

STRATEGIC MASTER PLAN



JANUARY, 2019



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STRATEGIC MASTER PLAN PORT OF MEMPHIS



EXECUTIVE SUMMARY



Economic Impact & Growth Potential

The International Port of Memphis is the second largest inland port on the shallow draft portion of the Mississippi River, and the 5th largest inland Port in the United States. The International Port of Memphis covers the Tennessee and Arkansas sides of the Mississippi River from river Mile 725 to mile 740. Within this 15 mile reach, there are 68 water fronted facilities, 37 of which are terminal facilities moving products such as: petroleum, tar, asphalt, cement, steel, coal, salt, fertilizers, rock & gravel, and of course grains.

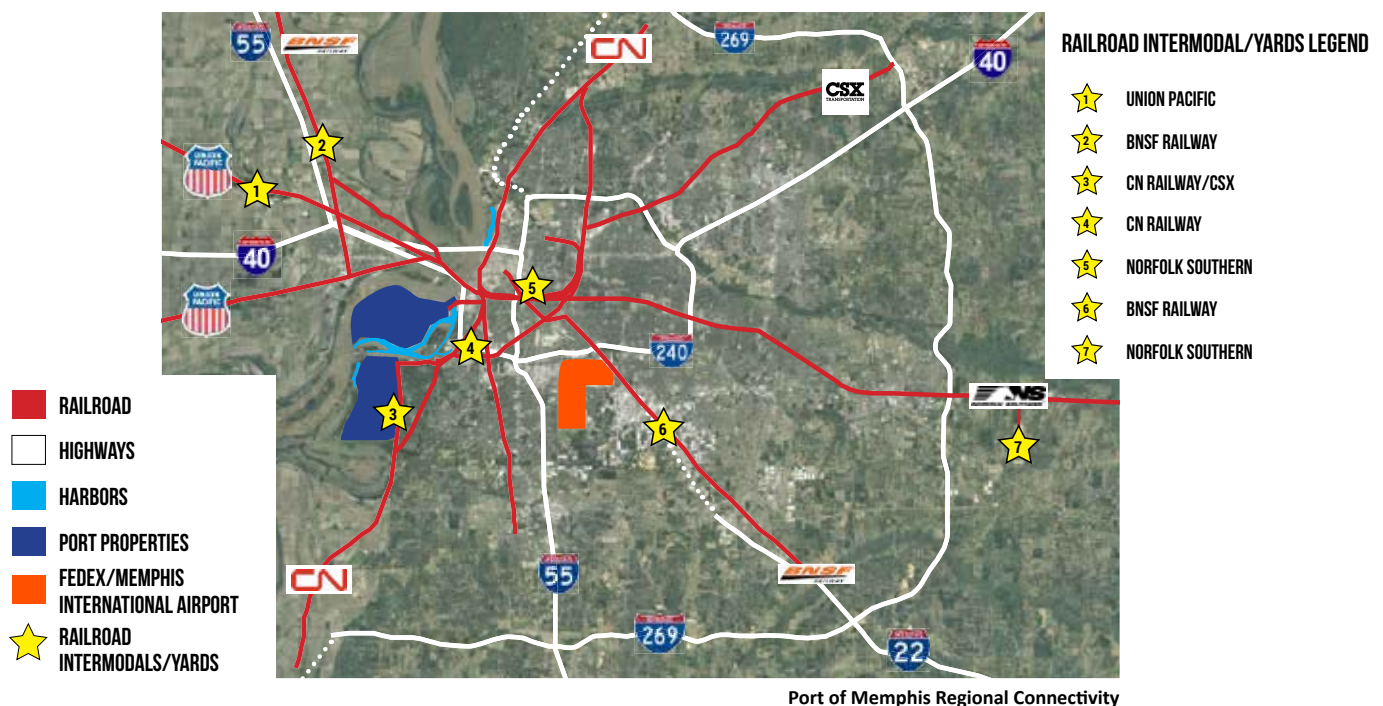
With an annual economic impact of approximately \$9.3 Billion, the Port of Memphis contributes significantly to the local, regional and statewide economies.

The 1947 actions to target and support industrial development on President's Island and the 1967 actions to target and support industrial development at the adjacent Pidgeon Industrial Park were visionary and today support more than 9,000 direct jobs and an additional 13,000 indirect jobs in the greater Memphis region.

Port-related jobs have the highest multiplier effect in the region—for every port-related direct job created, an average of 1.5 indirect jobs are also created or supported. Specifically, for every Water Transportation job created, 3.7 indirect jobs are also created in Shelby County.

The Port of Memphis encompasses approximately 127 operating entities, including major employers as diverse as Mitsubishi Electric Power Products, Inc., Nucor Steel, Valero, Cargill, TVA, CN Railway, CSX, Electrolux, and Seacor AMH.

The Port of Memphis is in a highly advantageous central U.S. location on the inland waterway. systems Infrastructure connectivity is more robust than many other metros, but the surrounding regional economy is weaker than other growth markets such as Atlanta and Dallas.



Port of Memphis Regional Connectivity

The Port of Memphis offers a full suite of maritime and riverine support services, a slack water harbor, numerous private marine terminals, and a skilled maritime workforce to support not only commodity movements on the Mississippi River but also water-dependent and water-advantaged industries in the steel, electronics, and petrochemical sectors.

- The Port of Memphis lies at a unique juncture of major north-south and east-west interstate highways, allowing the Port properties to not only serve local and regional markets, but also to adapt to the rapidly changing industrial, logistical, and commercial supply chains.
- The Port of Memphis is part of a metropolitan area that lies at one of the few junctures of five Class 1 railroads, allowing the movement of goods by rail to both north-south and east west markets—including the industrial and agricultural centers of the US and Canada. The Memphis region is ringed by major intermodal facilities, including the substantial intermodal yard in Pidgeon Industrial Park operated jointly by Canadian National Railway and CSX.
- The Port of Memphis has easy access to the busiest cargo airport in the U.S., Memphis International Airport. As shown in places like Mobile, Charlotte and Richmond, the combined access to roads, rail, runways and rivers can be attractive to freight originators, freight destinations and freight operators.
- The Port of Memphis is well-served by a variety of pipelines, including natural gas and the recently-completed Diamond Pipeline that allows the processing of domestic sweet crude oil at the local Valero refinery. Current and future pipeline access could support the expansion of existing high-wage industries as well as the attraction of new high wage industries.

The Port of Memphis can benefit from several regional, national and global trends.

Domestic investment opportunities in logistical, industrial, and energy facilities have attracted significant global capital, and streamlined state and federal regulatory regimes have supported these investments.

The combined effects of the expanded Panama Canal, revisions to the North American Free Trade Agreement, the evolution of e-commerce supply and distribution networks, and the imposition of new tariff programs have created barriers to some domestic industries, but also have created new opportunities for flexible and adaptive entities such as the Port of Memphis.

In this positive environment, the Port of Memphis may be in a position to improve, acquire or gain control of major development sites at Pidgeon Industrial Park, TVA Allen Steam Plant site, the Memphis Light Gas & Water (MLGW) Peninsula, and President's Island.



Downtown Memphis and Wolf River Harbor

Working together, the Port of Memphis, EDGE, the City of Memphis, Shelby County, the Chamber of Commerce, and the State of Tennessee can undertake several actions to protect and expand current employers, attract new industries and employers, and create a long term path of growth every bit as consequential as the 1947 and 1967 decisions creating the President's island and Pidgeon Industrial Park.

Impediments to Growth

While there are always impediments, the Port is uniquely positioned to leverage its assets to achieve sustained economic development and growth. This study has identified several target industries that make sense to locate to the Memphis region and more specifically, develop on Port controlled property. These options range from shorter term opportunities in the steel finishing and agricultural processing industries to longer term targets of chemical and automotive facilities. Also looming on the horizon is the promising concept of container on vessel transport on the Mississippi River and how the Port of Memphis can support, and benefit, from that industry.

While the overall conditions and long-term trends are favorable to growth at the Port of Memphis, a number of short, medium and long-term impediments to growth exist. In addition, the Port cannot compete in every industrial, logistical, or commercial sector; competitive choices must be made, and priorities established.

President's Island

The most immediate set of impediments to growth at the Port are at President's Island. That industrial park is essentially at capacity and has been for a number of years. When parcel vacancies occur they typically are too small for many contemporary users. While expansion of President's Island may be feasible, the raw timeline and cost for planning, designing, permitting and filling the expansion areas, along with extending the necessary roads, utilities and ancillary services to the reclaimed areas, is likely beyond a reasonable schedule or budget for a public enterprise. Reclaiming the property to an elevation above flood levels, and providing road and rail services to the 875 acres identified in the long-term master plan buildout, would require an investment in excess of \$50 million and may take over a year to get permits and approvals after completion of design. One cost savings approach would be to take advantage of planned river and harbor dredging to fill those areas over time.

Beyond schedule and cost, a major reclamation project on President's Island is fraught with significant regulatory risk. Changing floodplain and river flow standards could increase the cost or even preclude the reclamation of significant acreage on President's Island.

In addition, President's Island is now 70 years old. The roads, rail, stormwater, and marine terminal assets are all in declining to poor condition. The 53-acre Public Marine Terminal, managed by the Memphis and Shelby County Port Commission, is in extremely poor shape and immediate action is needed to forestall weight limitations or outright closure.

An infrastructure assessment was performed at President's Island and Pidgeon Industrial Park, with short term, priority maintenance projects identified below:

Recommendation	Estimated Conceptual Cost (for planning purposes only)
Repave President's Island Terminal Sites	\$1,750,000
Rebuild Public Terminal	\$4,000,000
Replace Railing at Crane Loading Facility	\$100,000
Repair Stormwater Outfalls to McKellar Lake	\$750,000
Riverport / Paul R. Lowry Road Resurfacing	\$5,700,000
Harbor and Channel Avenue Resurfacing	\$10,200,000
Add Paved Shoulder on Harbor Avenue	\$1,300,000
President's Island Cross Street Paving	\$3,500,000
Riverport Road Bridge Transitions	\$150,000
Rail Upgrade – President's Island (3.7 miles)	\$5,550,000

Pidgeon Industrial Park

The 4,500-acre Pidgeon Industrial Park has reasonable road, rail and utility service, and nearly 2,300 acres available for development on land controlled by the Port, Electrolux and Nucor. In addition, the adjacent Canadian National/CSX rail intermodal facility is a significant and underutilized asset.

Rail intermodal facilities have been significant catalysts for development in numerous locations around the country, including in California, Texas, Georgia, South Carolina and Virginia. The Burlington Northern rail intermodal facility in the Memphis region is surrounded by significant industrial and logistical users.



CN/CX Intermodal Site - Adjacent Development



BNSF Intermodal Site - Adjacent Development

While poor ground conditions constrain development at all current and potential Port sites (President's Island, Pidgeon Industrial Park, TVA Allen, and MLGW Peninsula), the Port-controlled and Port-owned sites in Pidgeon Industrial Park have the shortest timeline and lowest total cost for creating development sites attractive to current industrial and logistical users.

Poor soils have historically been a major deterrent in getting through the due diligence phase of attracting economic development projects. With virtually all other significant infrastructure requirements readily available in the Park, the need for a different approach to ground improvements, both technically and politically, is paramount. Failure to address the Pidgeon Industrial Park soil conditions will lead to continued underutilization of the Pidgeon land assets and a failure to fully capitalize on the Canadian National/CSX intermodal yard.

TVA Allen and MLGW Sites

The TVA Allen and the MLGW peninsula sites both have exceptional long term value to the Port of Memphis and offer both diversification new economic development opportunities. The timeline and/or cost of developing each or both sites is an impediment to short-term or even mid-term development of the sites.

With ownership transition and remediation of the TVA Allen site(s) underway, and road, rail, utility and flood protection assets generally in place, including the potential re-use of the TVA Allen marine terminal, development of these sites is a short term priority.

The processes for ownership transition of the MLGW peninsula are potentially reasonable. However, the cost of extending road, rail, and utilities to the MLGW site, and potentially developing a marine terminal onsite, is substantial.



TVA Steam Plant and MLGW Peninsula

Short Term Opportunities for Growth: Recommendations in the 1 - 5 Year Timeline

Over the next five years, the Port of Memphis should pursue actions to achieve a state of good repair for existing infrastructure assets in order to retain and expand current employers and industries; acquire or gain control of additional sites for future, long-term economic development; and implement selective ground improvements at Pidgeon Industrial Park in order to compete for industrial, logistical and commercial users in the short term.

While the general condition of President's Island infrastructure is poor, the public marine terminal is effectively at the end of its useful life and needs either a major rehabilitation or a relocation to the former TVA Allen marine terminal. Recent inspections revealed safety issues that must be addressed in the near term. The conceptual rehabilitation cost estimate is approximately \$4 million; the cost or schedule of relocating the public marine terminal to the TVA Allen site is unknown at this time.

While these rehabilitation efforts are underway, the Port of Memphis can secure the rights to valuable long-term expansion sites at the TVA Allen facility and the MLGW peninsula.

Over a five year time horizon, Pidgeon Industrial Park is the most likely development site for major new economic development. However, this will require proactive measures to address the poor soils in the Pidgeon Industrial Park:

- Immediately seek Tennessee Economic and Community Development (TECD) and/or Tennessee Valley Authority (TVA) Site Development Grant to determine the best location(s) and strategies for publicly-owned soil improvements
- Develop an internal strategy and approach to amend and compact soils at specific locations over 18 to 24 months in order to support up to 1 million square feet of logistic or light industrial uses that can benefit from the adjacent Canadian National/CSX intermodal facility (conceptual cost estimate of \$5 to \$10 million, depending on technology and allowable schedule)

With an estimated \$44 million in local tax revenues attributable to the Port of Memphis employers, the Port, EDGE and the City should also seek a long term, dedicated source of funding for capital improvements on President's Island—either by earmarking a portion of local revenues attributable to President's Island employers or a utility fee type of approach. Failure to address road, rail, stormwater and utility deficiencies could result in a loss of valuable tenants. As part of this initiative, the Port should seek to acquire or control individual parcels on President's Island in order to consolidate parcels and create larger development sites that are better able to accommodate contemporary facility and operational needs.

Finally, efforts should continue to complete negotiations with both the Canadian National rail lines and the marine terminal facility operators on Presidents Island.

Medium Term Opportunities for Growth: Recommendations in the 5-10 Year Timeframe

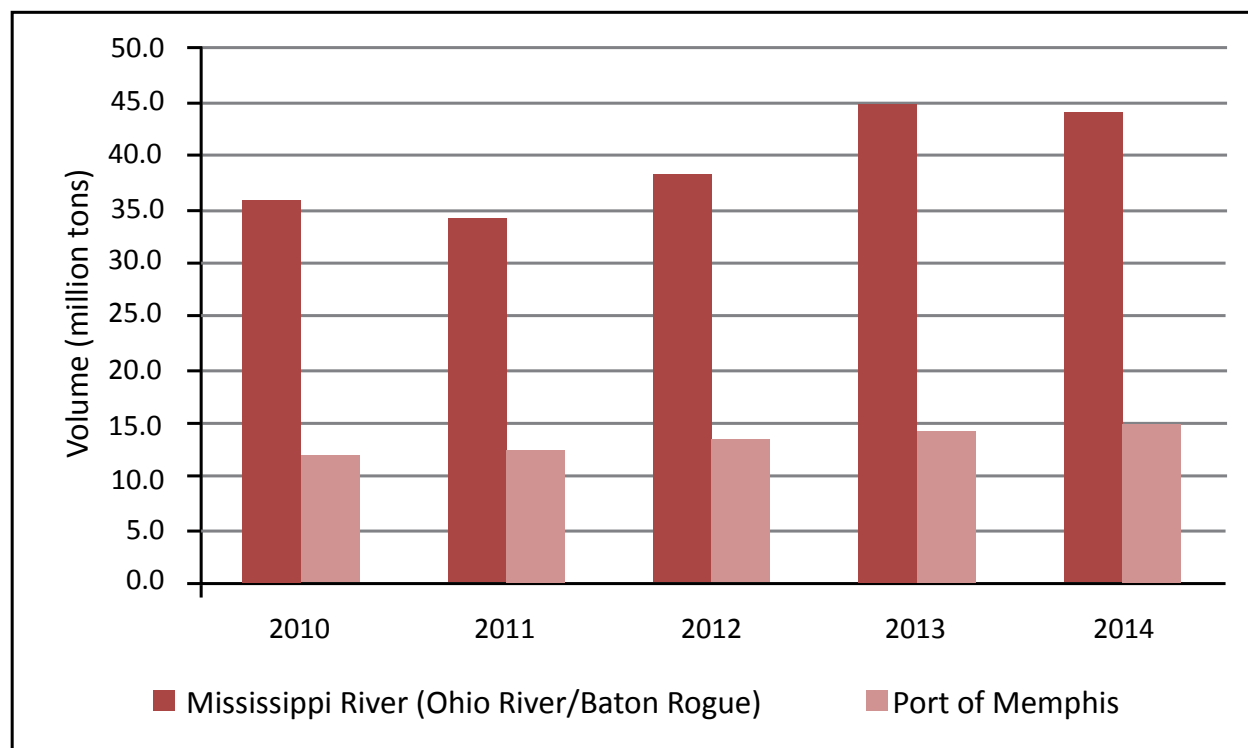
Based on current trends, the Port of Memphis has numerous opportunities for investments and growth. A careful review of those trends—both positive and negative—led to designating five target industries for the most likely short- to medium term location for major new facilities in the Pidgeon Industrial Park:

- Steel Finishing & Production
- Agricultural Processing & Food Production
- Intermodal Logistics & Distribution
- Waste Paper & Plastics Recycling & Aggregation
- Empty Container & Trailer Pools

Attracting all five targeted industries to Pidgeon Industrial Park over the next ten years will require significant public and private investments. But this “success scenario” could yield more than 1,900 new, direct jobs and an additional 2,200 new, indirect jobs that would produce an annual economic impact of \$655 million and nearly \$8 million in annual local tax revenues.

Medium Term Constraints

While inland waterway access is absolutely essential to major Port employers and the entire region, the long-term cargo trends on the Mississippi River show flat to declining cargo volumes and values. Inland waterway access can complement economic growth opportunities at the Port of Memphis, but it is unlikely to lead economic growth at the Port. Put another way, there is not a large amount of discretionary cargo that the Port of Memphis could feasibly capture from other river ports or other north-south rail or highway corridors.



Not reflected in these trends are the recent Chinese soybean and corn tariffs. These tariffs could be extremely consequential not only to soy and corn producers, but also to the waterborne commerce of the U.S. inland waterway system.

A second set of constraints are the timelines needed to develop sites within the Port-controlled properties. Cost considerations aside, planning, permitting, and executing a major floodplain expansion of President's Island is a lengthy process, with a high degree of regulatory risk. While Pidgeon Industrial Park requires significant soil improvements, the schedule and risk of those actions can be managed by the City and the Port of Memphis. As noted above, a ground improvement investment of \$5-10 million could support approximately 1 million square feet of industrial or logistical facilities in the Pidgeon Industrial Park.

An evaluation of market and site constraints points to Pidgeon Industrial Park as the strongest candidate for medium term growth—likely taking advantage of the synergistic and adjacent Canadian National/CSX intermodal facility.

Medium Term Trends

Despite the inland waterway limitations and the previously discussed site availability constraints, a number of global, national and regional trends illustrate significant opportunities for public and private investments and growth.

At the global level, the expansion of the Panama Canal has allowed east and Gulf coast container ports to grow faster than west coast container ports. The Panama Canal expansion also has enabled significant export volumes of liquified natural gas (LNG) and LNG-derived resins and plastics. U.S. produced resins and plastics often require empty containers for back haul trips to Asian destinations, and Memphis has historically been a major depository of empty shipping containers.

The renegotiated NAFTA agreement (USMCA) calls for higher domestic automobile content and higher wages for Mexican auto workers. In addition to the NAFTA renegotiation, ongoing tariffs on steel, aluminum and numerous Chinese products may strengthen existing Memphis steel industries and may create opportunities for additional automobile component production and distribution. A Memphis location could compete in both midwestern and southeastern steel and U.S. automobile component markets.

At the national level, the combined effect of railroad re-engineering and consumer supply chain evolution create new opportunities for logistic and light industrial/assembly facilities. Over the last two years, Class 1 railroads have begun moving towards “precision railroading” with longer, denser train sets, fewer stops, and more predictable schedules. Fewer and higher volume rail intermodal facilities are a likely outcome of this process, with significant synergies and economic benefits accruing to communities and markets served by the remaining intermodal facilities. The Greater Memphis Region is ringed by rail intermodal facilities and the Pidgeon Industrial Park is immediately adjacent to the Canadian National/CSX rail intermodal facility.

While the rail network are consolidating and densifying services, the consumer supply chain is expanding and moving away from the traditional hub-and-spoke model and towards a vast network of consolidation, distribution and fulfillment centers to meet the needs of e-commerce and reduced inventories for traditional retailers—the “Amazon Effect.”

The combined effect of these rail and consumer supply chain consolidations is public and private investment in facilities with excellent air, rail, trucking, and seaport services and access.

