

ABSTRACT

The expansion of the Houston Ship Channel under Project 11 generates significant impacts on terminal design, necessitating adaptation to larger vessel classes, deeper drafts, and revised maneuvering patterns. As the channel widens and deepens, terminals must reassess berth spacing, mooring systems, crane outreach, and yard configurations to meet evolving operational requirements. These infrastructure modifications also affect tugboat pilot navigation strategies and landside logistics, resulting in a complex relationship between waterway geometry and terminal performance. This study examines these ripple effects to demonstrate how channel modernization transforms the physical, operational, and strategic design requirements of Gulf Coast port terminals.

PROJECT 11 OVERVIEW

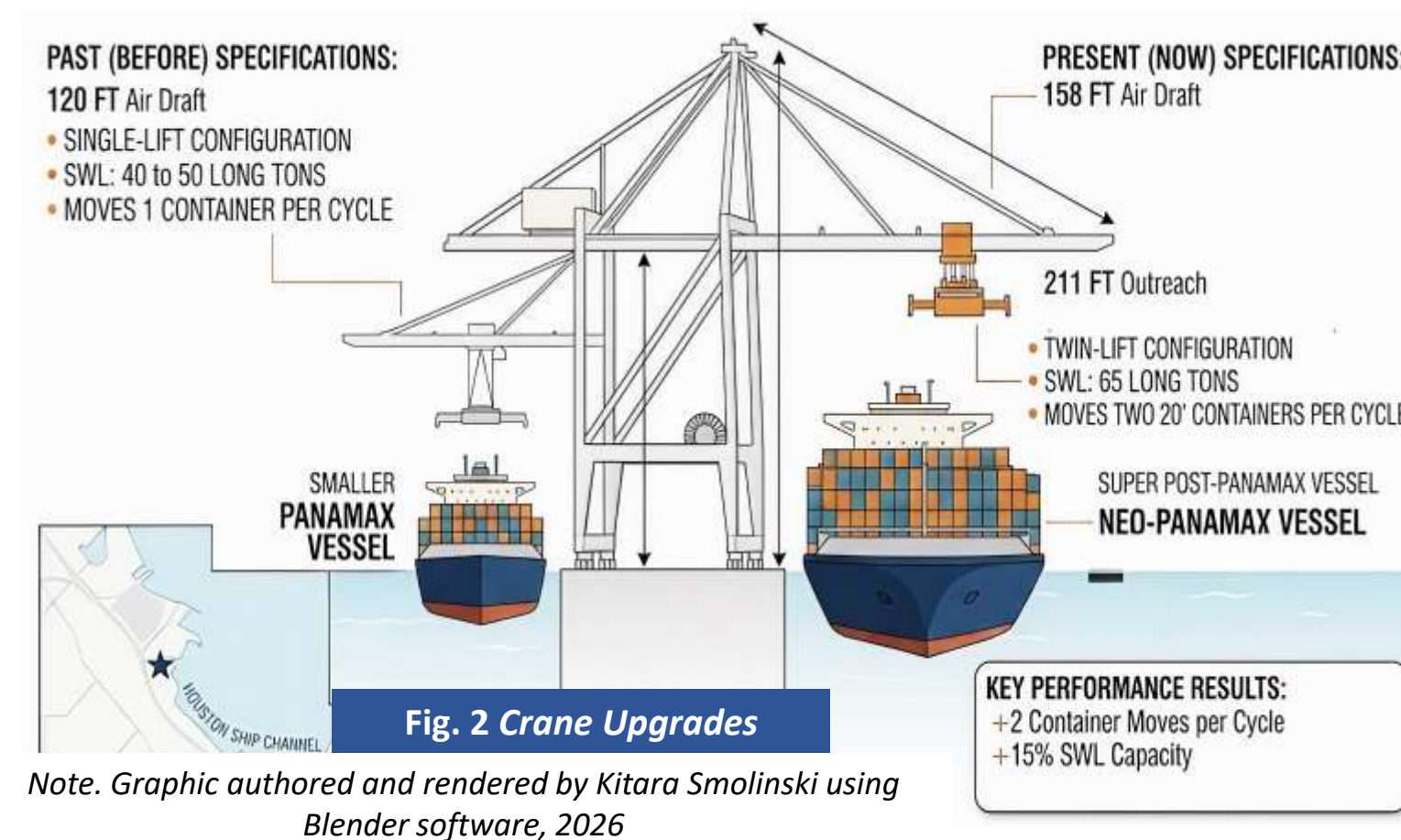
Project 11 is a \$1B+ federal and Port Houston initiative to widen and deepen the Houston Ship Channel, improving safety, capacity, and long-term competitiveness. The channel is being expanded from 530 ft to 700 ft, allowing safer two-way traffic for large neo-Panamax vessels and other ships of equal size. Key segments are being deepened to 46.5 ft MLLW, increasing under-keel clearance and reducing grounding risk across the waterway.

The project spans six major segments from Bolivar Roads to the Main Turning Basin. Port-led portions are already complete, including Segment 1A, which removed daylight restrictions for large vessels and improved cargo fluidity. Additional work includes major bank stabilization, such as a 3,600-ft steel-and-concrete bulkhead at Spillman Island, and environmental improvements, including marsh creation, bird islands, and oyster reef restoration.

