

Elderly (>65 years old)

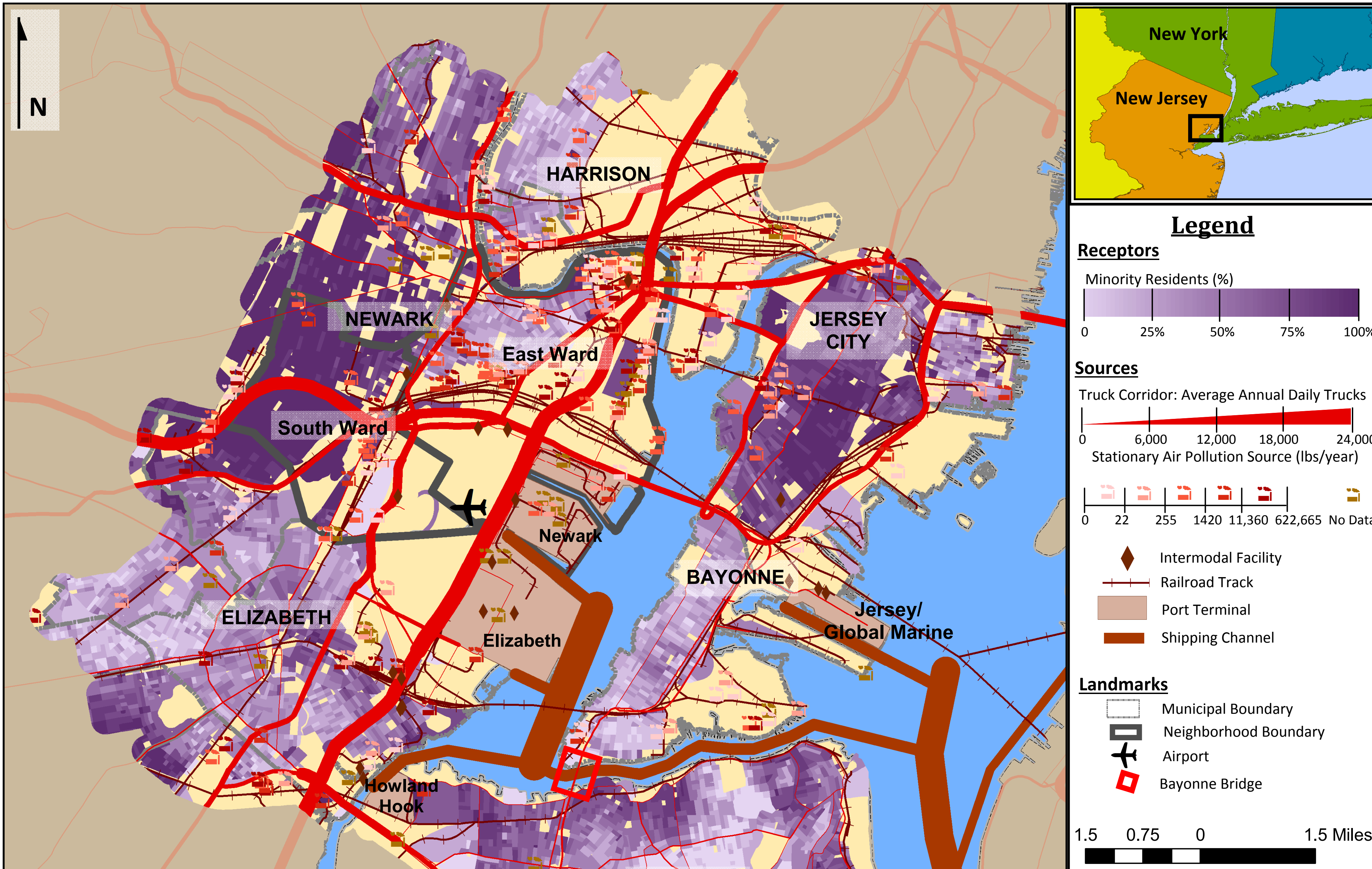

Figure 9:
Port of NY/NJ Area

Minority Residents

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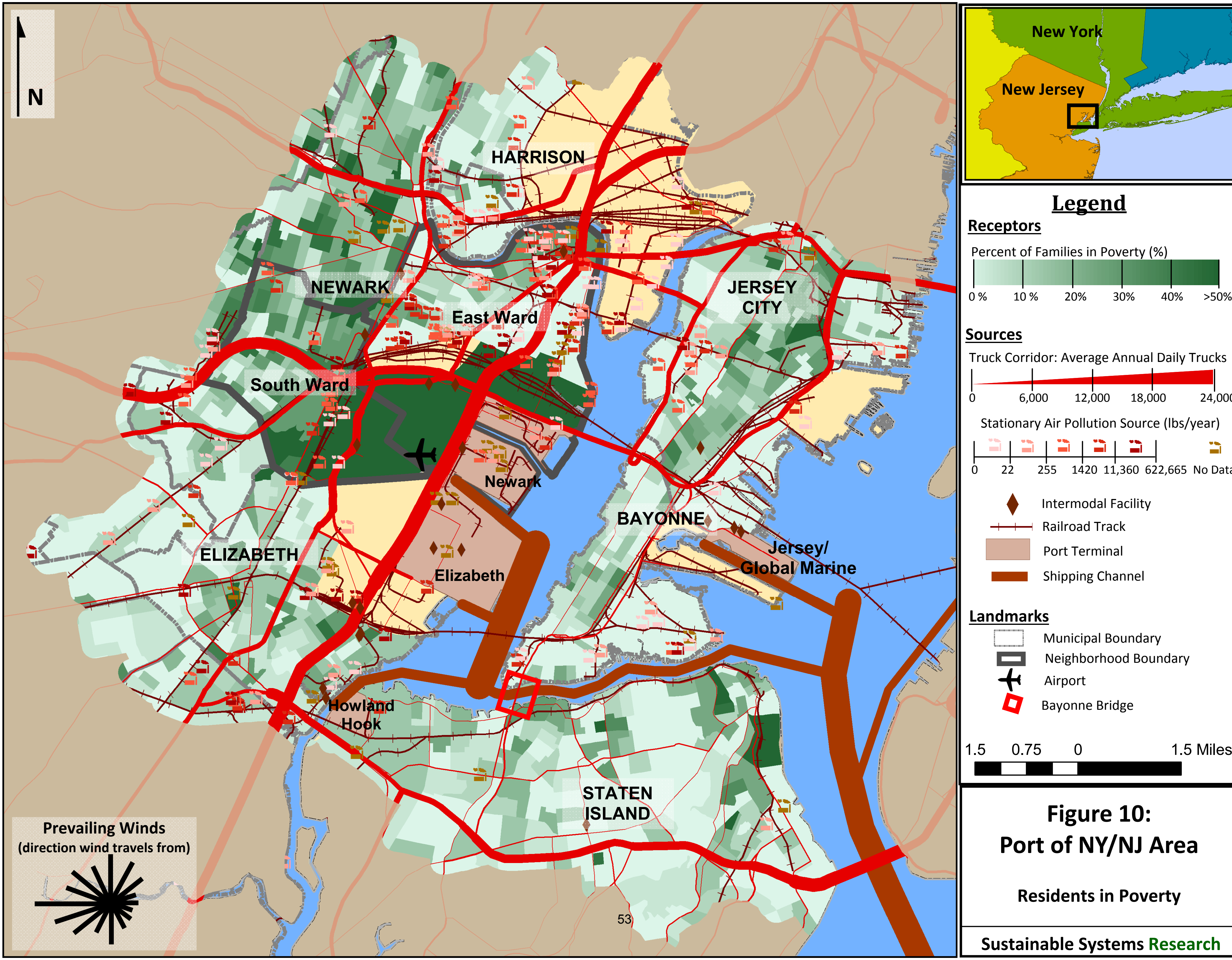

Figure 10: Port of NY/NJ Area

Residents in Poverty

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CONCLUSIONS

In summary, the proposed Bayonne Bridge project will likely increase cargo volumes moving through the Port of NY/NJ. These increases of cargo are of particular concern in terms of the air pollution impacts in the communities surrounding the Port, which are already greatly impacted by air pollution and which are composed of a disproportionate number of minority and low-income residents. The analysis presented here provides an estimate of the magnitude of the potential effects. We conclude that the Draft EA is inadequate and should be redone to address the issues presented in this report.