Targeted Industries

Based on the above constraints and trends, five industries are targeted for growth in the medium term. These contain both base and support industries. Base industries are those that export nearly all of their production outside of the local economy, creating new incomes and spending power locally. In contrast, support industries primarily offer goods and services to local base industries. Detailed summaries for each target industry are contained within the body of this report.

Steel finishing and production is an existing industry in the Memphis region with an identifiable workforce and a major employer within the Port of Memphis (Nucor). Expansion of Nucor may require a reconfiguration of the Nucor harbor chute, improved road and rail service, and ground (soil) improvements. Attraction of additional steel industries to Pidgeon Industrial Park may require improved road and rail service as well as ground (soil) improvements. The Ports of Indiana have shown long-term success in building a range of steel and specialty steel industries in and around their three port facilities.



Agricultural Processing and Food Production is an existing industry in the Memphis region with an identifiable workforce and a major employer within the Port of Memphis (Cargill). Previous initiatives



to support primarily bulk transports and exports in the corn and soy markets do not appear viable in the current tariff and global market environments. The 5 - 10 year forecast in the bulk market does not appear strong due to the number of underutilized storage and processing facilities north and south of Memphis, including West Memphis and St. Louis and the back haul rail opportunities to west coast ports. However,

attracting higher value agricultural processing and actual food production facilities and employers to Pidgeon Industrial Park is consistent with TECD goals and market analysis. Attraction of agricultural processing and food production facilities to Pidgeon Industrial Park may require improved road and rail services, and almost certainly will require ground (soil) improvements. The Ports of Philadelphia and Delaware have shown long term success in supporting a range of higher-end food production, cold storage, and related distribution facilities.

Intermodal Logistics and Distribution is an existing industry in the Memphis region with an identifiable workforce and a potentially major employer within the Port of Memphis (CN/CSX). The synergies and opportunities for rail and truck intermodal growth at Pidgeon Industrial Park, including access to Memphis International Airport, are evident within the greater Memphis region, and in numerous regions across the U.S. The greater opportunity lies in containerized freight. Memphis is one area of the country which has a surplus of empty containers and enjoys a competitive advantage when that surplus is combined with the CN/CSX facility. Certain specialized agricultural commodities are both higher value and amenable to containerization, e.g. non-GMO soy, organic corn and wheat, ginger, etc. These are much more specialized markets and would require a more detailed knowledge of Tennessee supply and global demand. In addition, recent changes to NAFTA (USMCA) and tariff regimes may incent the development of facilities for the consolidation, assembly, or distribution of auto parts or components. However, attracting intermodal logistics and distribution facilities to Pidgeon Industrial Park will almost certainly require ground (soil) improvements and may also require a second road access point to the industrial park and/or the construction of a highway bridge over the CN/CSX rail line for enhanced,



uninterrupted access to the property east of the existing intermodal yard. The current Trade Point Atlantic development in Baltimore is but one of many examples where value is created by bringing together multiple modes of transportation to serve national and global markets and supply chains.



Waste Paper and Plastics Recycling and Aggregation is a rapidly changing global industry due to Chinese regulatory actions to reduce the volume and nature of waste paper and waste plastics transported to China. In terms of raw volume, waste paper and waste plastics represent the largest containerized exports from the U.S. The export of containerized waste paper and waste plastics is an important backhaul segment in the global supply chain—

returning otherwise empty containers to Asian producers at a lower cost than returning empty containers. In addition, domestic recyclers of paper and plastic, both public and private, may see either increased recycling costs or increased use of domestic landfills, both public and private. These trends could support at least two growth opportunities for the Pidgeon Industrial Park and its excellent road, river and rail connections:

- Location of a recovered paper facility to break down and re-use old corrugated containers, old newspaper pulp, or recycled containerboard or recycled boxboard. Several domestic papermills have reopened and revised their production capacity in the last year to capture or incorporate recyclable components.
- Location of a selective paper or plastic aggregator to transport containerized and sorted plastics either to Mobile or Prince Rupert, BC for export to willing and permissible Asian markets.

Empty Container or Trailer Pools are existing industries within the Memphis region with at least one identifiable employer in the Port of Memphis (Seacor). While neither industry is likely to become a major employer within the Port, both are necessary to support the growth of existing, targeted and base industries. For example, empty containers are highly valued by plastic and resin producers in Louisiana and Texas. Reliable access to empty containers could help to attract base industries such as plastic or resin facilities to the Port of Memphis, or at least to develop supporting services to those industries. Similarly, “grey” trailer pools are becoming increasingly common throughout the U.S. and the presence of one or more could help to attract other logistic, distribution and light industrial facilities to Pidgeon Industrial Park.



Targeted Land Acquisitions

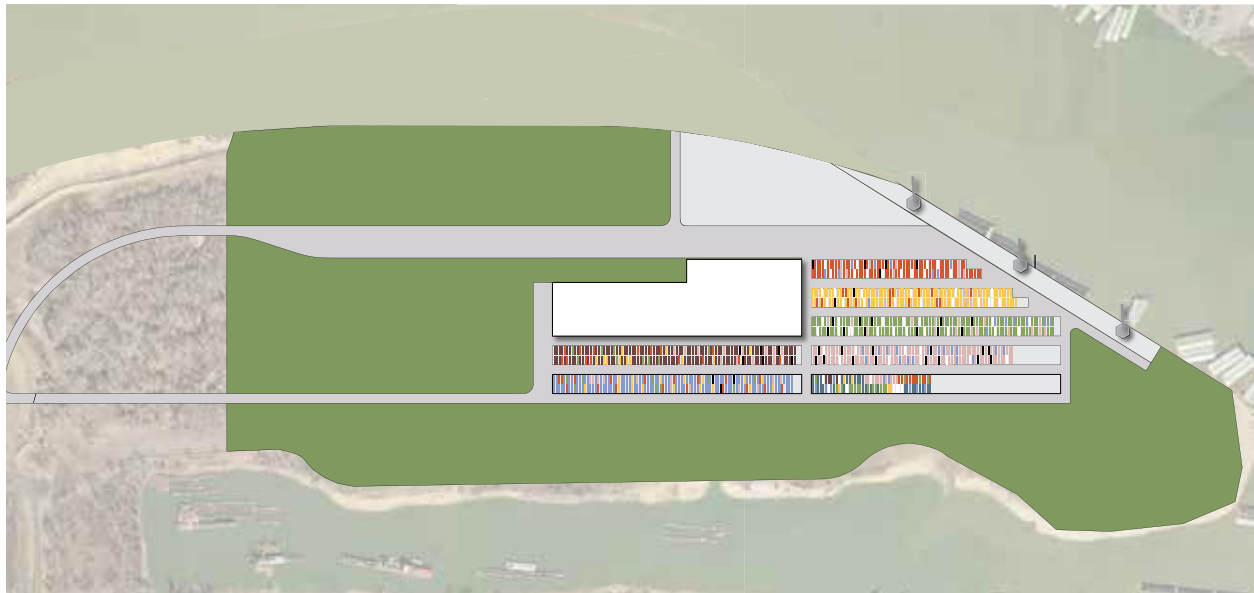
While acquisition of all potential properties for future development is a short term priority, two of these properties, once acquired, lend themselves to more medium term economic development opportunities to ensure another 20-30 years of uninterrupted growth.

The old TVA Allen site has been decommissioned and is in the demolition design process. That process can be grouped into two phases. The first is the main steam plant, which would typically require 4-5 years to demolish. The second is the remediation and removal of the coal ash pond/storage areas on both sides of the main plant, which could require 5-8 years. Once the properties that are currently under TVA ownership have been transferred, movement toward re-use can commence. This site is properly positioned, has significant infrastructure assets, and is of adequate size to support a heavy industrial or terminal operations user in the future.



TVA Steam Plant

Additionally, a peninsula exists across the TVA harbor to the north that is currently owned by the City of Memphis on behalf of Memphis Light Gas & Water and contains approximately 350 acres as configured in the master plan. It is expected that this ownership transition would be relatively uncomplicated. However, significant investment would be required to raise the site above flood elevation and to extend road, rail, and utility service to the site. Again, given those cost and permitting constraints, this is likely a mid-term development opportunity, with the property well suited for terminal operations (high volume container or bulk marine) or waterfront industry user.



MLGW Peninsula Development Concept

Long Term Vision for Growth: Recommendations in the 10 - 20 Year Timeframe

The long term vision for the Port of Memphis is simple—commit to growing and diversifying the existing base industries at the Port with a long term commitment to protecting and enhancing those industrial sectors which are most likely to be employment and investment anchors for the region for at least another twenty years.

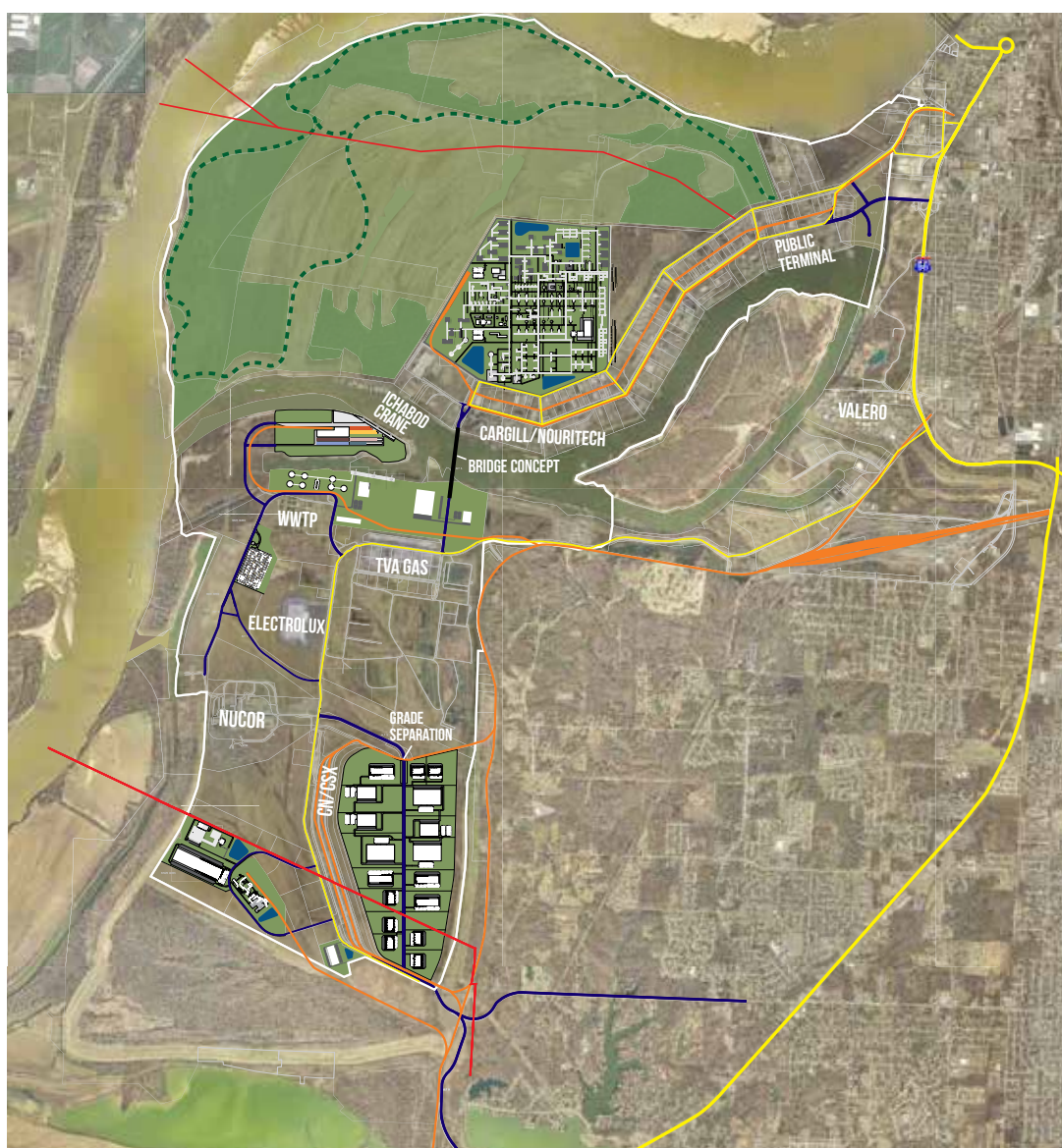
As short and midterm objectives are achieved, land availability at the Port properties becomes increasingly scarce. In an effort to alleviate that shortage, planning should commence for flood plain reclamation on President's Island. Given permitting processes, land acquisition, Mississippi River hydraulics, and cost of execution, 875 acres of Pidgeon Industrial flood plain have been identified for future reclamation. The most cost-effective approach in accomplishing this task is through use of dredge spoils from the Mississippi River, and to a lesser extent, the harbor. To enhance cost savings, a systematic long-term approach using the spoils from regular river and harbor maintenance is possible. Once reclaimed, this land mass and accompanying infrastructure is well suited for the long-term target industries identified. The long-term vision doesn't start in year ten; it starts on day one.

As recent developments have shown in the petroleum, LNG and containerized supply chains, the supply chains and networks are capable of significant and even radical adaptation, including the complete reversal of pipeline flows and import supply chains. Some areas of potential long term growth and public sector commitments within the Port of Memphis include:

- **Chemicals and petrochemicals** may be able to draw from recent and future pipeline investments in the region that would support major production facilities on President's Island, McKellar Lake or in the Pidgeon, TVA/Allen or MLGW Peninsula sites. In addition, the robust rail, roadway, river, runway and pipeline networks could provide highly efficient means of delivering chemical and petrochemical products to the next-phase users in manufacturing, export, or consumer markets.

- **Petroleum distillates** could draw from or expand on the highly successful Valero refinery on McKellar Lake and its related workforce and suppliers. Petroleum distillates is a category that encompasses the full range of petroleum products, from coke to ultra-pure solvents. New energy-related products are being developed all the time, from both petroleum and LNG sources. This industry is naturally synergistic with the existing refinery. As with chemicals and petrochemicals, the robust rail, roadway, river, runway and pipeline networks could provide highly efficient means of delivering petroleum distillates to the next-phase users in manufacturing, export, or consumer markets.
- **Automotive parts** and components have historically been manufactured overseas and assembled in the U.S. The very recent re-negotiation of the NAFTA agreement (USMC) appears to include stronger domestic content requirements. This may provide an opportunity for the Memphis region to either produce automobile parts or components, or to utilize the region's road, rail, runway, and river assets to serve as a hub supplier to both the Midwestern (Detroit) and the Southeastern automobile manufacturing centers.

These current and potential base industries yield among the best wage and longevity returns for any public investments in industrial and logistic industries. The right investments and disciplined execution could yield very successful employment and investment returns as conceptually illustrated below:



Long Range Port Property Buildout

There are numerous recommendations contained within this report that are focused on maintaining and growing the level of economic impact that currently exists as a result of operations on Port jurisdiction properties. In addition to the recommendation of industries to target as potential economic development partners, the study also provided recommendations geared toward sustaining existing economic activities and enhancing future development opportunities. In an effort to help the Port focus on the highest and best use of existing and potential resources, the top development and maintenance action item recommendations are presented.

Development Priorities

- 1. Public Terminal Redevelopment**
- 2. Create President's Island Short Line Railroad**
- 3. TVA Pidgeon Industrial Park Property Acquisition and Utilization**
- 4. MLG&W Pidgeon Industrial Park Peninsula Utilization**
- 5. Property Acquisition Program**
- 6. EDGE Property Access Roadway in Pidgeon Industrial Park**
- 7. Shelby Drive Access Road into Pidgeon Industrial Park**
- 8. President's Island Industrial Site Expansion**

Maintenance Priorities

- 1. President's Island Industrial Road Resurfacing**
- 2. President's Island Outflow Structure Repairs**
- 3. Riverport Road Industrial Road Resurfacing**
- 4. Riverport Road, Cypress Creek Bridge Transition**

STRATEGIC MASTER PLAN PORT OF MEMPHIS



I. TENANT INTERVIEW/STAKEHOLDER INPUT



Tenant Interview/Stakeholder Input

A critical component of this master planning effort was public participation. The first phase consisted of a Port tenant survey and subsequent in-person and telephone interviews. The effort was geared toward soliciting responses about company employment and business plans for the purpose of providing input to economic impact and labor studies. Additionally, companies were asked to provide feedback on Port infrastructure, their waterfront business activities, and overall Port operations.

The Port tenant survey was initiated in February of 2018. Surveys were mailed to 169 business entities with a 20% return rate. The return rate was less than it has been in years past when previous economic impact studies were performed, but the data quality of companies returning surveys (i.e. larger employers, greater economic impact industries) was better. A synopsis of tenant survey results follows:

Survey responses

- The average respondent employs approximately 100 people
- Almost 400 jobs are needed to be filled, collectively, over the next 12 months
- Workforce challenges include shortage of applicants, unskilled applicants, and candidates not meeting the basic requirements
- One third of the industries are dependent on direct access or close proximity to the harbor
- The two major infrastructure concerns are roads and rail service

Interviews

- General disappointment that service roads adjacent to Channel Avenue aren't regularly maintained
- Very satisfied with waterfront operations
- Rail service has been substandard and declining
- Private industries are resorting to maintaining public side streets to prevent operation disruption
- Rail services block roads and business entrances for extended periods
- Great location (President's Island) for industrial users
- Pidgeon Industrial Park is ideal for industry, isolated yet close to metropolitan center
- Soils issues a surprise after making commitment to locate in Pidgeon
- Wayfinding signage needs improvement
- Difficult to market their businesses on President's Island to regional and national clients due to aesthetics and access. Port needs to look like a vibrant area.
- Intermittent power outages and surges have been problematic

The second phase of public participation was to garner feedback from stakeholders in addition to Port tenants. In April, a public meeting was held at the National Civil Rights Museum and follow up interviews with those who could not attend were conducted for this purpose. In addition to existing industries at the Port, input was provided from pertinent industry leaders from the region, government agency representatives, trade association leaders, real estate professionals, site selection consultants, contractors, and former regional port executives. This group echoed many of the comments from our tenant survey participants but also added the following:

- The mouth of McKellar lake should be widened to enhance maritime operations
- Public Terminal should be located closer to the mouth to enhance maritime services
- Larger barges than those used in the past have created harbor logistics issues
- Lake siltation from Nonconnah Creek is a major concern
- Negative connotation to working on President's Island
- Pursue container on barge opportunities
- Leverage the Foreign Trade Zone status
- Engage core industry tenants and local industry leaders to strategize for future industrial growth
- Large tracts of developable land in Shelby County are scarce
- Difficulty competing with neighboring states for economic development incentives
- PILOTs merely level the playing field before development incentives are considered
- Minimal growth opportunities for bulk agricultural transport on the east side of the river
- Difficult to bring logistics/distribution markets back from Fayette, Marshall, and DeSoto Counties.
- Secondary access roads are crucial to operations and growth
- Public investment should provide good returns
- Water quality and capacity a potential issue for future growth
- Memphis is the best harbor on the inland system, however St. Louis is more proactive in business development
- Regular discussions on the Port are helpful and should be continued

The comments above reflect the discussions that took place with tenants and stakeholders, and are based on their personal experience and overall knowledge of the industries in question. Comments have not been substantiated but for the most part are in alignment with collective knowledge and understanding of the master plan team as it relates to Port and industrial development. This feedback was used as input to economic impacts, labor study, infrastructure assessment and target industry recommendations.



STRATEGIC MASTER PLAN PORT OF MEMPHIS



II. PORT FACILITY & INFRASTRUCTURE ASSESSMENT



Port of Memphis Infrastructure Assessment



Four sites with operational marine facilities and the systems serving the port's industrial properties were identified for an initial site and infrastructure assessment. There are some immediate maintenance concerns at the port owned waterfront facilities and significant capacity and maintenance concerns with the infrastructure serving the greater port area.

The Public Terminal has substantial widespread damage to the dock's reinforced concrete deck, along with significant erosion of material around the substructure elements

on the west side. Due to the current critical state of the Public Terminal, it is recommended to restrict all live loads on this structure until further data can be obtained, a load rating can be calculated, and/or structural repairs can be made. Following the due diligence of a structural analysis and prioritized engineering repairs, it is recommended to perform a full rehabilitation of the public terminal facility. In the case that full rehabilitation is infeasible, a secondary option is to move the public terminal to the decommissioned Allen Steam Plant property.



Most other facilities have moderate concerns that moreover affect operational and maintenance costs. The port's crane loading facility needs a repair and maintenance plan of action in order to increase the service life of the marine facility. Site pavements and railings at this location need replacement to accommodate current operations. The TVA harbor needs a baseline waterfront facility inspection tailored to future uses of this facility as those uses become apparent. The Nucor harbor needs maintenance dredging and a reorientation of its access channel to reduce future maintenance costs.





The stormwater system within the port area is generally in good condition. The outfall locations for stormwater on President's Island experience significant erosion due to the sandy nature of soils on the island. It is recommended that the outfalls be stabilized with heavy rip rap to reduce future erosion potential. The roadways on President's Island and within Pidgeon Industrial Park require routine resurfacing due to the heavy loads those roads normally experience and in some areas, damage has reached a point where full depth replacement of the road section is recommended.

A summary of capital and recurring maintenance costs necessary to support current operations are summarized in the following tables. Detailed findings and recommendations are in Appendix A.

Recommendation	Estimated Cost
Repave President's Island Terminal Sites	\$1,750,000
Rebuild Public Terminal	\$4,000,000
Replace Railing at Crane Loading Facility	\$100,000
Repair Stormwater Outfalls to McKellar Lake	\$750,000
Riverport / Paul R Lowry Road Resurfacing	\$5,500,000
Riverport Road Full Depth Spot Repairs	\$200,000
Harbor and Channel Avenue Resurfacing	\$8,700,000
Add Paved Shoulder on Harbor Avenue	\$1,300,000
Channel Avenue Full Depth Spot Repairs	\$1,500,000
President's Island Cross Street Paving	\$3,500,000
Riverport Road Bridge Transitions	\$150,000
Rail Upgrade – President's Island (3.7 miles)	\$5,550,000
Total	\$33,000,000

Table 1: Projected Project Costs

Recommendation	Estimated Rate	Annual Cost
Roadway Maintenance	\$2,000 / Lane Mile	\$160,000
Dredging – McKellar Lake		\$2,250,000
Dredging – Nucor Harbor		\$350,000
Stormwater System Maintenance		\$100,000
Facilities Maintenance	\$1.50/ SF	\$150,000

Table 2: Estimated Maintenance

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III. PRESIDENT'S ISLAND PROPERTY REDEVELOPMENT



President's Island Property Redevelopment

Vacant and underutilized parcels on President's Island were evaluated for their redevelopment potential and ability to accommodate contemporary industrial users. This evaluation consisted of determining potential market values for target properties, evaluating property consolidation for prospective target industries, and providing recommendations for action based on anticipated redevelopment costs versus the benefits to the Port and Memphis. Sites with existing or historical uses will need to be evaluated further to determine if any environmental concerns related to those uses will require mitigation.

President's Island was originally subdivided as a series of mostly 9-12 acre parcels for the purpose of industrial development. As uses moved onto the island, property was consolidated into parcels as large as 66 acres. There currently exists a large variability among parcel sizes on President's Island and the island is effectively at full occupancy. The remnant parcels that are vacant or underutilized on the island are generally too small for contemporary uses and industries that would target this area.



President's Island Property Redevelopment

Two blocks of properties on the south side of Channel Avenue can potentially be targets for acquisition by the Port due to their relatively low level of activity compared to the surrounding area and the presence of vacant land that can be used to tie these parcels into a larger development. The 99.76 acre block south of Channel Avenue between Wharf and Pier Streets (Area 1) contains one completely vacant parcel and several properties with a low apparent level of activity. The 41.94 acre collection of properties south of Channel Avenue between Buoy Street and the Port's crane facility (Area 2) contains two small city owned properties and two properties with light to moderate apparent levels of activities. Charts summarizing the property ownership in these areas are below.

AREA 1

DREXEL CHEMICAL COMPANY	9.90 AC
CITY OF MEMPHIS	0.30 AC
SUPERIOR BULK LOGISTICS INC (1)	14.03 AC
SUPERIOR BULK LOGISTICS INC (2)	23.33 AC
CONTINENTAL CEMENT CO	12.32 AC
NEXEO SOLUTIONS LLC	9.63 AC
OWENS CORNING ROOFING AND ASPHALT LLC	11.77 AC
CHS INC	18.48 AC

AREA 2

HCI CHEMICAL DISTRIBUTION INC	7.56 AC
VERTEX CHEMICAL CORP	29.14 AC
CITY OF MEMPHIS AND COUNTY OF SHELBY (1)	2.62 AC
CITY OF MEMPHIS AND COUNTY OF SHELBY (2)	2.62 AC

Both potential consolidation areas can accommodate the target industries of waste paper and plastics recycling and aggregation and empty container and trailer pools identified in the medium term target business recommendations. Additionally area 1 can accommodate steel finishing and production, agricultural processing and food production, and intermodal logistics and distribution target industries.

The aggregate assessed values in Area 1 is \$4,844,800. Based on recent sales in the area, the approximate land value is approximately \$30.5 million. Area 2 has an aggregate assessed value \$2,801,500 and the approximate land value for parcels not currently owned by the city is \$15.9 million. Both areas have a significant amount of above ground storage tanks that could affect redevelopment costs due to potential environmental mitigation.

Due to the potential for higher intensity uses and lower levels of current activity, Area 1 is recommended as a property consolidation and redevelopment priority area. The current activity on this land does increase property costs by 50-75% relative to purely greenfield sites. However, the benefits of location, namely waterfront access which is constrained in availability, can serve to justify the added costs associated with development at this location.



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IV. RECOMMENDATIONS ON FACILITY EXPANSION



Recommendations for Facility Expansion

The Port Commission, as a part of the strategic master plan, solicited recommendations for facility expansion within the port's jurisdictional area. Several potential projects were targeted to enhance the current operations of the port, improve freight movements for the port and industrial park tenants, and to support future industries and changes in freight movement. The waterway, land development, and roadway projects are detailed below and include preparatory ground improvements to facilitate developments for target industries, a second highway access for both Pidgeon Industrial Park and President's Island, an access road and rail overpass for access to the area behind the CN/CSX Intermodal facility, additional port facilities and land reclamation activities to increase developable areas.

Various geotechnical studies performed over time for developments within the port area have highlighted concerns with the natural soils and ground conditions that are present. For vacant developable sites, there is potential for liquefaction and lateral spreading in seismic events and settlements risks related to soft soils, uncontrolled fill, and high plasticity clays. These issues have become an impediment to economic development in the vicinity of the port. In order to incentivize development in this area, it is suggested to either surcharge select development sites or utilize ground improvement techniques to mitigate concerns with the soils (\$8-\$10 million for a 1 million square foot logistics facility).

Access to facilities is a concern that has been shared by current and prospective tenants in the port vicinity. There is currently a project in the regional transportation plan to connect Paul R. Lowry Road to Shelby Drive. It is recommended that this road project be prioritized. For President's Island, two potential solutions were evaluated to mitigate access restrictions. One option is to provide a bridge across the harbor connected both segments of Buoy Street. Another option is to extend Southern Parkway to Channel Avenue by filling in a portion of McKellar Lake. Though permitting may be a challenge, the cost benefits favor an extension of Southern Parkway to mitigate access restriction on President's Island.

The property to the immediate east of the CN/CSX Intermodal facility has been identified as a target area for industrial and logistics development. An issue constraining development of this property is its lack of accessibility. Due to the proximity of this property to the intermodal facility, an at-grade rail crossing will not provide reliable access for potential tenant. It is recommended that a new industrial park road be constructed with grade separation at rail road crossings to facilitate development of this property.

Recommendations for Facility Expansion

The decommissioning of the TVA Allen Steam Plant presents several opportunities for redevelopment. This site could serve as an ideal location for many of the target industries or other prospective industries that require direct water access. This location can also serve as an intermodal hub for the industrial facilities in the area. A consideration could be made to relocate the public terminal to this location if a rehabilitation of the existing facility is infeasible. A benefit for relocating to the TVA property is a less constrained site for port operations, however, significant capital would be required to provide adequate infrastructure and services to that location. Furthermore, there have been recent discussions with barge operators interested in bringing high volume container traffic through Mississippi River ports. The operation of a container port would be significantly different than current operation and would require high capacity and high volume crane service. We recommend that a dedicated facility for container service be built on the MLGW peninsula property with dedicated rail service should this venture secure the necessary commitments to move forward.

The MLGW Peninsula property would require fill to elevate the property above the flood plain of the Mississippi River. We suggest, pending the timeline of any terminal development, that dredge spoils from operations in the river and McKellar Lake be diverted to the MLGW peninsula property. Also, as Pidgeon Industrial Park becomes more developed over time, reclaimed land that is currently in the floodplain on President's Island could potentially be used for industrial development. Dredge spoils should also be diverted to reclaim portions of President's Island from the flood plain over time to facilitate development. A cost summary for all facility expansion projects is included in the table below.

Improvement	Total Cost
MLGW Peninsula Fill and Roads	\$ 25,000,000 – 30,000,000
President's Island Reclamation	\$ 40,000,000 – 50,000,000
Southern Parkway Extension and Fill	\$ 17,000,000 – 22,000,000
Logistics Park Connector and Overpass	\$ 16,000,000 – 20,000,000
Paul R Lowry Extended - Option 1	\$ 70,000,000 - 90,000,000
Buoy Street Extension and Bridge	\$ 120,000,000 – 140,000,000

A presentation detailing these findings was made to the joint board of the Port Commission and EDGE. That presentation can be found in Appendix B. This presentation provides background and supporting information used to develop the aforementioned facility expansion recommendations.

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V. ECONOMIC IMPACT STUDY



Port of Memphis Economic Impact on the Memphis-Shelby County Economy

Scope and Purpose of Study

The Memphis Shelby County Port Commission initiated this analysis to quantify the impact of the International Port of Memphis on the economy of Memphis and Shelby County, Tennessee. This analysis is one component of a comprehensive master plan for property and facilities within the jurisdiction of the Port of Memphis.

In this study, impact is measured in terms of dollar value of total economic output, direct and indirect jobs supported, and local tax revenues generated as a result of business activity related to The Port of Memphis. One purpose of this study is to provide policy makers with an understanding of the Ports' economic significance as determined by a professional third-party evaluator using recognized methodology. The full text of this study, along with contributing information, is included in Appendix C.

Methodology

Primary data on direct Port operations, employment and expenditures was provided by the Port staff. To collect needed data from the individual companies operating within the Port, a survey was conducted among all companies within the Port's jurisdiction. The survey instrument collected information on each company's type of operations, annual revenue, employment, hiring, and capital investments.

Survey forms were sent by mail, and the survey was available for online completion. Participation in the survey was encouraged by mail and email communications sent on behalf of the Port, and by stakeholder meetings.

To supplement the survey data, proprietary licensed data from business and credit reporting services was purchased for each business within the Port's jurisdiction. This data included annual revenue and/or value of product output, and the current number of employees. A sample of businesses that did not complete the survey instrument was contacted to collect data and to verify that the purchased financial and employment data correctly represented the company's operations within the Port.

The economic impact calculations in this study were generated using a model of the Shelby County economy that is based on regional input-output multipliers (RIMS II) from the U.S. Bureau of Economic Analysis. The model was designed for Shelby County using county-specific multipliers for each type of operation within the Port. Local tax rates, local wage rates, historic tax collection ratios, worker commute patterns and other Memphis-Shelby County factors were collected from local, state and federal agencies and utilized in the impact model.

Overview of the Port of Memphis

The Port of Memphis, which has jurisdiction from miles 715.5 to 741.0 on the Mississippi River, consists of three separate slack-water harbors: Pidgeon Industrial Harbor and McKellar Lake Harbor in the southern part of the city and Wolf River Harbor in the northern part of the city. Port properties include two major industrial parks, Pidgeon Industrial Park and President's Island. The Port of Memphis is the second largest inland port on the Mississippi River.

Waterborne operations within The Port of Memphis handled 12.2 million short tons in 2016, the most recent year for which waterborne commerce statistics have been reported by the U.S. Army Corp of Engineers at the time of this analysis. The tonnage handled in 2016 remained down from the peak of 19.1 million short tons in 2006.

Based on annual tonnage, the Port of Memphis ranks 47th among all U.S. coastal and inland ports. The top commodities moving through the Port of Memphis are listed in Table 1.

Table 1. Tonnage of Top Port of Memphis Commodities 2016

Commodity	Short Tons
Coal & Lignite	1,815,833
Gasoline	1,573,244
Soy Beans	1,137,504
Limestone	1,095,556
Distillate Fuel Oil	1,095,244

The Port of Memphis is designated as a Port of Entry and a Foreign Trade Zone. Port of Entry status allows imported cargo to be shipped directly to Memphis where it is inspected and receives U.S. Customs clearance. Foreign Trade Zone status allows goods to be imported duty-free for assembly, manufacture or storage. These goods may then be exported duty-free, or sold in a U.S. Customs territory after the proper duty is paid.

The Army Corp of Engineers has major operations and maintenance facilities within the Port of Memphis. The U.S. Navy operates a testing facility within the Port. There are numerous public and private docking facilities, terminals, storage facilities, and crane operations.

Because of its central North American location and transportation infrastructure, Memphis is known worldwide for its multi-modal distribution and logistics capabilities. The Port of Memphis is a critical element in that transportation infrastructure. The Port of Memphis is connected by rail and interstate highways to most major markets and is located at one of the few points in the U.S. where cargo can cross the Mississippi River by rail and truck.

Interstate 40, Interstate 55, Interstate 69 and seven major U.S. highways converge near the Port of Memphis. Forty-five states can be reached by two-day truck service from the Port. Cargo arriving at the Port of Memphis can reach more major markets overnight by truck than from any other city in the U.S.

Five Class I rail systems serve Memphis: BN, CN, CSX, Norfolk Southern and Union Pacific.

A rail to truck inter-modal terminal, Gateway Memphis, is located in Frank Pidgeon Industrial Park within the Port of Memphis. The Pidgeon Industrial Park offers dual rail access, with service by two Class I rail lines. Cargo arriving at the Port of Memphis can be shipped by single system rail to 48 states, Mexico and Canada.

The only petroleum refinery in Tennessee is located at The Port of Memphis. Pipelines and storage facilities supply fuel to the Memphis International Airport. Located approximately 10 miles away, the airport is the global hub for FedEx.

Annual Economic Impact

The Port of Memphis and the related industry operations are highly integrated into the Memphis regional economy. Employment at the Port has a high level of impact on other businesses and industries. The multiplier effects related to the Port are significantly higher than other transportation industries, in an economy that has a predominance of transportation services. Table 2 compares transportation related U.S. BEA multipliers for Shelby County.

Industry Sector	Employment Multiplier Direct-Effect	Output Multiplier Final-Demand
Water-related	4.7067	1.9769
Air	2.2592	1.7073
Rail	3.1498	1.6613
Truck	2.3193	1.9924

Table 2. Transportation Industry Multipliers

The overall economic impact of the Port of Memphis and the business entities operating within its jurisdiction is \$9.27 Billion annually. This figure is the value of all goods and services produced within the Shelby County economy as a result of the Port and its related operations. This does not include the one-time impact of capital investments made by port-related entities.

The number of jobs supported within Shelby County by the Port and all related operations is 22,465. This total includes an estimated 9,128 jobs directly employed by all port-related operations. An additional 13,337, indirect jobs exist elsewhere in the Shelby County economy in support of the Port and related operations. These indirect jobs are employed in a broad range of activities such as trucking, warehousing, customs brokerage, maintenance services, business services, personal services and retail.

Projected wages paid to direct jobs employed by Port and related operations are \$689.1 Million annually. Wages generated by the indirect jobs are projected to be \$721.4 Million, which brings the total wage impact to more than \$1.4 Billion annually.

As a result of this economic activity, Memphis and Shelby County governments receive \$44.6 Million in local tax revenues each year. This revenue comes from local sales tax, local business permits and taxes, as well as other local taxes such as hotel/motel tax, plus property taxes paid by businesses and individuals employed as a result of port-related operations. This tax revenue calculation does not include tax revenues collected by the state and federal governments and reapportioned to local government entities.

Comparison of Prior Studies

The economic impact of The Port of Memphis has been analyzed at seven intervals beginning in 1979. Key impact measures from each analysis are summarized in Table 3.

Table 3. Economic Impact 1979 - 2018

Year Conducted	2018	2014	2011	2007	2004	1995	1997
Economic Impact (in \$ Billions)	\$9.267	\$8.464	\$7.108	\$6.777	\$5.500	\$1.414	N/A
Direct Jobs Supported	9,128	7,145	5,162	5,585	6,555	N/A	N/A
Indirect Jobs Supported	13,337	12,835	10,691	9,975	10,210	N/A	N/A
Total Jobs Supported	22,465	20,115	15,691	15,560	16,765	12,310	12,475
Total Local Taxes (in \$ Millions)	\$44.6	\$43.3	\$32.5	\$32.5	\$26.4	N/A	N/A

The value of products handled through the Port of Memphis is increasing as more manufacturing operations use the Port for finished components rather than just raw commodities. The increase in value more than offsets the decrease in tonnage handled since the peak year of 2006, to yield a net increase in economic impact.

While many port-related operations ship or receive a small proportion of goods and materials by barge, these companies report that the ability to ship by barge gives them a competitive advantage when negotiating freight rates for other modes of transportation. In some cases, movement of key components is only possible by water. The increasing significance of the Port has been demonstrated by recent economic development activity including a Mitsubishi industrial electronic transformer manufacturing plant and a Cargill facility that utilizes a new process for producing food proteins.

Future Impact of Target Industries

The master planning study for the Port of Memphis included the identification of target industries that can benefit from the location, infrastructure and other resources offered by the Port of Memphis. Using the same model that was applied to determine the economic impact of current operations within the Port, the impact of new operations by the target industry sectors was calculated.

The master planning study identified the number of acres within Port properties that can potentially be filled by each type of target industry. Potential employment was derived from the number of acres for each type of operation, and economic impact was based on the ratio of output to employment from the U.S. Bureau of Economic Analysis multiplier system for Shelby County. Table 4 below summarizes the key measures of impact for each target industry type, and for the total for all industry targets at the point when all new target companies are fully operational.

Table 4. Projected Impact of Target Industries

Annual Impact of Operations	Agricultural Product Processing & Food Production	Metal Processing, Production & Recycling	Paper & Plastics, Processing, Production & Recycling	Intermodal Logistics/ Distribution/ Warehousing Yard	Transportation Support Services, Trailer Pool & Empty Container	Total
Projected Employment, Direct (full-time equivalent jobs)	120	722	389	667	24	1,921
Employment, Indirect	34	964	514	672	24	2,208
Total Employment	154	1,686	902	1,338	48	4,129
Total Wages	\$8,189,215	\$97,108,532	\$55,304,621	\$93,178,689	\$2,881,739	\$256,662,797
Economic Impact	\$10,998,245	\$328,267,069	\$112,451,361	\$112,451,361	\$7,015,647	\$654,550,572

STRATEGIC MASTER PLAN PORT OF MEMPHIS



VI. TARGET BUSINESS MARKET ANALYSIS



Target Business: Steel Finishing & Production

Steel finishing and production is an existing industry in the Memphis region with an identifiable workforce and a major employer within the Port of Memphis (Nucor). Expansion of Nucor may require a reconfiguration of the Nucor harbor chute, improved road and rail service, and ground (soil) improvements. Attraction of additional steel industries to Pidgeon Industrial Park may require improved road and rail service as well as ground (soil) improvements. The Ports of Indiana have shown long term success in building a range of steel and specialty steel industries in and around their three port facilities.

The metal production, processing and recycling industries in the greater Memphis region currently employ more than 153,000 people. Current projections indicate modest 3% employment growth between 2017 and 2028. However, these projections were developed before the most recent round of trade, tariff, and transport costs increased the likelihood of additional growth in this industry cluster.

The National Outlook for Steel

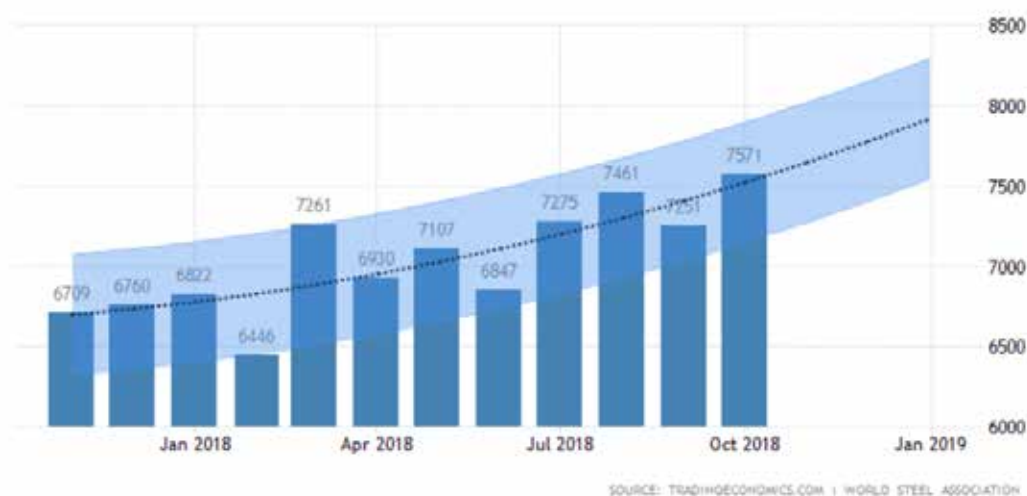
According to Trading Economics, Inc., monthly steel production in the United States is expected to be nearly 7600 thousand tons by the end of the year and grow to nearly 8000 thousand tons monthly in 2019. In the long-term, the United States steel production is projected to average around 7150.00 thousand tons in 2020, according to the Trading Economics econometric models.

The combined effects of three current trends—strong growth in construction (infrastructure, industrial and commercial), steel and aluminum tariffs, and the revised NAFTA agreement (United States-Mexico-Canada or USMC)—all support these growth projections.

Current investor interest in steel production facilities that rely on recycling of nearby scrap steel also supports these projections: in December 2018, the global metals firm GFG acquired Liberty Steel US, based on the GFG assumption that transporting scrap steel from the US to Turkey or China for subsequent re-sale back to the US was not a sustainable business model, given the current global trade climate, the cost of bunker fuels, and long term environmental regulations and expectations.

Similarly, a number of specialty steel firms have located their finishing facilities closer to their final customer, rather than relying on a global supply chain that is increasingly vulnerable to weather, financial, political, and regulatory interruptions. Nucor growth in automotive deliveries and GFG expansion into “near client” production facilities illustrate these trends.

With its multimodal freight access and proximity to both the Southeastern and Midwest automobile and manufacturing industries, the Port of Memphis could and should compete nationally for steel finishing and production industries.



Target Business: Steel Finishing & Production

The Memphis Outlook for Steel

The Port currently hosts Nucor Steel at its Pidgeon Industrial Park site and supported its 2017 PILOT expansion. The steel industry generally, and Nucor specifically, are poised for growth. Nucor's use of recycled steel materials requires multimodal access to their plants, as provided by the Port of Memphis. The more recent Nucor focus on higher-value products such as automotive materials (62% growth 2012-2017) and tubes and specialty steel sheets offer opportunities for further Nucor expansion.

More broadly, the Memphis region is home to other steel producers, fabricators and transporters, including Memphis Wire & Iron, Southern Steel, Tomsin Steel, Delta Metals, and many others. It is a diverse set of industries which could be further expanded with smart investments and strategies, starting with the Port of Memphis.

Perhaps the best example of river ports serving the steel industry is the Ports of Indiana, winner of the American Metal Markets 2018 Logistics/Transportation Provider of the Year award. The Ports of Indiana operate three ports on the Ohio River and Lake Michigan and generate \$7 billion per year in economic activity while handling cargo for all 50 states and over 30 countries. According to the Ports of Indiana, "More than half of the companies located at our three ports are related to the steel industry and our ports provide unmatched advantages for steel-related businesses that need multimodal access to international and domestic markets."

Next Steps for the Steel Industries at the Port of Memphis

- Plan and fund the reconfiguration of the Nucor harbor chute
- Identify plant expansion opportunities, needs and costs adjacent to Nucor facility, including road and rail improvements
- Identify and prepare new sites within Pidgeon Industrial Park for steel finishing and production plants
- Work with relevant workforce development entities to upgrade and train existing steel employees

Target Business: Agricultural Processing & Food Production

Agricultural Processing and Food Production is an existing industry in the Memphis region with an identifiable workforce and major employers within the Port of Memphis (Cargill/Nouritech and ADM). Previous initiatives to support corn and soy bulk transports and exports do not appear viable in the current tariff and global market environments. However, attracting higher value agricultural processing and actual food production facilities and employers to Pidgeon Industrial Park is consistent with TECD goals and market analysis. Attraction of agricultural processing and food production facilities to Pidgeon Industrial Park may require improved road and rail services, and almost certainly will require ground (soil) improvements. The Ports of Baltimore, Philadelphia and Delaware have shown long term success in supporting a range of higher-end food production, cold storage, and related distribution facilities.

The agricultural production and processing industries in the greater Memphis region currently employ more than 163,000 people. Current projections indicate a 4% reduction in employment between 2017 and 2028. However, these projections were developed before the most recent round of trade, tariff, and transport costs increased the likelihood of further reductions in export-related employment within in this industry cluster.

The National Outlook for Agricultural Processing and Food Production

Soy production and processing has served as a surrogate measure for overall US agriculture health due to its export strengths as well as its support for numerous domestic industries.

Most soybeans are processed for their oil and protein for the animal feed industry, with a smaller percentage processed for human consumption and made into products including soy milk, soy flour, soy protein, tofu and many other retail food products. Soybean oil is also used in many non-food (industrial) products, including polyurethane foam, plastics, paints, coatings and solvents. Soybean meal is also used as filler in plastics, rubber, paper coatings, resins and formaldehyde-free adhesives, as well as detergents, candles and cosmetics. Soybeans are the most valuable agricultural commodity exported from the U.S., with annual total soybean export value up \$200 million to \$24.1 billion, according to USDA's November 2017 Outlook for U.S. Agricultural Trade.

Exports accounted for more than 47% of U.S. soybean production last year, making them key to growing the industry's profitability, and soy exports continue to trend upward for the foreseeable future. Biotechnology has led to soy crops with higher and quicker yields; and better seeds, fertilizer and fungicides, combined with higher prices at market, have helped the U.S. soy industry continue to grow. This year, soybean plantings are projected to surpass corn, reaching an estimated record crop of 89 million acres.

However, concerns are growing over the Administration's recent tariffs and escalating trade war with China, which buys about 60% of the soybeans exported by U.S.

The soy industries are responding by seeking new export markets (e.g. Latin America, Australia) as well as new domestic uses (e.g. higher value soy crushing and processing facilities, organic niche markets, and new non-food uses such as packaging).

The ports of Delaware and Philadelphia have longstanding ties to regional, added-value food producers and processors in the mid-Atlantic and Northeastern regions of the US. In recent years, those public and private port facilities have added significant cold storage and related logistic facilities.

Target Business: Agricultural Processing & Food Production

More recently, Perdue AgriBusiness is investing in a \$30 million organic grain receiving and storage facility at the Tradepoint Atlantic site near the Port of Baltimore in Maryland. The Tradepoint Atlantic facility will include grain and oilseed processing/milling capabilities to provide organic grain and soybean products to domestic and international customers. Like the Port of Memphis, the Tradepoint Atlantic site has excellent rail, road, and water access to key agricultural, consumer and industrial markets—for both imports and exports. The Tradepoint shortline railroad loop that serves the Tradepoint industrial park is a key element in the Perdue Partnership.

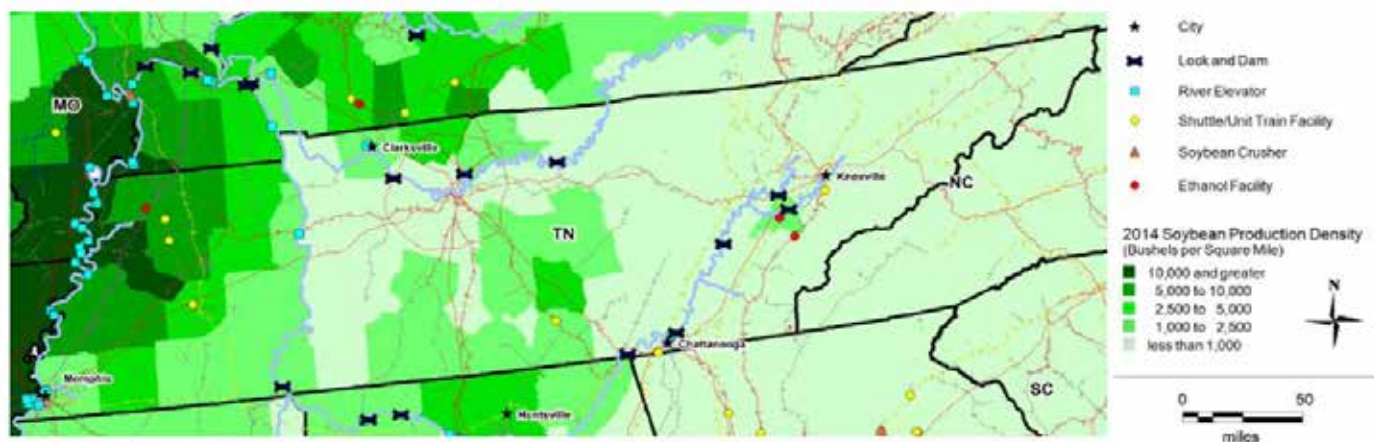
The Memphis Outlook for Agricultural Processing and Food Production

While the Tennessee agricultural economy is highly diversified, the recent trade and tariff disruptions may offer the potential for new soy export markets and new domestic soy uses.

Soybeans are planted on more acres than any other row crop in Tennessee, with over one million acres grown annually. Each year, soybeans rank in the top three for cash receipts for row crops. In 2015, Tennessee harvested a near record soybean crop of 46 bushels per acre across almost 1.7 million acres.

According to the Tennessee Department of Economic and Community Development, Tennessee ranks number 2 in the Southeast for employment concentration, or location quotient, for soybean and other oilseed processing. Much of that capacity is located in the greater Memphis region.

Most of the state's soybeans are grown on farms located in western and central Tennessee counties, then transported to the Memphis region, where five of the six soybean and other oilseed processing facilities processing facilities in the region are located. More than 98% of the demand for soybean processing in the Memphis area is met by these local processing facilities, which sell the majority of their products and services (89.2%) to customers outside the region.



Target Business: Agricultural Processing & Food Production

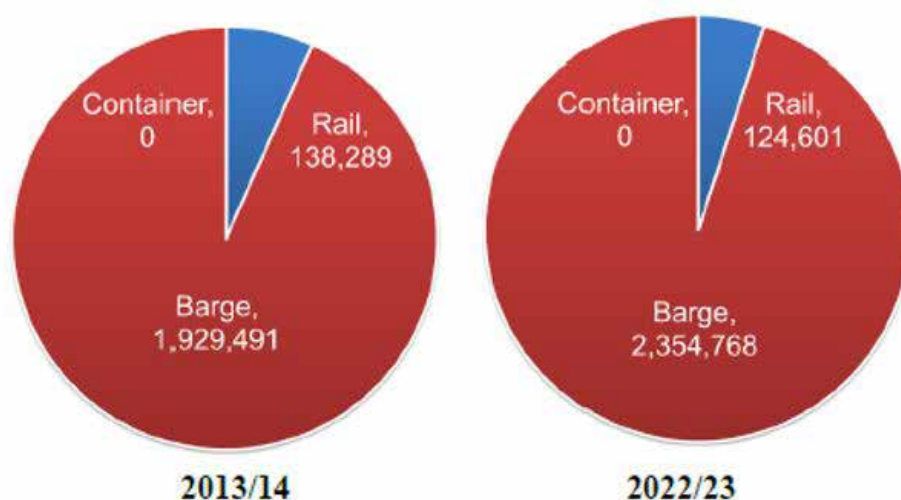


Figure 2: Anticipated growth in Tennessee soybean movements (short tons)

Source: Soy Transportation Coalition

Prior to the current trade and tariff disruptions, barge exports of soy products from the International Port of Memphis (including West Memphis) were projected to grow by approximately 20% over the next decade. As shown by the Tradeport Atlantic example above, new soy export markets and new domestic soy uses are emerging from these disruptions.

A similar strategy of identifying niche soy export markets and new soy domestic uses, including added value food products, would be consistent with the Tennessee Department of Economic and Community Development emphasis on added value agricultural and food and agribusiness strategies (<https://tnecd.com/industries/food-agribusiness/>). Similar strategies for corn or other agricultural products are also possible, given the location and accessibility of the Port of Memphis.

Next Steps for the Agricultural and Food Processing Industries at the Port of Memphis

- Work with TECD and TVA economic development teams to identify potential niche markets for soybeans and soy products, for both domestic and export markets
- Work directly and confidentially with current Port of Memphis agricultural industries to identify short term needs and medium term market opportunities for added value agricultural and food products
- Consider a public-private partnership to further identify market opportunities and private sector investment opportunities

Target Business: Intermodal Logistics & Distribution

Intermodal Logistics and Distribution is an existing industry in the Memphis region with an identifiable workforce and a potentially major employer within the Port of Memphis (Canadian National). The synergies and opportunities for rail and truck intermodal growth at Pidgeon Industrial Park, including access to Memphis International Airport, are evident within the greater Memphis region, and in numerous regions across the U.S. In addition, recent changes to NAFTA (USMCA) and tariff regimes may incent the development of facilities for the consolidation, assembly, or distribution of auto parts or components. However, attracting intermodal logistics and distribution facilities to Pidgeon Industrial Park will almost certainly require ground (soil) improvements and may also require a second road access point and/or the construction of a highway bridge over the CN rail line. The current Trade Point Atlantic development in Baltimore is but one of many examples where value is created by bringing together multiple modes of transportation to serve national and global markets and supply chains.

The intermodal logistics and distribution industries in the greater Memphis area currently employ more than 190,000 people. Current projections indicate a 3% growth rate between 2017 and 2028. This growth rate lags the projected national growth rate of 8%, despite the presence of major freight, logistic and intermodal facilities in the region.

The National Outlook for Intermodal Logistics and Distribution

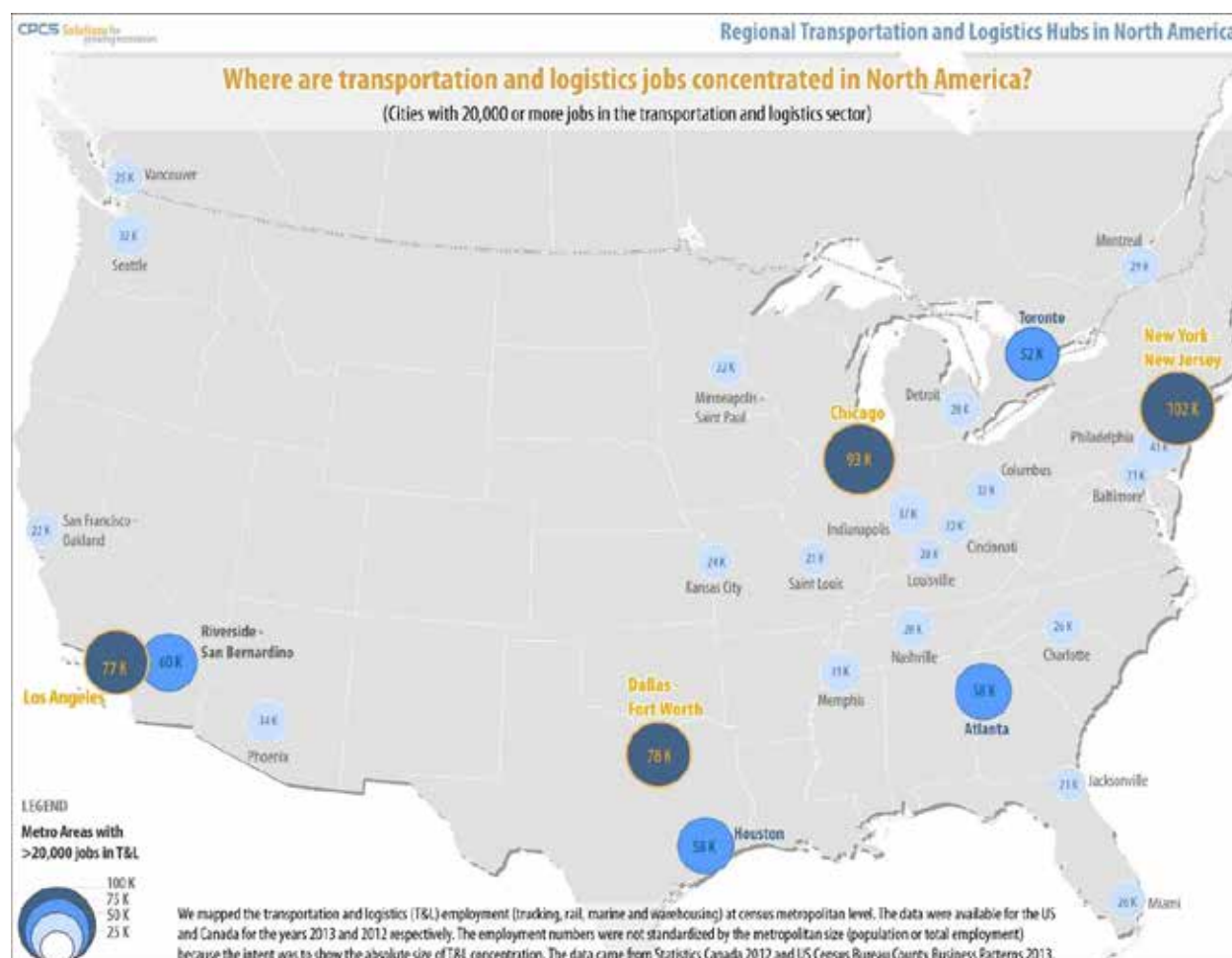
Intermodal and multimodal logistics and distribution is one of the faster growing industrial sectors in the US. Characterizing the sector is extremely difficult, due to its recent growth and internal diversification, the explosion of global trade, the more recent e-commerce effects, and the most recent round of tariffs, sanctions and regulations.

While more than 32 million US jobs technically fall within this sector, it includes an increasingly large technology component. And recent global actions on tariffs, regulations and sanctions make it a sector in flux.

Nevertheless, numerous national examples illustrate the need for the Memphis region and the Port of Memphis to maintain their leadership position in the fields of intermodal logistics and distribution.

The graphic below illustrates the Memphis regional freight and logistic employment against other major regions in the US. Atlanta and Dallas regions are some of the leading concentrations of these job types, following the better-known regions of New York/New Jersey, Southern California, and Chicago. Atlanta and Dallas are highlighted here due to their long-term commitment to growth in this sector and individual successes such as Alliance Texas.

Target Business: Intermodal Logistics & Distribution



In addition to the success of Atlanta and Dallas, relevant examples of intentionally growing the freight and logistic sector include Mobile, Alabama and the Tradeport Atlantic complex in Baltimore, Maryland. Both have combined road, rail, and water access to support logistic industries such as Amazon, Walmart and FedEx, but also to support nearby industrial development such as Airbus or Perdue Agriculture.

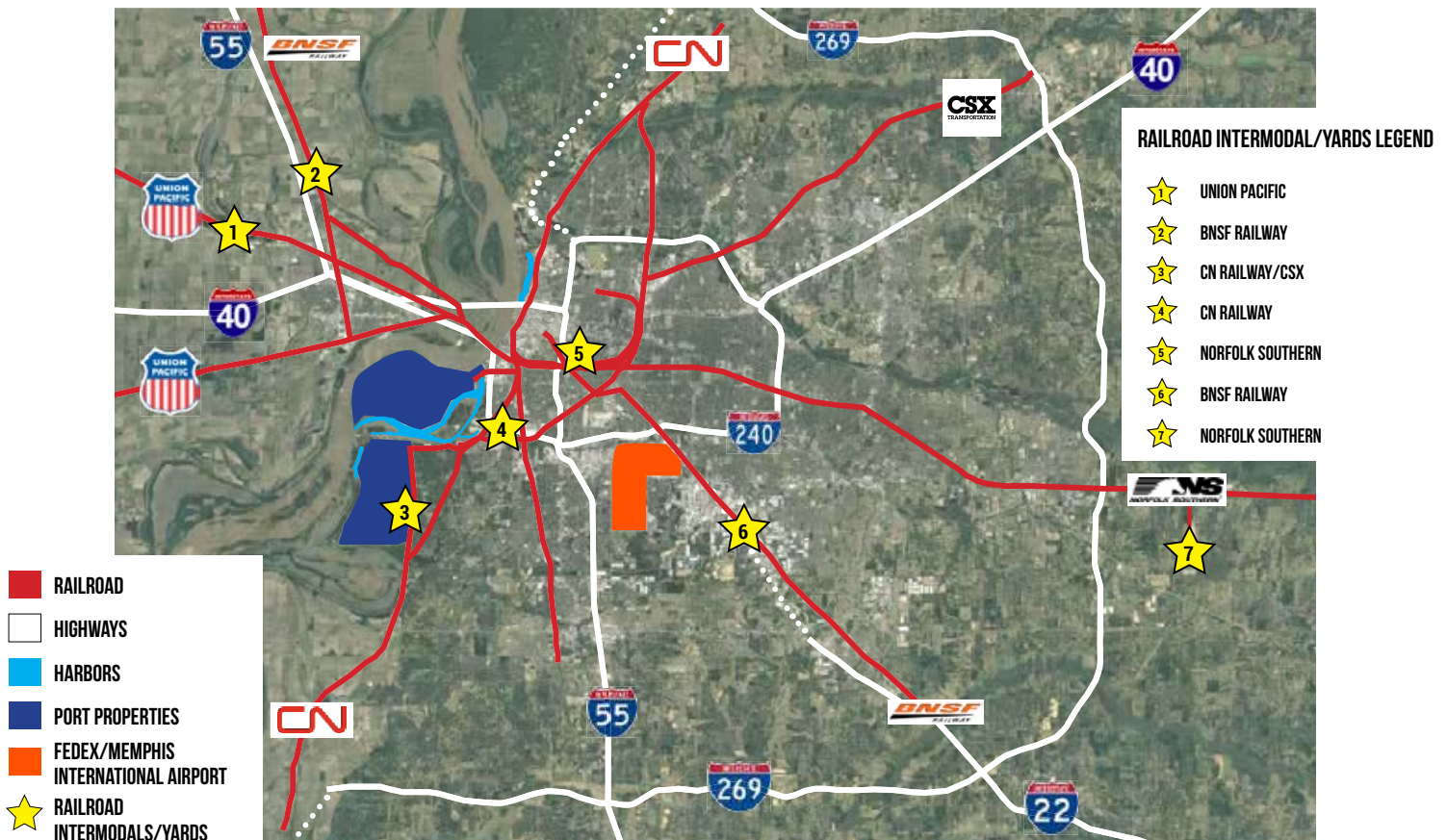
The Memphis Outlook for Intermodal Logistics and Distribution

The Port of Memphis lies at a unique juncture of major north-south and east-west interstate highways, allowing the Port properties to not only serve local and regional markets, but also to adapt to the rapidly changing industrial, logistical, and commercial supply chains.

The Port of Memphis lies at one of the few junctures of five Class 1 railroads, allowing the movement of goods by rail to both north-south and east west markets—including the industrial and agricultural centers of the US and Canada. The Memphis region is ringed by major intermodal facilities, including the substantial intermodal yard in Pidgeon Industrial Park operated jointly by Canadian National Railroad and CSX Railroad.

Target Business: Intermodal Logistics & Distribution

The Port of Memphis has easy access to the busiest cargo airport in the U.S., Memphis International Airport. As shown in places like Mobile, Charlotte and Richmond, the combined access to roads, rail, runways and rivers can be attractive to freight originators, freight destinations and freight operators.



Port of Memphis sites with access to the CN intermodal facility will be attractive to the intermodal logistics and distribution industries, provided that the site development costs—principally ground stabilization and foundation costs—are made competitive through direct soil amendment or compensating incentives. The growth around the BNSF intermodal facility illustrates the need for some type of intervention on the soil issue.

The Port of Memphis will need to add a second highway access point to Pidgeon Industrial Park in order to continue growth of this sector. In addition, a highway bridge over the rail line to eliminate truck/rail conflicts inside the Pidgeon Industrial Park will ultimately be needed.

Target Business: Intermodal Logistics & Distribution



CN/CX Intermodal Site



BNSF Intermodal Site

Next Steps for Intermodal Logistics and Distribution at the Port of Memphis

- Identify sites adjacent to or with excellent access to the CN/CSX intermodal facility
- Plan and fund soil amendment and improvement program
- Reach out to global real estate and logistic providers to market the site

Target Business: Waste Paper & Plastics Recycling & Aggregation

Waste Paper and Plastics Recycling and Aggregation is a rapidly changing global industry due to Chinese regulatory actions to reduce the volume and nature of waste paper and waste plastics transported to China. In terms of raw volume, waste paper and waste plastics represent the largest containerized exports from the U.S. The export of containerized waste paper and waste plastics is an important backhaul segment in the global supply chain—returning otherwise empty containers to Asian manufacturing locations at a lower cost than returning empty containers. As a consequence of these new regulations, domestic recyclers of paper and plastic, both public and private, may see increased recycling costs, increased use of domestic landfills, or both. These disruptive trends could support at least two growth opportunities for the Pidgeon Industrial Park and its excellent road, river and rail connections:

- Location of a recovered paper facility to break down and re-use old corrugated containers, old newspaper pulp, or recycled containerboard or recycled boxboard. Several domestic papermills have reopened and revised their production capacity in the last year to capture or incorporate recyclable components.
- Location of a selective paper or plastic aggregator to transport containerized and sorted plastics either to Mobile or Prince Rupert, BC for export to willing and permissible Asian markets.

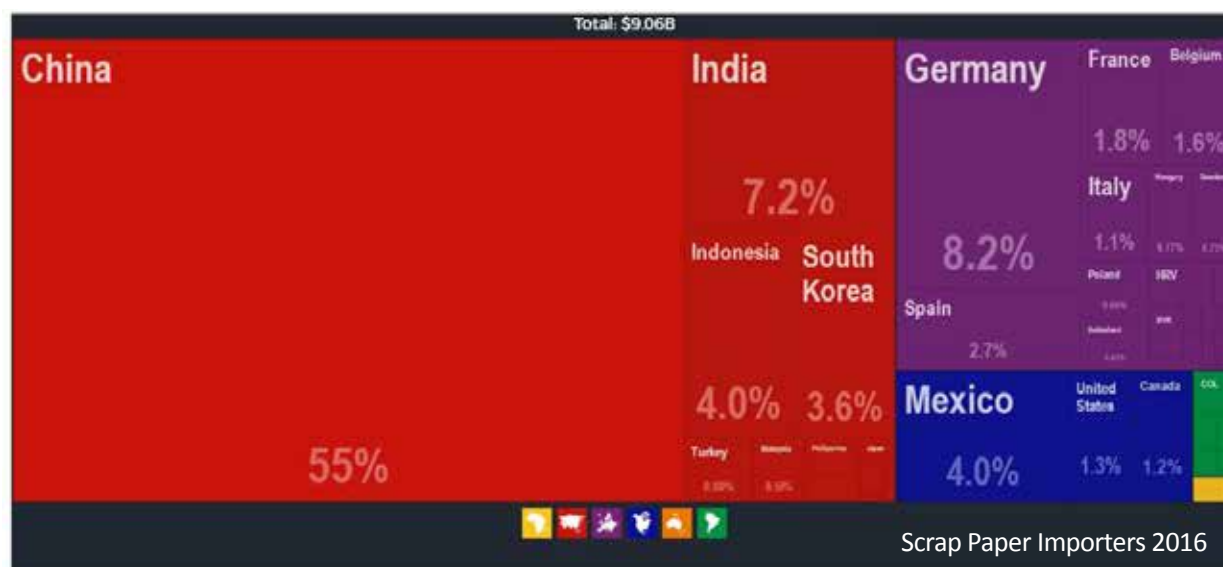
The Memphis region supports more than 161,000 jobs in the paper and plastics manufacturing and recycling industries. Current projections indicate a modest 4% increase in jobs in these industries between 2017 and 2028, approximately half of the projected national job growth rate of 8%. The Memphis region has an opportunity to capitalize on an existing workforce, an existing corporate presence (International Paper), and existing road, rail and river networks—all positive elements within a rapidly changing market and a disrupted global supply chain.

Target Business: Waste Paper & Plastics Recycling & Aggregation

The National Outlook for Waste Paper and Plastics Recycling and Aggregation

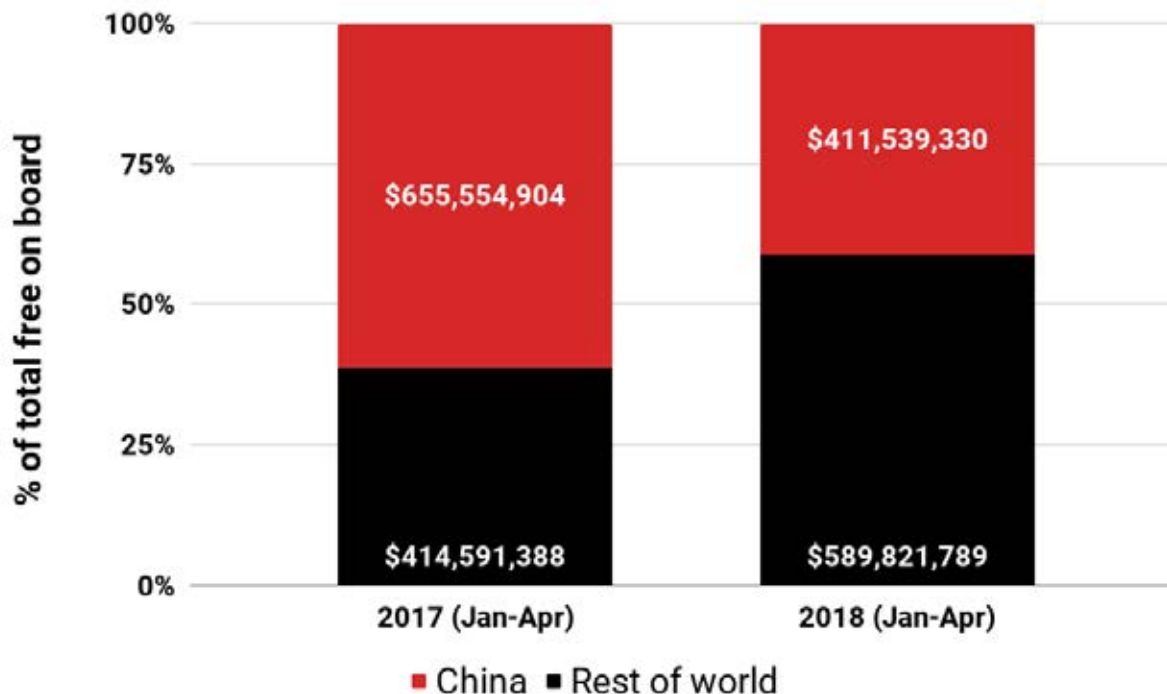
The waste or “scrap” markets for both paper and plastics are somewhat opaque, and both have grown substantially over the last two decades based on the willingness of China to accept, sort and process both commodity sets. The containerization of these scrap products allowed otherwise empty containers to earn revenue on their return to China, supporting the low-cost supply chain for Chinese and Asian manufactured goods flowing to North America and Europe.

The scope of this backhaul trade is illustrated by the following two OECD graphics. The first graphic illustrates waste paper exporters. The second graphic illustrates waste paper importers. **Both graphics are based on 2016 data, before China enacted its scrap paper and plastic importation standards.**



Despite the integration of scrap paper, scrap plastics, and scrap metal products into the global supply chain, China in 2017 imposed strict new standards on the importation of scrap paper and scrap plastics. The impact was nearly immediate, as next chart from WasteDive shows.

Target Business: Waste Paper & Plastics Recycling & Aggregation

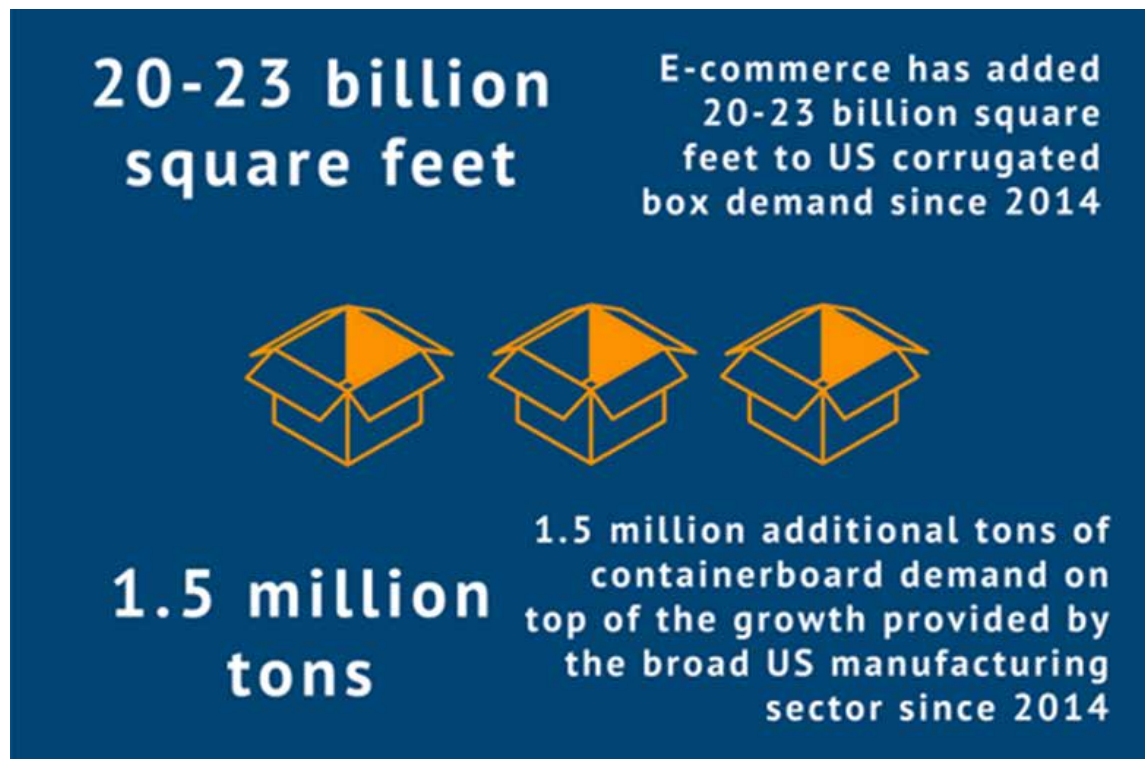


In the short term, other Asian countries such as Vietnam and Thailand are accepting scrap paper and plastic imports. However, many Southeast Asia countries are developing their own standards for the importation of scrap paper and plastics, indicating that the scrap paper and scrap plastic markets are undergoing systemic and structural changes that will affect not only recyclers and ocean carriers, but also the entire global container supply chain circuit and the billions of public and private US dollars invested in the collection, aggregation and shipping of waste paper and waste plastics. While these scrap markets are highly disaggregated, the US has three broad policy options to address this issue:

- Identify willing countries to receive and process scrap products. Given pending scrap regulations in Vietnam and Malaysia, as well as the loss of container backhaul revenues, this would likely increase overall transportation costs for containerized freight.
- Landfill the scrap paper and plastic products. Landfill capacity is generally limited in much of the US, and many landfills have been sized based on recycling assumptions. This option would likely increase municipal solid waste management costs.
- Develop domestic US scrap paper and scrap plastic industries. This option holds economic potential for the Port of Memphis.

At the same time the demand for corrugated boxes and containerboard has soared due to the growth of e-commerce, as illustrated in the following RISI graphics.

Target Business: Waste Paper & Plastics Recycling & Aggregation



Several shuttered paper mills have reopened in the US, many relying on scrap paper and cardboard, as well as pulp, for feedstock. These include substantial capital investments and upgrades:

- Kentucky http://www.paperage.com/2018news/08_20_2018global_win_wickliffe.html)
- Wisconsin <https://fox6now.com/2018/06/12/green-bay-packaging-announces-plans-for-new-500m-paper-mill/>
- Virginia <http://www.areadevelopment.com/newsItems/7-12-2018/white-birch-paper-mill-bear-island-hanover-virginia.shtml>

Target Business: Waste Paper & Plastics Recycling & Aggregation

The Memphis Outlook for Waste Paper and Plastics Recycling and Aggregation

As noted above, employment growth in the Memphis waste paper and plastics recycling industries has lagged national averages. However, the Memphis region has an established workforce for waste paper recycling and a major corporate presence in paper.

The challenge for the Port of Memphis is to understand the following impacts on the waste paper recycling and aggregation industries, including:

- The rapidly changing private marketplace
- The disruptive regulatory/tariff environment
- The impacts on state and local governments
- The impacts on the global container supply chain

The commercial, logistic and industrial value of the Port of Memphis to economically resolve many of these issues

Unlike other targeted industries in this study, the recycling and aggregation of waste or scrap paper will take place in a volatile marketplace and regulatory environment for some time. That degree of change offers two opportunities for the Port of Memphis.

With proper incentives, the road, river and rail assets could support an industrial recruitment to the Port of a recovered paper facility to break down and re-use old corrugated containers, old newspaper pulp, or recycled containerboard or recycled boxboard.

Another option would be to work with CN railroad to aggregate higher value papers or plastics and to transport containerized and sorted papers or plastics to either Mobile or Prince Rupert, BC for export to willing and permissible Asian markets.

Next Steps for Waste Paper and Plastics Recycling and Aggregation at the Port of Memphis

- Work with TECD, TVA, CN and local corporate industry leaders to further understand the dynamics of the scrap paper markets, regulations, global logistics and their impacts on state and local governments
- Work with Tennessee state agencies and local government associations to determine any potential industry subsidies
- Based on the above analyses, identify the preferred option of either an industrial recruitment to the Port of a recovered paper facility or an aggregation facility serviced by CN

Target Business: Empty Containers & Trailer Pools

Empty Container or Trailer Pools are existing industries within the Memphis region with at least one identifiable employer in the Port of Memphis (Seacor). While neither industry is likely to become a major employer within the Port, both are necessary to support the growth of existing, targeted and base industries. For example, empty containers are highly valued by plastic and resin producers in Louisiana and Texas. Reliable access to empty containers could help to attract plastic or resin facilities to the Port of Memphis in the long term, or at least to develop supporting services to those industries. Similarly, “grey” trailer pools are becoming increasingly common throughout the U.S. and the presence of one or more could help to attract other logistic, distribution and light industrial facilities to Pidgeon Industrial Park.

Unlike other targeted industries, the provision and distribution of empty containers or grey chassis is a small and specialized subset of a much larger industry cluster which employs more than 177,000 people in the Memphis region. That larger industry cluster is projected to grow by 3% between 2017 and 2028, less than half the national growth rate of 8%.

The National Outlook for Empty Container or Trailer Pools

Dry containers are either owned or leased by ocean carriers, and those ocean carriers expend considerable resources tracking empty containers and ensuring that they are returned to key manufacturing regions such as east Asia.

In order to reduce the costs associated with “dead head” empty container moves, ocean carriers seek commodities like waste paper or high value soybeans or wood pellets to stuff the empty container and thereby reduce the cost of the return trip. Containerizing and transporting commodities like these back to East Asia helps to hold down overall supply chain costs for ALL containerized goods.

Due to its location, the Memphis region has been an historic destination for the accumulation of empty “dry” containers, many of them originating in Asia, entering the US from a west coast seaport, travelling by truck or rail to its delivery point, and travelling by truck or rail to various locations in the Memphis region. Empty refrigerated containers or “reefers” tend to accumulate in the dense and affluent consumer markets New York, LA, Chicago and Houston.

As illustrated in dark green below, a number of states have serious dry container deficits—mostly to serve the **export** needs of the surrounding agricultural or petrochemical industries. Dallas, Memphis, Columbus and Cincinnati all have dry container surpluses that can help meet the needs of their surrounding regional exporters.

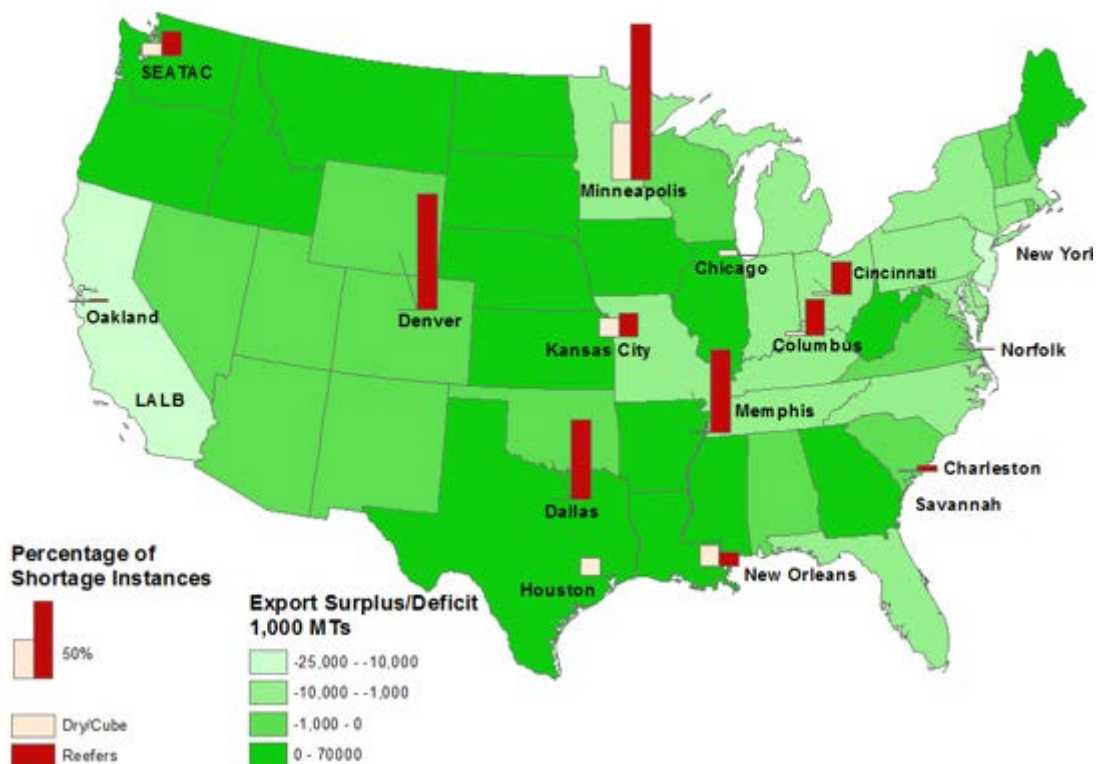
Target Business: Empty Containers & Trailer Pools

Memphis is unique in that its empty dry containers can serve the needs of both its surrounding agricultural area (Illinois, Tennessee, Arkansas, Mississippi, Louisiana) as well as the rapidly expanding petrochemical export needs of Louisiana (Principally Baton Rouge).

A similar dynamic is emerging in the US trailer market as ocean carriers have exited the trailer business and various regional “grey” trailer pools have emerged.

The graphic below also illustrates in red the longstanding shortage of refrigerated containers outside of the very largest urbanized areas.

CONTAINER SHORTAGE INCIDENCE BY CITY



The Memphis Outlook for Empty Container or Trailer Pools

Memphis has a globally advantageous position with respect to dry empty containers. While the Memphis dry empty container surplus has been historically available to serve the agricultural export needs of the multistate region (e.g. baled cotton or organic soy or corn exports), the burgeoning demands of the petrochemical industry are increasingly reliant on empty dry containers from Memphis.

Target Business: Empty Containers & Trailer Pools

The explosive growth of domestically produced natural gas and its attendant pipeline networks has led to a critical secondary industry—raw plastic “pellets” that are the basic building block of most plastic manufactured products, from automobile dashboards to Christmas toys to micro circuitry insulators. Natural gas is the feedstock for plastic plants in Louisiana and Texas that desperately need dry empty containers to export their plastic pellets to Asian manufacturing destinations (automobile dashboards, toys, micro circuitry insulators, etc.).

The scale and speed of this growth is extraordinary, with approximately 25% of US polyethylene (PE) production currently being exported. Some analysts foresee as much as 90% of domestic polyethylene production being exported from the US!

North America PE expansions

Company	Capacity (kt/year)	Grade, breakdown	Location	Start-Up
Dow Chemical	400	ELITE PE	Freeport, Texas	Q3 2017
Dow Chemical	350	LDPE	Plaquemine, Louisiana	Q4 2017
Chevron Phillips Chemical	1,000	Bimodal HDPE (500), mLLDPE (500)	Old Ocean, Texas	Q3 2017
ExxonMobil Chemical	1,300	mLLDPE plus LLDPE (2 x 650)	Mont Belvieu, Texas	End 2017
INEOS/Sasol	470	HDPE	La Porte, Texas	Q4 2017
Formosa Plastics	800	HDPE (400), LDPE (400)	Point Comfort, Texas	H2 2018
Dow Chemical	125	Bimodal HDPE	St Charles, Louisiana	Q4 2018
Sasol	890	LLDPE (470), LDPE (420)	Lake Charles, Louisiana	H2 2018 (LLDPE), 2019 (LDPE)
LyondellBasell	500	HDPE	La Porte, Texas	Mid-2019
ExxonMobil Chemical	650	PE (unspecified)	Beaumont, Texas	2019
Total/Borealis/NOVA	625	Borstar PE	Bayport, Texas	2021
Shell	1,600	HDPE/LLDPE (2x 550), HDPE (500)	Monaca, Pennsylvania	Early 2020s
PTT Global Chemicals*	700	HDPE (2x 350)	Belmont County, Ohio	2021
NOVA Chemicals	430	LLDPE	Sarnia, Canada	Late 2021/ Early 2022
SABIC/ExxonMobil*	NA	PE unspec (2 units)	Corpus Christi, Texas	H2 2022
Dow Chemical*	600	PE (unspec)	US Gulf Coast	2020s
Dow Chemical*	350	PE (unspec)	Various debottlenecks	2020s

*No FID yet

**Assuming 1,300kt PE for SABIC/ExxonMobil

Through 2019 = 6.5m tonnes/year (+39% US capacity)

Through 2022 = 12.1m tonnes/year** (+74% US capacity)

Image: ICIS

In the short term, the Memphis region has a number of businesses addressing the empty container needs of the mid-South, including CN and Seacor. CN can transport empty containers by rail to either Mobile, Alabama or Prince Rupert, British Columbia. Seacor has established a barge service moving empty containers downriver to Baton Rouge. In addition to the plastic pellet market, these containers are also used to export liquid and dry specialty chemicals produced in the Baton Rouge region. USDOT recently awarded a Marine Highway grant to further grow this waterborne service between Memphis and Baton Rouge.

Target Business: Empty Containers & Trailer Pools

In the long term, the Memphis catchment area for empty dry containers may be an incentive for the construction of a chemical or petrochemical plant and the subsequent export of those products via container on rail or barge.

Next Steps for Empty Container or Trailer Pools at the Port of Memphis

- Develop ongoing container market analysis skills through some or all of EDGE, TVA, TECD, universities, and/or private partnerships
- Identify container management practices to benefit current industries
- Identify future growth industries that could benefit from access to empty containers

STRATEGIC MASTER PLAN PORT OF MEMPHIS



VII. LABOR STUDY



Labor Study

Background and Methodology

The labor market that serves Memphis, including the Port of Memphis is primarily comprised of nine counties in three states that make up the Memphis Metropolitan Statistical Area (MSA). The counties in the Memphis MSA are:

- Shelby, TN
- Fayette, TN
- Tipton, TN
- Crittenden, AR
- Benton, MS
- DeSoto, MS
- Marshall, MS
- Tate, MS
- Tunica, MS

The 2017 population of the Memphis MSA was approximately 1.35 million people. The projected 2017 annual average number of jobs in the MSA was 683,595. A survey and employer reported data compiled as part of this master plan process project that 9,128 people are employed by businesses within the Port of Memphis jurisdiction. Another 13,337 jobs exist in the MSA economy because of business operations in the Port, so in total 22,465 jobs are attributable to the Port at the time of this study.

This labor study compares the MSA workforce characteristics to the current and potential future workforce needs of businesses related to the Port of Memphis. Tables D11-D12 in the appendix provide details on employment by occupation and industry for the entire MSA.

In addition to the analysis of historic labor data and statistical labor projections from state and national bureaus, a survey of companies operating with the jurisdiction of the Port of Memphis was conducted. The survey asked companies to identify the occupations in highest demand and gaps in filling the workforce demand. Stakeholder meetings that included companies operating within the Port also allowed opportunities to collect qualitative information about workforce needs and availability.

Economic development projects within the Port of Memphis will create new jobs directly employed by new or expanded companies at the Port, and additional indirect jobs throughout the regional economy. The Port of Memphis Master Plan identified five target industry sectors that are likely candidates for growth and development over the medium term of five to ten years.

Labor Study

The five target sectors identified in the Master Plan are:

- Agricultural Product Processing & Food Production
- Metal Processing, Production & Recycling
- Paper & Plastics Processing, Production & Recycling
- Intermodal Logistics, Distribution, Warehousing
- Transportation Support Services, Empty Container & Trailer Pools

As part of the Master Plan process, the types and number of jobs that would likely be created by these target industries were analyzed. The target industry sectors were evaluated using U.S. Bureau of Labor Statistics data to identify the types of occupations that are associated with each target.

The targets in the Master Plan are not limited to standard industry classifications; they combine related industries that reflect development opportunities at the Port. For example, Agricultural Product Process and Food Production are two separate standard industry classifications. Both industry sectors were compared to determine the top occupations in demand for these related industries.

For each target industry sector, the top occupations were ranked based upon the national level of employment in that occupation within the sector. For example, for the combined Agricultural Product Processing and Food Processing target sector, the highest number of people employed nationally in both industries are in the occupation of Packaging and Filling Machine Operators and Tenders.

Job projection data tables were developed for each target sector to allow the comparison of employment trends by occupation at both the national and Memphis MSA levels. These tables show the number of people employed in each of the top occupations across all industry types. This allows for an analysis of how increased employment in a target industry could impact all types of industries.

Current employment levels were captured, along with employment change projections at five and ten year intervals, from the U.S. Department of Labor Data as well as the Tennessee, Arkansas and Mississippi departments of labor and workforce. The ratio of Memphis MSA employment in each top ranked occupation for each target industry was compared to the national ratio of employment in the same occupation. Tables D1-D5 in the appendix contain this data.

Separate hourly earnings data tables were also developed for the top occupations in each target sector. These tables allow the comparison Memphis MSA hourly earnings (wages, or salaries converted to hourly rates) with national hourly earnings. Tables D6-D10 in the appendix contain this data.

Labor Study

Current Jobs in Demand

Businesses located in the Port of Memphis area were asked to list the types of jobs they needed to fill most frequently. They were also asked to rate the availability of workers with the needed jobs skills on a scale of one to five with one indicating that workers for this job are not available and five indicating that workers for this job are plentiful. Table A below summarizes the responses to this question.

Table A. Jobs in Demand as Reported by Survey Respondents	
Occupation	Availability (5=plentiful, 1=unavailable)
Chemical Mixer/Batch Maker	1
Electrical	1
Electrical engineer	1
Level Line Operator	1
Mechanical engineer	1
Quality control inspectors	1
Slitter Operator	1
Supervisor, test hall	1
CNC operators and set-up	2
Driver/Technician	2
Entry Level Production	2
Equipment Operator	2
Fab Machine Operators	2
Grain Inspector	2
Hydraulic Tech	2
Laborer	2
Machine Operators	2
Mechanics	2
Operators	2
Press brake operator	2
Project Supervisor	2
Riggers	2
Temporary Grain Sampler	2
Truck driver	2
Yard Operators	2
Mill operator	3
Packers	3
Supervisor, production	3
Technician, machine operator	3
Technician, production	3
Administrative Assistant	4
Financial analyst	4
Forklift Operator	4
Packer Machine Operator	4
Production Team Members	4
Warehouse technician	4
Warehouse manager	5

Labor Study

In the same survey, respondents were also asked to note which of the workforce recruitment and development challenges listed were currently being faced by their company. The percentages of responses by type of workforce challenge are summarized below in Table B.

Table B: What are the greatest workforce challenges facing your company? (Check all that apply)

51.4%	Shortage of applicants
34.3%	New hires lack soft skills (communication, customer service, team work, etc.)
31.4%	New hires lack job specific technical skills
0.0%	Skilled workers are leaving to work for other companies
17.1%	Skilled workers are retiring
0.0%	Recruiting costs are too high
25.7%	Training costs are too high
8.6%	Other: Response - Finding Reliable Labor (absenteeism, tardiness)

Key Findings

An economic impact analysis conducted as part of the Port of Memphis Master Plan projected the number of direct and indirect jobs to be created by target industries based upon the number and size of development sites within the Port. Table C, below, summarizes the number of jobs projected to be created by each type of target industry, if fully developed on available acreage within the Port of Memphis.

Table C also summarizes the average hourly wages for the top 30 jobs in demand for each industry category.

Table C: Projected Job Creation and Average Direct Hourly Wages.

Target Industry	Projected Direct Job Creation at the Port	Memphis MSA 2017 Annual Average Wage of Top 30 Direct Occupations	Memphis MSA Total Direct and Indirect Jobs
Agricultural Product Processing & Food Production	120	\$19.16	154
Metal Processing, Production & Recycling	722	\$19.30	1,686
Paper & Plastics Processing, Production & Recycling	389	\$18.44	902
Intermodal Logistics, Distribution, Warehousing	667	\$19.11	1,338
Transportation Support Services, Empty Container & Trailer Pools	24	\$19.94	48

Sources: Tennessee, Mississippi and Arkansas Departments of Labor and Workforce, U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis

Labor Study

The top occupations for all five target industries closely mirror the current existing top occupations across all industry types in the Memphis MSA. The occupation with the highest level of employment across all existing industries in the Memphis MSA is Laborers and Freight, Stock and Material Movers, Hand.

This occupation is also the first or second highest ranked among all five target industries. More than 1,000 workers are projected to be needed by existing industries for this occupation over the next five years. Development of the target industries would add to this projected demand. The current average hourly earnings for this occupation is \$13.78 in the Memphis MSA, versus \$14.31 nationally.

Although many of the top ranked occupations in demand by the target industries are not considered high-skill level jobs, the average hourly earnings for these jobs range from \$18.44 for paper and plastics recycling target to \$19.94 for transportation support services target.

Development of the target industries is projected to increase demand for workers in other occupations where skill gaps are currently reported to exist by companies operating within the Port. These occupations include:

- Industrial Truck and Tractor Operators
- First Line Operation Supervisors
- General and Operations Managers
- Customer Service Representatives

While there is a national shortage of Industrial Truck and Tractor Operators, the shortage is more acute in the Memphis MSA due to the high concentration of the logistics distribution industry within the MSA.

In a related occupation, the projected growth rate for Light Truck and Delivery Service Drivers is higher for the Memphis MSA (13%) than the national growth rate projection of 10%. This occupation is not only projected to require almost 500 new workers over the next five years in the MSA, it is also a top ranked occupation for the Intermodal Logistics/Distribution target industry.

First Line Operations Supervisors is a top ranked category of occupation for all five target industries. The most highly ranked among the five targets as a group is the occupation of First Line Supervisors of Production and Operating Workers. The average hourly earnings vary widely by industry sector but the overall average within the Memphis MSA is \$26.82 which is slightly below the national average.

Customer Service Representatives is a prevalent and important occupation category to existing companies located within the Port and across the Memphis MSA economy. Industries related to wholesale trade, logistics and distribution employ a high ratio of Customer Service Representatives, and these are large employment sectors in the MSA. Over 500 workers in this occupation are projected to be needed over the next five years. Among the five target industries, all except the Metal Production, Processing and Recycling rank Customer Service Representatives among the top occupations.

Labor Study

With a slightly different skill set, Sales Representatives, particularly those related to Wholesale and Manufacturing except Technical and Scientific Products are reported among the top occupations for all five targets. Just over 250 workers are projected to be needed by existing industry in the Memphis MSA over the next five years. With both Customer Service Representative and Sales Representatives the average earning varies widely by industry type and product knowledge complexity.

General and Operations Managers is a high-growth and high-wage occupation among existing Memphis MSA industries. The current annual average hourly earnings for this occupation is \$56.37 in the MSA. This is higher than the national average hourly earnings of \$59.09 which may reflect the relatively high level of demand in the MSA.

Existing industries are projected to require more than 600 workers in this occupation over the next five years. All five target industries rank this as a top occupation.

According to the Bureau of Labor Statistics: General and Operations Managers responsibilities include formulating policies, managing daily operations, and planning the use of materials and human resources, but are too diverse and general in nature to be classified in any one functional area of management or administration, such as personnel, purchasing, or administrative services. Across all industries nationwide, specific job titles reported include: Facilities Manager, General Manager, Operations Director, Operations Manager, Plant Manager, Plant Superintendent, and Production Manager.

A closely related occupation, that is also a top ranked occupation specifically for the Intermodal Logistics/Distribution target industry, is Transportation, Storage and Distribution Managers. In the Memphis MSA the average hourly earnings for the occupation are \$43.55, which is significantly below the national average of \$59.09

The screening of the top occupations for the target industries did not identify any types of new or specialized training that needs to be implemented within the Memphis MSA to meet the projected occupational demand types of the next five to ten years. Training and workforce development programs exist to prepare workers for the top ranked occupations for the target industries. Industrial Readiness Training programs may not currently have sufficient capacity to meet an immediate increased demand for entry level laborers, but the size and number of these programs could be increased.

STRATEGIC MASTER PLAN PORT OF MEMPHIS



VIII. FUNDING



Port of Memphis Funding Options

The Pickering team has identified significant unmet funding needs at the Port of Memphis, as well as significant market opportunities for the Port. Meeting some of its unmet, short-term needs will make the Port a more attractive location for current industry expansions and new economic development.

In the medium and longer term, the Port will likely need to partner with entities such as the State of Tennessee, the Tennessee Valley Authority, and the private sector to compete in the regional and global market place for the medium- and long-term targeted industries identified in the Strategic Master Plan.

However, the Port and the City of Memphis must take the first steps in this process.

Pidgeon Industrial Park Short Term Funding

The Strategic Master Plan identified the need for a program of soil improvements to allow for a regular turnover of developable land for up to 1 million square feet of light industrial or logistic uses that could benefit from the adjacent rail intermodal facility. While such a program could cost \$5-10 million per site, those costs can be significantly reduced by starting that work NOW, identifying the best site(s), and planning for the most economical way to improve the soils at that site. Potential funding sources for that initial study include:

- TECD Site Development Grant
- TVA Regional Site Development Grant
- City/County matching funds

Completing the program for soil improvements will require additional resources, possibly from some or all of the following sources:

- State legislative appropriation
- TECD Site Development Grant
- TVA Regional Site Development Grant
- City/County appropriations/bonds
- Public/Private Partnership



Port of Memphis Funding Options

President's Island State of Good Repair

The Strategic Master Plan identified nearly \$30 million in infrastructure improvements that will be necessary to properly serve and retain existing tenants. Not all of this funding is needed immediately. The most urgent need is for the potential reconstruction or relocation of the public marine terminal. The terminal is in very poor shape and could either be reconstructed onsite or relocated to the TVA Allen site. Reconstruction of the main wharf is estimated to cost approximately \$4 million while the cost of relocating the terminal to the TVA Allen site is yet to be determined. The two options should be compared expeditiously, and could rely on some or all of the following sources:

- US DOT Marine Highway Grant
- TDOT Surface Transportation Block Grant
- City/County appropriations/bonds

While less urgent, the long-term maintenance, rehabilitation and repair of current roads, stormwater facilities, rail and bridge facilities does require a long term, programmatic approach and dedicated funding from some or all of the following sources:

- Dedicated annual funding from the City and County, either through a guaranteed appropriation or through a utility fee
- TDOT Surface Transportation Block Grant
- TDOT NHFP Freight grants and allocations
- TDOT allocations for bridge rehabilitation
- USDOT INFRA Grant for major roadways on the National Highway Freight Program
- USDOT BUILD Grant for road, rail and bridge improvements
- USDOT CRISI Grant for rail improvements

As the recent \$71 million Lamar Avenue INFRA grant illustrates, a regional team effort, combined with local financial resources, can yield significant state and federal allocations and grant awards.

Port of Memphis Funding Options

Acquiring Additional Economic Development Sites

The Strategic Master Plan called for the acquisition of additional sites by the Port of Memphis. The two major sites include the TVA Allen powerplant site and the Memphis Light & Gas Works (MLGW) peninsula. The Strategic Master Plan assumes that these sites would be transferred to the Port following environmental review and remediation by their current owners. The cost to develop either of these sites could be substantial, depending on the projected use. The Port may wish to consider the use of a public-private partnership to develop either or both sites.

Attracting Target Industries to Pidgeon Industrial Park

The Strategic Master Plan identified five targeted industries, based on current and mid-term market projections and potentially available labor force:

- Steel Finishing & Production
- Agricultural Processing & Food Production
- Intermodal Logistics & Distribution
- Waste Paper & Plastics Recycling & Aggregation
- Empty Container & Trailer Pools

The Strategic Master Plan did not identify infrastructure improvements specific to these industries, but did identify and conceptually price general infrastructure needed to support the full build out of Pidgeon Industrial Park. Key elements include a second, southern highway access to Pidgeon Industrial Park (\$70 to \$90 million) and a highway overcrossing (grade separation) over the CN intermodal line north of their intermodal yard (\$16.6 million). Potential funding sources for those improvements are similar to the State of Good Repair funding for President's Island above:

- City and/or County bonds
- TECD grants/incentives
- TVA regional grants/incentives
- TDOT Surface Transportation Block Grant
- TDOT NHFP Freight grants and allocations
- USDOT INFRA Grant for major roadways and grade separations serving the National Highway Freight Program
- USDOT BUILD Grant for road, rail and bridge improvements
- USDOT CRISI Grant for rail improvements and grade separations

Given the potential magnitude of these costs, the Port may wish to also consider the following additional approaches to funding these improvements:

- Public Private Partnership
- TECD/Legislative Appropriations

Conclusions

The Port of Memphis has very strong potential for sustained economic growth. With the right investments, the Port can continue to provide economic and employment opportunities for the City and indeed the entire region. The key in today's competitive market is to take that first funding step that signals the long term vision of the Port and City of Memphis.

STRATEGIC MASTER PLAN PORT OF MEMPHIS



IX. AESTHETICS/SECURITY



Aesthetics

A common item of feedback among tenants within Pidgeon Industrial Park and President's Island is that the aesthetics of those areas cause a hindrance to their business operations. At a stakeholder meeting for port area tenants and business interests, it was detailed how the appearance of the port area leaves a bad impression on clients, encumbers employee morale, and repels prospective employees considering employment in the area. In particular; poor maintenance, worn infrastructure, private property conditions and surface storage of materials within private properties have been reported as negative factors among port tenants.

Industrial parks, logistics parks, and commerce center type developments have changed in recent decades to improve the environment around them and for the employees that work within. Signage and entryway landscaping in industrial parks can create a positive impression and help create a brand image for the park. General recommendations for achievable outcomes within the Port of Memphis study area include providing a gateway to port areas, improving streetscapes within port areas, updating the port's branding and applying branding standards to signs and facilities throughout the port area, and having consistent site development and maintenance standards within the port area.

There are some issues associated with the port's industrial parks due to their age, such as lack of restrictive covenants that address how properties are to be maintained. Some existing companies have become accustomed to the appearance of the Port's industrial parks, while new companies who are comparing industrial sites have higher expectations. In order for the Port to compete as a prime site for economic development, it needs to appear vibrant and meet the expectations of modern site selectors. Since the Port area contains some of the largest industrial sites in Memphis, companies choosing a location will compare sites within the port to sites in modern industrial parks that have placed an emphasis on brand image and industrial park aesthetics.

President's Island currently has one principle entrance as all traffic entering the park arrives through Jack Carley Causeway. Where possible, vegetation should be provided along Jack Carley Causeway along with a proposed southern extension of the River Line Trail. Jack Carley causeway splits to form Channel and Harbor Avenues at the beginning of the developed portions of President's Island. This location provides an opportunity to develop a gateway into the industrial park and place-setting signage. A concept of park gateway is shown below. The existing islands at the junction of Harbor and Channel Avenues provide the opportunity for signage placement and landscaping.



Aesthetics

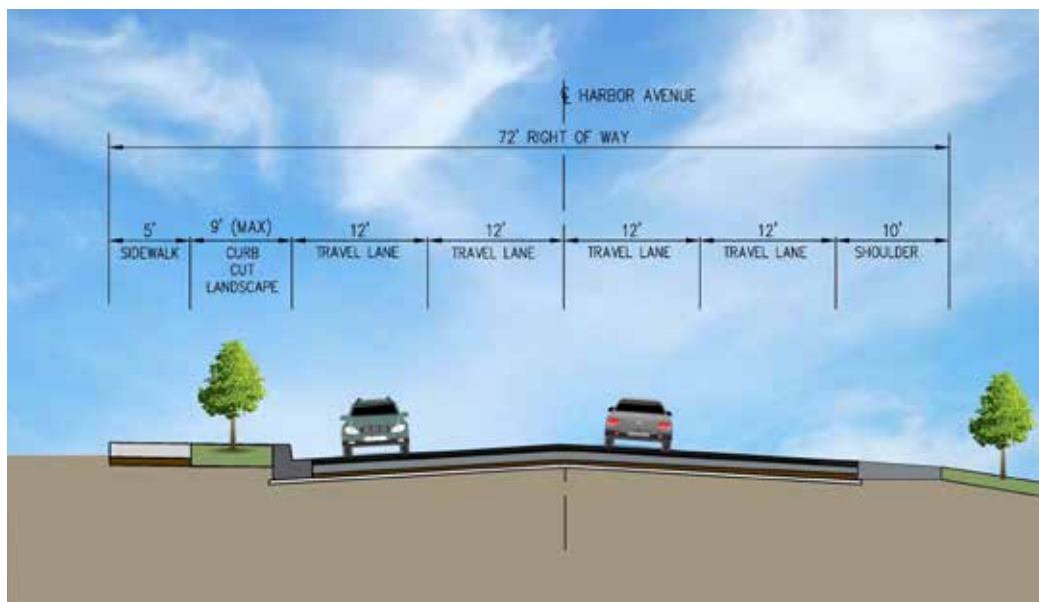
Similar to President's Island, the Pidgeon Industrial Park has one principle entrance on Paul R. Lowry Road. An ideal location for park entrance signage would be between Plant Road (TO Fuller State Park) and Buoy Street. This entrance can be enhanced with landscaped beds around signage. An example of an entrance configuration is shown below.



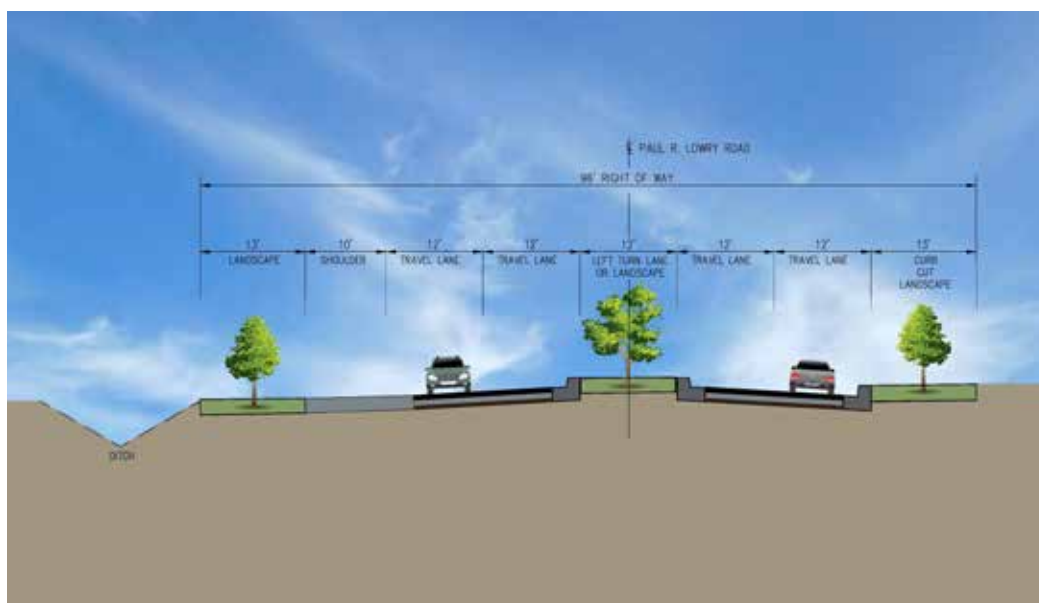
Most of the major roads in the port area are proposed to be resurfaced or repaired in the next few years. There is an opportunity to implement some streetscape improvements at the time of these projects to improve the aesthetics of the port area. Some representative examples of street cross sections are shown below. These options were derived using existing right of way dimensions and the features shown in some more recently built industrial roads such as Palmetto Commerce Parkway in North Charleston, SC and Fulton Industrial Boulevard in Atlanta, GA.



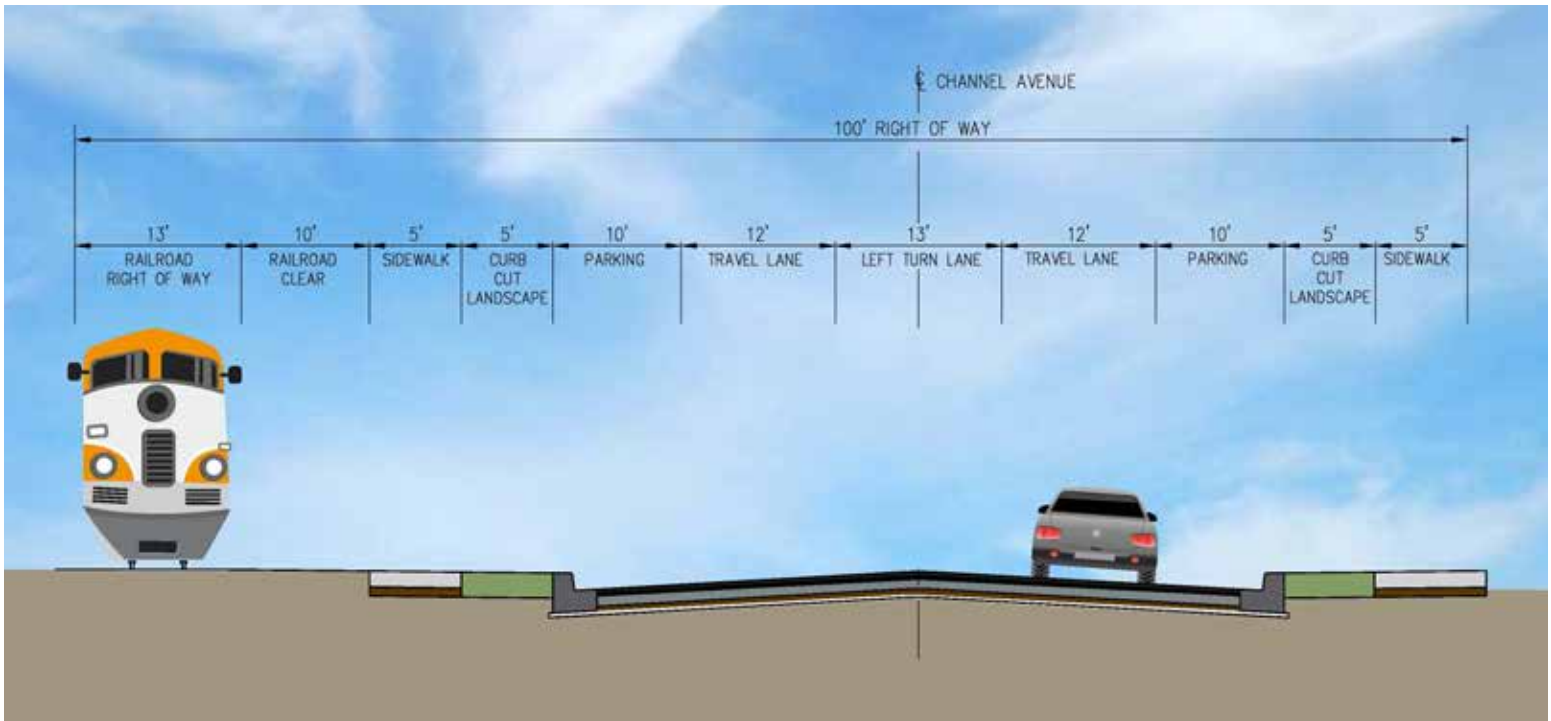
For all street sections on President's Island we propose using a 5-9' landscaping strip and 5' sidewalk on portions of the road fronting businesses. For Harbor Avenue, a paved shoulder is recommended to reduce damage caused truck and passenger vehicle parking outside of the travel lanes. For Paul R. Lowry road, a landscaped median is recommended in areas without curb cuts requiring left turn movements. We recommend that street trees, per the Memphis – Shelby County Unified Development Code, be used within the right of way. For sections on Channel Avenue that abut rail, a screening mechanism is recommended either in the form of shrubs or fencing.



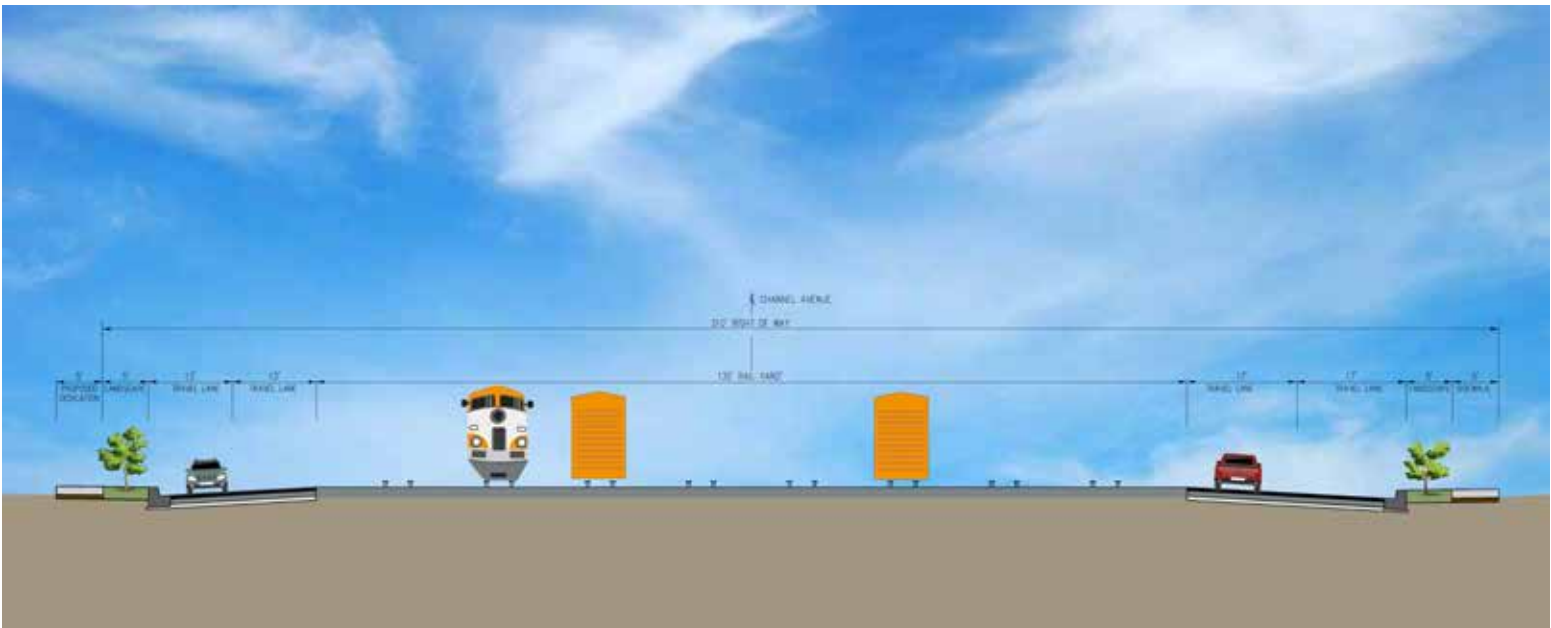
Harbor Avenue Streetscape showing paved shoulder.



Paul Lowry Road Streetscape showing landscaped median.



Channel Avenue 100' ROW Streetscape



Channel Avenue 210' ROW Streetscape

The logo for the Port of Memphis does not pose any technical problems. It reproduces well in color or black and white, and is legible even when presented in very small applications. The logo is applied consistently on all Port materials. The anchor motif is appropriate for quickly communicating a water-related organization. The logo does not appear to have been changed in many years, and so consideration could be made for updating the logo prior to creating new signage and designing entryways for the Port.

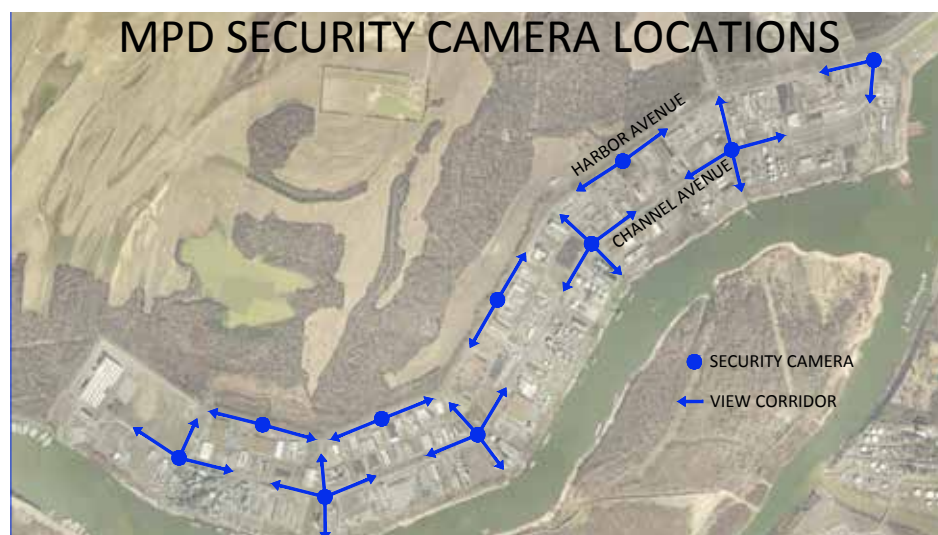
Security

In the course of evaluating Port security enhancements, it was determined that the Port of Memphis is somewhat unique in the fact that, for the most part, these properties are an agglomeration of privately owned and operated entities. As such, these operations maintain and execute security measures and policies driven by their own corporate guidelines. These measures include, but are not limited to, emergency response plans, site evacuation, and perimeter control. The President's Island Industrial Association, which consists of tenants within President's Island and Pidgeon Industrial Park, regularly convenes a Port Security Committee, where security incidents and best practices are shared among the members to promote future enhancements.

Beyond the perimeter of privately held industries, it was determined that security measures fall into the categories of personnel safety and crime prevention. For Port controlled properties, including the Public Terminal and Crane Unloading facilities, personnel safety concerns and recommendations have been provided as part of the Infrastructure Assessment Section of this report.

The multiple operations at both President's Island and Pidgeon Industrial Park, and the significant employment numbers at those operations, provides a natural deterrent for crime during the daylight hours. With the focus on the back shift hours when facilities are either shutdown or in reduced operations, there are two recommendations for enhanced crime prevention as follows.

- Install a network of Memphis Police Department monitored security cameras throughout Presidents Island. Initially it is recommended that 10 cameras be installed as noted below. This will provide maximum street coverage along the extents of Harbor and Channel Avenues, as well as the side connecting streets. Additional camera density can be added in the future as warranted. With Pidgeon Industrial Park being much less dense, more remote, and not having experienced the degree of crime, there does not appear to be an immediate need for this technology. Based on the publicized cost of the camera systems, this recommendation is estimated to cost approximately \$100,000.



- Given the workforce population reduction and increased potential for criminal activity in the off hours, it is also recommended that the Port employ a private security patrol to supplement regular, primarily daytime, Memphis Police Department patrol schedule. Cost will vary depending on the frequency of patrol, extent of hours patrolled, and number of patrol units utilized.

STRATEGIC MASTER PLAN PORT OF MEMPHIS



X. ENVIRONMENTAL



Port of Memphis Environmental Permit Review

A review of existing environmental and cultural resources assessments at the Port of Memphis's President's Island Expansion Area and Pidgeon Industrial Park was completed to determine permitting needs for future projects. The review covers the undeveloped areas of the two sites that are being assessed as part of the Port's master planning, and is specifically focused on jurisdictional waters (wetlands, streams and other waters) and cultural and archaeological resources.

Jurisdictional Waters

Waters of the U.S. and/or State are regulated by the U.S. Army Corps of Engineers (USACE) and the Tennessee Department of Environment and Conservation (TDEC), respectively. These agencies both concur with delineations of, and permit impacts to, jurisdictional waters. The USACE permits impacts under Section 404 of the Clean Water Act, while TDEC issues permits under Section 401, via its Aquatic Resource Alteration Permit (ARAP) program.



Pidgeon Industrial Park

Figure 1 demonstrates the areas of the Pidgeon Industrial Park that are considered in this review. The majority of the historical work regarding delineation of jurisdictional waters at the Pidgeon Industrial Park has been focused on the 700 acre tract adjacent to the Intermodal Facility and its immediate surrounding areas. No delineation work was identified covering the remainder of the undeveloped areas at the Pidgeon Industrial Park, although portions of the Electrolux site may have been previously assessed by other entities. According to the current National Wetlands Inventory map (attached), the South Woods area is a forested wetland, which explains why this area has historically been agricultural and not been considered for development.

Regarding the 700 acre tract, the first identified delineation work conducted is a 1999 report from the National Resource Conservation Service (NRCS) identifying numerous wetlands located throughout the site. NRCS delineations can be utilized in obtaining concurrence from the USACE and/or TDEC. However, NRCS delineations are not considered jurisdictional in and of themselves by these agencies.

TDEC first issued a delineation concurrence of onsite streams and wet weather conveyances in 2003. The concurrence letter noted the likely presence of additional wetlands onsite, particularly near the South Woods area. Since 2003, the 700 acre tract has been fully delineated several times in order to maintain a current approved delineation for the site. The 700 acre tract has approximately 58.4 acres of wetlands and three streams totaling 16,830 linear feet. USACE and TDEC issued concurrence for the most recent delineation in March 2017.



Figure 1

President's Island Expansion Area

The first identified delineation of the President's Island Expansion Area was circa 2012 as a part of the proposed Cargill Rail line expansion along Harbor Avenue. The remainder of the assumed developable site area was delineated circa 2014 as part of the TIGER Grant application for the Cargill/Multimodal Expansion facility. Numerous wetland areas, wet weather conveyances, and open waters were identified onsite. No records of concurrence submittals or approvals for this delineation were available for review.

Figure 2 provides a visual representation of the areas of President's Island that have been previously assessed for wetlands and jurisdictional waters.

Any planned future work at either site will require a review to verify if historical delineations in the work area have been conducted, if these delineations are currently approved by both TDEC and the USACE, and if any permitting for potential impacts will be required.

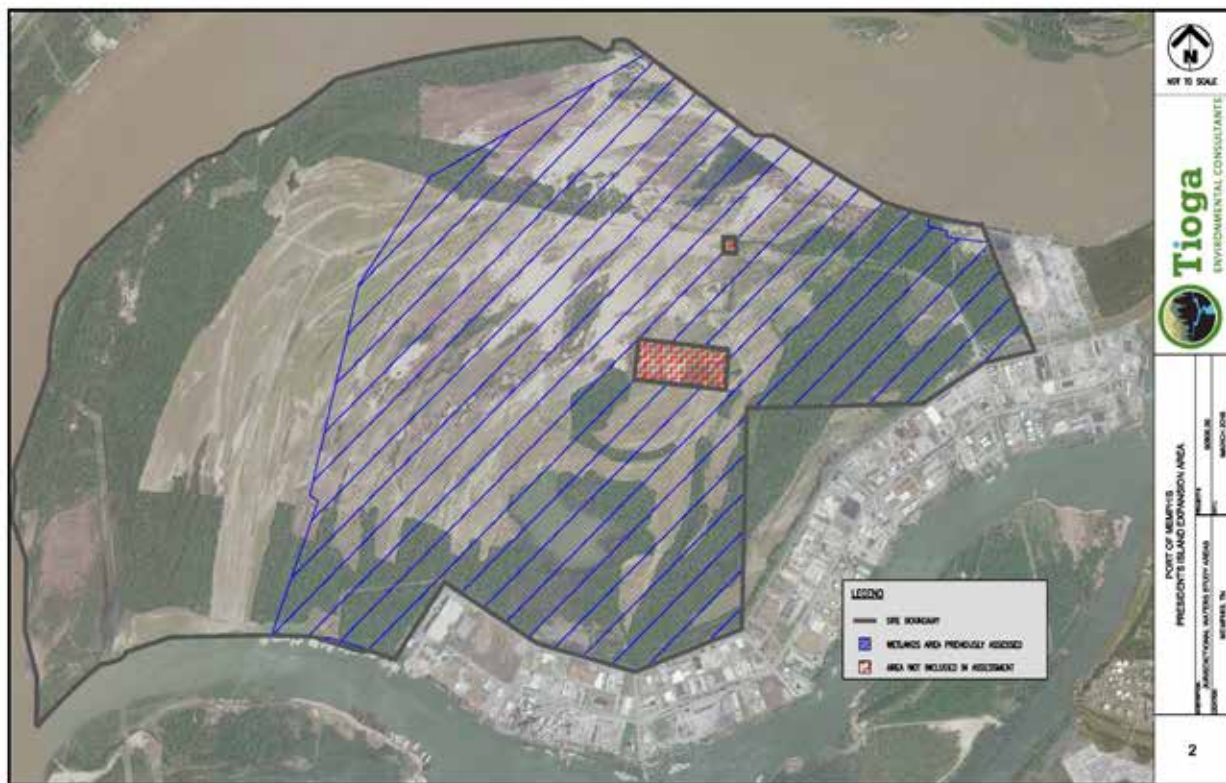


Figure 2

Cultural and Archaeological Resources

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties. This requirement may be triggered in a number of ways, including when funding projects or issuing permits to projects. It is likely that any substantial development of Port property will require Section 106 review and compliance. In Tennessee, such review is conducted by the Tennessee Historical Commission, which acts as the State Historic Preservation Office (SHPO), within TDEC's Division of Archaeology. SHPO will typically require site investigations to determine if any archaeological sites eligible for listing on the National Register of Historic Places (NRHP) are present within the area of potential effect.

Pidgeon Industrial Park

All previously undeveloped areas of Pidgeon Industrial Park within the levee, excluding only the forested South Woods portion of the site, were investigated in a Phase I archaeological survey in 1994. No delineation work was identified covering the remainder of the subject area. These areas are represented on Figure 3.

From the 1994 study, a total of 25 historic sites were identified, two of which were potentially significant, i.e., requiring additional investigation and potentially eligible for listing on the National Register of Historic Places (NRHP). Subsequent Phase II work at these two sites in 2004 determined that one of the sites was not eligible for listing on the NRHP, and a 2008 Phase III Archaeological Mitigation was undertaken to mitigate the negative effect any planned development might have on the final location.

Although all of the previously identified sites have been deemed ineligible for listing and/or mitigated, the original report concluded that all high probability areas may not have been identified because of poor surface visibility and the large size of the tract surveyed.

It is likely that no additional archaeological work at Pidgeon Industrial Park within the levee would be required unless new work within the southern forested South Woods area is proposed. However, it is recommended that consultation with the State Historic Preservation Office be conducted prior to any ground disturbing activities taking place.



Figure 3

President's Island Expansion Area

Unlike Pidgeon Industrial Park, archaeological work on President's Island Expansion Area has only occurred in targeted areas. Figure 4 provides a visual representation of the areas of Expansion Area that have been previously assessed for archaeological resources.

The first noted work was conducted in 2002 for the then proposed MAPCO pipeline that crosses the property, identifying two sites, both of which were recommended ineligible for listing on the NRHP. This source was not available for review but was referenced in later documents.

Two archaeological studies were conducted as part of the potential Cargill/Multimodal expansion: one on the proposed borrow pit site, dated August 2014 and covering approximately 650 acres, and one on the proposed rail expansion Option 2B area, dated March 2014 and covering approximately 280 acres. Although archaeological sites were found, neither study found sites that were significant or required additional investigation, or that were considered eligible for the National Register of Historic Places.

Any planned development in the areas not previously surveyed will likely require study and approval through the State Historic Preservation Office prior to beginning project work.



Figure 4

Port of Memphis Air Quality

Introduction

The Memphis-Shelby County Port Commission (Port) and the Economic Development Growth Engine (EDGE) have commissioned a Master Plan to evaluate the development opportunities of Port properties including undeveloped areas of Presidents Island and the Frank C. Pidgeon Industrial Park. These properties, located within Shelby County, were assessed to determine whether there were any obstacles to constructing new sources of air pollutant emissions and whether there were any funding opportunities available for these new sources.

Background

One of the major indicators of the capacity of an airshed to withstand new air pollutant sources is the airsheds compliance with the National Ambient Air Quality Standards (NAAQS).

The United States Environmental Protection Agency (EPA) designated Shelby County, Tennessee as in nonattainment with the carbon monoxide (CO) NAAQS on March 3, 1978. Through an inspection and maintenance program and later improvements in automotive technology, Shelby County came into attainment in 1994 and was designated as a maintenance area for CO. Maintenance areas are areas that were previously in nonattainment for a particular NAAQS but have since been redesignated to attainment with an approved maintenance plan for that NAAQS.



On April 30, 2004, the EPA designated Shelby County, and Crittenden County, Arkansas, as nonattainment for the 1997 8-hour ozone NAAQS, with a classification of 'moderate'. After adopting additional measures to control ozone-forming emissions in the region, the EPA reclassified the area from moderate to marginal nonattainment. Tennessee, on behalf of Shelby County, submitted the redesignation request and maintenance plan for its portion of the 1997

8- hour Ozone Area to EPA on February 26, 2009. EPA approved Tennessee's redesignation request and maintenance plan on January 4, 2010.

The Memphis, TN-MS-AR Area as defined by EPA consists of a portion of DeSoto County in Mississippi, all of Shelby County in Tennessee, and all of Crittenden County in Arkansas. On March 12, 2008, EPA promulgated a revised 8-hour ozone NAAQS of 0.075 parts per million. EPA designated the Memphis, TN-MS-AR Area, as a marginal nonattainment area for the 2008 8-hour ozone NAAQS on April 30, 2012 (effective July 20, 2012).

On January 19, 2016, the Tennessee Department of Environment and Conservation (TDEC) requested that EPA redesignate Tennessee's portion of the Memphis, TN-MS-AR Area to attainment for the 2008 8-hour ozone NAAQS, and submitted a State Implementation Plan (SIP) revision. On June 23, 2016, the EPA agreed and redesignated Shelby County to attainment for the 2008 8-hour ozone NAAQS. Tennessee operates under a Clean Air Act SIP to maintain the 2008 8-hour ozone NAAQS through 2027.

Permitting Process

When a facility is interested in constructing an air pollutant emissions source, it must determine if New Source Review is applicable. The New Source Review permitting regulation ensures that when air pollutant emission sources are constructed, they are as clean as possible and contain technologies that are consistent with the most current technological advances.

There are two different types of New Source Review (NSR) that are undertaken for larger facilities. For facilities locating in areas not in attainment with the NAAQS, Nonattainment NSR review must be undertaken. This process requires the most stringent emissions reductions and most advanced controls. However, when an area is in attainment with the NAAQS the NSR review is called Prevention of Significant Deterioration (PSD) and the control requirements are less stringent.

PSD applies to the construction of Major Sources and Major Modifications of air emission sources. Under PSD a Major Source is a facility with emissions exceeding 250 tons per year of any regulated NSR pollutants, or emissions exceeding 100 tons per year of any regulated NSR pollutants at sources in specific categories such as power plants, large boilers, kraft pulp mills, iron and steel mills, etc.

A Major Modification includes increases in emissions at an existing source of:

- Carbon monoxide: 100 tons per year (tpy)
- Nitrogen oxides: 40 tpy
- Sulfur dioxide: 40 tpy
- Particulate matter: 25 tpy of particulate matter emissions
- PM10 emissions: 15 tpy of particulate matter emissions less than 10 microns
- Ozone: 40 tpy of volatile organic compounds or nitrogen oxides
- Lead (elemental): 0.6 tpy
- Fluorides (excluding HF): 3 tpy
- Sulfuric acid mist: 7 tpy
- Total reduced sulfur (including H₂S): 10 tpy
- Reduced sulfur compounds (including H₂S): 10 tpy
- Municipal waste combustor organics (measured as total tetra-through octa-chlorinated dibenzo-p-dioxins and dibenzofurans): 3.2x10⁻⁶ megagrams per year (3.5x10⁻⁶ tpy)
- Municipal waste combustor metals (measured as particulate matter): 15 tpy
- Municipal waste combustor acid gases (measured as sulfur dioxide and hydrogen chloride): 36 megagrams per year (40tpy)
- Ozone depleting substances (listed under Section 602 of the federal Clean Air Act): 40 tpy

Shelby County, TN is in attainment with all of the NAAQS; therefore, Major Sources looking to locate; or sources performing Major Modifications in Shelby County are subject to PSD.

If sources are below the thresholds to be considered a PSD Major Source or Major Modification, then no special analysis needs to be included in the application. However, PSD Applications require the source to perform an impact analysis as well as an evaluation of the best available control technologies for equipment being installed or modified.

The impact analysis is a computer modeling exercise performed to ensure that the ambient air quality is not affected by the construction of the new source or modification. This analysis starts with baseline conditions and existing air pollutant emissions in the geographic area of interest.

Then, the emissions of the new Major Source or Modification are added and the impact is evaluated.

Recent changes in the permitted sources inventory in the Memphis/Shelby County area have resulted in a significant decrease in air pollutant emissions that will be generated in the future. This affects the baseline inventory. Specifically, with the significant reduction in emissions from the President's Island Cargill facility and the replacement of the Tennessee Valley Authority (TVA) Allen coal fired power plant with a combined cycle natural gas fired power plant (2018) the baseline of emissions generated will be dramatically lower.

Recent changes in the permitted sources inventory in the Memphis/Shelby County area have resulted in a significant decrease in air pollutant emissions that will be generated in the future. This affects the baseline inventory. Specifically, with the significant reduction in emissions from the President's Island Cargill facility and the replacement of the Tennessee Valley Authority (TVA) Allen coal fired power plant with a combined cycle natural gas fired power plant (2018) the baseline of emissions generated will be dramatically lower.

These two facilities have been two of the largest generators of air pollutant emissions in the area. For example, the Allen fossil plant generated nearly 1,500 tons of nitrogen oxides, nearly 500 tons of carbon monoxide and 4,000 tons of sulfur dioxide in the 2015 air emission inventory. In 2014 Cargill was generating more than 500 tons of nitrogen oxides, more than 700 tons of volatile organic compounds, more than 1,200 tons of carbon monoxide and more than 3,000 tons of sulfur dioxide. Both of these operations have been replaced or will soon be replaced with much lower polluting operations.

In an interview, Mr. Robert Rogers the Director of Pollution Control for the Shelby County Health Department, indicated that he could not imagine a facility that would begin operations in Memphis that would have difficulty receiving permit approval.

Funding

Various sources were contacted to identify air quality related funding sources that might be appropriate for industries within the study area.

Currently, the State of Tennessee is apportioning settlement fees from the Volkswagen Diesel Settlement Mitigation Trust Fund. Approximately \$2.9 billion is to be distributed among states based on the number of registered illegal VW vehicles within its boundaries. Tennessee is expected to be eligible to receive approximately \$45.7 million. Most of these monies are to be spent on sectors related to replacing or repowering on-road diesel equipment with less polluting engines. However, one category that may be an applicable mitigation action for the study area is shipboard diesel engines, for example tug boats.

The State of Tennessee has yet to determine details associated with selection of projects for funding but is working to solicit proposals for specific categories of eligible mitigation actions. After receiving input from the public, TDEC will review proposals and determine which projects will receive funding.

Specific information can be found at the TDEC website for this settlement: <https://www.tn.gov/environment/program-areas/energy/state-energy-office--seo-/tennessee-and-the-volkswagen-diesel-settlement.html> and there is a link to sign up for the TDEC VW Environmental Mitigation Trust electronic mail list on this main website page.

Additionally, the Tennessee Valley Authority (TVA) offers incentives to all commercial and industrial participants (subject to eligibility requirements and funding availability) for the purchase of a variety of electrical equipment such as electrically powered non-road vehicles, lighting, food service equipment, HVAC equipment and other types of miscellaneous equipment.

On a federal level, the EPA awards grants, rebates and low-cost revolving loans to eligible entities to fund the cost of a retrofit technology that significantly reduces emissions through implementation of a certified engine configuration, verified technology, or emerging technology for equipment to include: medium heavy-duty or heavy heavy-duty diesel trucks, marine engines, locomotives, or nonroad engines or diesel vehicles or equipment used in construction, handling of cargo (including at port or airport). In addition, eligible entities may also use funds awarded for programs or projects to reduce long-duration idling using verified technology involving a vehicle or equipment described above.

Eligible applicants are: A regional, State, local or tribal agency or port authority with jurisdiction over transportation or air quality; and a nonprofit organization or institution that represents or provides pollution reduction or educational services to persons or organizations that own or operate diesel fleets; or has, as its principal purpose, the promotion of transportation or air quality are eligible for assistance under this program. City, county, or municipal agencies, school districts, and metropolitan planning organizations (MPOs) that have jurisdiction over transportation or air quality are all eligible entities under this program to the extent that they fall within the definition above. Approximately \$34 million is projected to be available under this program in 2018 and more information can be found at: <http://www.epa.gov/cleandiesel>.

Summary

Industrial and commercial facilities with air pollutant emission sources wishing to locate to Shelby County Tennessee will find a favorable permitting atmosphere. Currently, the region has significant growth capacity and there are a number of potential sources of funding available to new and existing sources of air pollutant emissions.



Phase I Environmental Assessment

A Phase 1 Environmental Site Assessment was conducted on the potential President's Island expansion area and the Pidgeon Industrial Park property adjacent to the CN/CSX intermodal facility. These assessments included site reconnaissance, interviews with knowledgeable people, records review and a report. Having completed the process detailed in the standard, we have determined there is evidence of one recognized environmental condition on President's Island in connection with the subject properties.

For the President's Island expansion area, we found that the site has been agricultural back to at least the 1930's. It is likely that various pesticides and/or herbicides have been utilized onsite during these operations. Also, we found the presence of numerous Historic UST (Underground Storage Tanks) sites located within 500 feet on south and east adjoining properties. For these two findings do not represent a recognized environmental condition.

There was also the presence of numerous SEMS (Superfund Enterprise Management System), SEMS Archive, SRP (State Remediation Program), and VCP (Voluntary Cleanup Oversight and Assistance Program) sites within 1,750 feet of the subject Property. The EDR (Environmental Data Resources, Inc.) report identifies ten SRP sites (two open sites and eight closed), four VCP sites (three open and one closed), seven SEMS Archive and three SEMS sites within ½ mile of the subject Property. The available records indicate that all the sites except Harcros Chemicals are closed out or in the process of submitting final closure documentation. Harcros Chemicals is still conducting ongoing monitoring and assessment under the State's VOAP (Voluntary Cleanup Oversight and Assistance Program) program. There is no documentation of offsite impacts at these sites; however, based on the preponderance of sites, their relative proximity to the subject Property, and the tendency of area groundwaters to flow north and northwest towards the subject Property, the presence of these remedial sites represents a recognized environmental condition at the subject Property.



For the Pidgeon Industrial Park parcel, we found that the site has been agricultural back to at least the 1930's. It is likely that various pesticides and/or herbicides have been utilized onsite during these operations. Additionally, these operations currently include the use of an onsite fuel oil aboveground storage tank. Impacts from pesticides/herbicides are typically limited to onsite surficial soils. The proposed future use of the property is for agricultural and/or heavy industrial use. Based on these proposed uses, no indications of illicit use, disposal, or leaks of any chemicals onsite, the likely significant earth moving that would be required for redevelopment, and the low exposure potential for industrial users to any residual chemical, the historical agricultural use of the Property does not represent a recognized environmental condition at the subject Property. As defined in the Standard, this assessment has identified one finding and revealed no evidence of recognized environmental conditions in connection with the Property. No further investigation is recommended at this time.

Two Phase 1 Environmental Site Assessments reports that detail these findings are found in Appendix E1 and E2. These documents include a matrix of environmental related conditions and provide detailed site information and recommendations for the subject properties should development occur on either or both sites.



Port of Memphis Geotechnical Summary



A geotechnical desktop study was performed to evaluate the general subsurface conditions within the Port of Memphis areas of President's Island and the Frank C. Pidgeon Industrial Park (Port Study area). The services consisted of a review of archival geotechnical data, preliminary engineering analyses, general recommendations for geotechnical aspects of the design and construction for a range of potential project needs, and preparation of this report. Please note that the discussions herein are preliminary in nature and should be used for preliminary cost evaluation only. A design phase exploration must be performed to finalize these recommendations.

Based on a review of the stratigraphy present in the select archival documents and our experience in the area, the stratigraphy in the Port Study area generally consists of predominately fine-grained, clay and silt designated as Layer A, which with increasing depth grade into a predominately coarse-grained stratum designated as Layer B. In some of the borings, Layer B was in turn underlain by predominately high plasticity clay stratum designated as Layer C. An exception to this general stratigraphy was encountered in isolated areas where Layer B was encountered at the surface. Based on our experience in the area, isolated areas with fill soils are also common in Port of Memphis.

Groundwater was noted in the archival documents at depths ranging from 7 to 48 feet. Groundwater levels could vary over time due to the effects of seasonal variation in precipitation, recharge, the stage of the Mississippi River and Lake McKellar, or other factors not evident at the time of exploration. Groundwater can be perched within pockets of permeable fill.

Items of geotechnical concern within the Port Study area include liquefaction, lateral spreading, high plasticity clay, soft soils, uncontrolled fill, and soil moisture sensitivity. A detailed evaluation of these concerns can be found in the desktop study document located in Appendix E3.



Port of Memphis Geotechnical Summary

A summary of key geotechnical concerns follows:

Liquefaction

Soil liquefaction occurs when a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress such as shaking during an earthquake, in which material that is ordinarily a solid behaves like a liquid. It has been noted that ground water elevations have been encountered at depths from 7 to 48 feet and that Memphis lies within the influence of the New Madrid Seismic Zone. Preliminary analysis shows that groundwater levels at 10 and 30 feet, combined with a seismic event, can translate to ground settlement of roughly 12 and 9 inches respectively. It should be noted that groundwater levels were recorded in the floodplain at Presidents Island and in Pidgeon Industrial Park. The developed sites on President's Island were elevated during the industrial park's inception with upwards of 20 feet of fill, thereby partially mitigating the effects of potential liquefaction.

High Plasticity Clays

High plasticity clay was encountered at or near the surface in some areas of the Port of Memphis. Highly plastic clays are potentially expansive with changes in the soil moisture content. Pavement and lightly loaded structural features supported on high plasticity, potentially expansive clays within the drying/wetting zone can undergo distress as the soil shrinks or swells, unless these soils are mitigated. Mitigation typically comes in the form of ground improvement technologies.

The ground improvement technologies (geopiers, rigid inclusions, rammed aggregate, etc.) are all proprietary technologies. On the Electrolux site, the cost can be estimated to be \$3.50 per SF of building area, which has been fairly consistent pricewise, with other applications. In addition, there is a need for piles along the walls and columns that adds another \$1.00 per SF, totaling \$4.50 per SF of building area. This unit cost is for a moderately loaded building such as warehousing with some light assembly/packaging. It will be slightly less for pure warehousing, and increase variably for more industrial applications. For example, the cost on a 1 million square foot facility, for ground improvement only, would be \$4.5 million. Since a 1 million SF building would typically require a 75 acre site, that cost can be spread out to arrive at a \$60,000 per developed acre. This does not include addressing liquefaction from earthquakes, which is not a typical practice in this area. It also does not include bringing in soil for site grading.

Pre loading soils is a simpler approach assuming there is time in the project schedule, but comes with some risk on the back end. In reviewing previous recommendations, it can be assumed 20 feet of compacted fill is needed to generate the proper pressure to consolidate the native soils. That process can take 12-18 months to complete. 20 feet of fill over a 1 million SF building footprint is roughly 750,000 cubic yards of soil. If adjacent, on site soils are used or soils can be obtained from a property owner across the levee, the cost can approach \$2-3/CY, or around \$2.25 million. When complete, it makes sense to keep a third of that soil there to maintain grade for drainage and preparation for paving, roads, etc. By only removing 500,000 CY, that cost is \$1 million for a total of \$3.25 million. When finished, a truly pad ready site is available for around \$43,000 per developed acre. If earthwork were added to the ground improvement technology number above to get to an equal comparison, that would increase the per acre number in that scenario to almost \$70,000 acre. Therefore, there is roughly a 40% savings if time is available to use the pre loading technique.

Another benefit to preloading is that the soils removed after compaction can be located to the next site to be developed to start the next phase of pre-loading, likely lowering the cost of the next phases of site preparation. The downside is that there needs to be careful thought on where and to what extent the preloading approach is executed. That would likely require the collective thought, testing, and analysis of a geotechnical engineer, civil land development engineer, and possibly an industrial developer to lay out a long range plan with turnover acreages and dates.

APPENDICES

- A. Port Facility & Infrastructure Assessment**
- B. Port Commission EDGE Board Presentation**
- C. Economic Impact**
- D. Workforce Data**
- E. Environmental**
 - E1. Phase I Environmental Site Assessment: President's Island Expansion Area**
 - E2. Phase I Environmental Site Assessment: Frank C. Pidgeon Industrial Park - 700 Acre Tract**
 - E3. Geotechnical Desk Top Study President's Island & Frank C. Pidgeon Industrial Park**