Funding commitments exceed \$900M, including \$600M from Port Houston, \$142.5M from the 2022 Infrastructure Bill, and additional federal construction and maintenance allocations. More than \$100M has already been invested in widening and deepening efforts. Bayport dredging and shoreline work are underway, with full project completion expected in late 2026. Once finished, the channel will support 15,000–17,000 TEU vessels and deliver long-term maintenance savings of nearly \$380M. Estimated total project completion is set for late 2028/early 2029.

Crane Modernization

Port Houston is upgrading its terminals with next-generation ship-to-shore cranes designed for larger, deeper-draft vessels. Barbours Cut and Bayport wharves are being rebuilt with reinforced concrete structures engineered for heavy electric STS cranes. Crane rail gauges have doubled from 50 ft to 100 ft, allowing wider and more powerful cranes to operate safely. New berths add more than 2,300 ft of waterfront capacity, supported by dual crane beams and high-strength foundations. These upgrades increase lift height, outreach, and moves per hour, enabling terminals to efficiently handle 15,000–17,000 TEU vessels.



FUTURE OPERATION IMPACTS

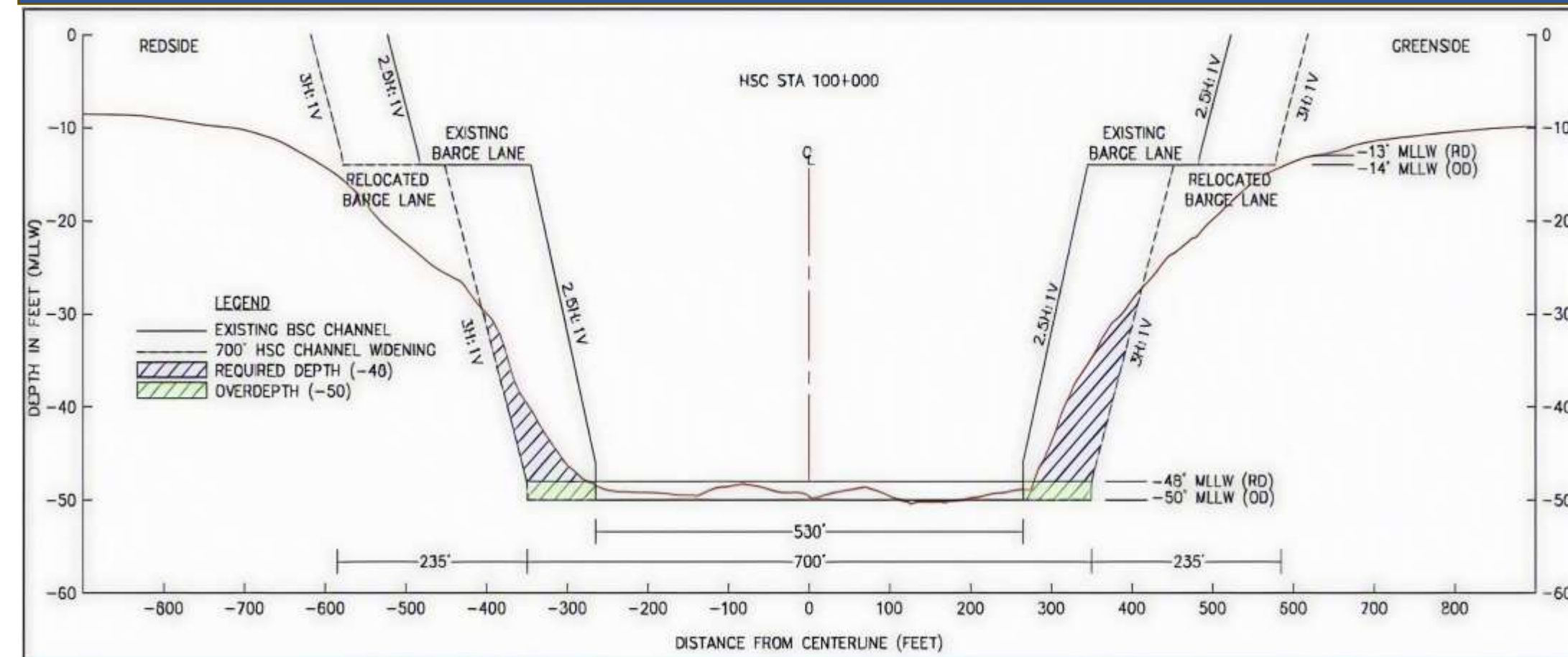
The widened 700-ft channel will significantly reduce congestion and allow more predictable two-way vessel traffic. Pilots gain more maneuvering room, improved under-keel clearance, and safer handling conditions due to deeper drafts and stabilized banks. The elimination of daylight restrictions in Segment 1A increases scheduling flexibility and reduces transit delays for large vessels.

Upgraded berths, reinforced wharf foundations, and high-capacity fender systems support safer docking for ships with larger windage profiles. Stronger wharf structures and modern electric STS cranes increase moves per hour, shortening time at berth and improving overall vessel turnaround. Enhanced mooring systems, including 150–200 ton bollards, automated hooks, and docking aid systems, reduce securing time and improve operational reliability in high-wind conditions.

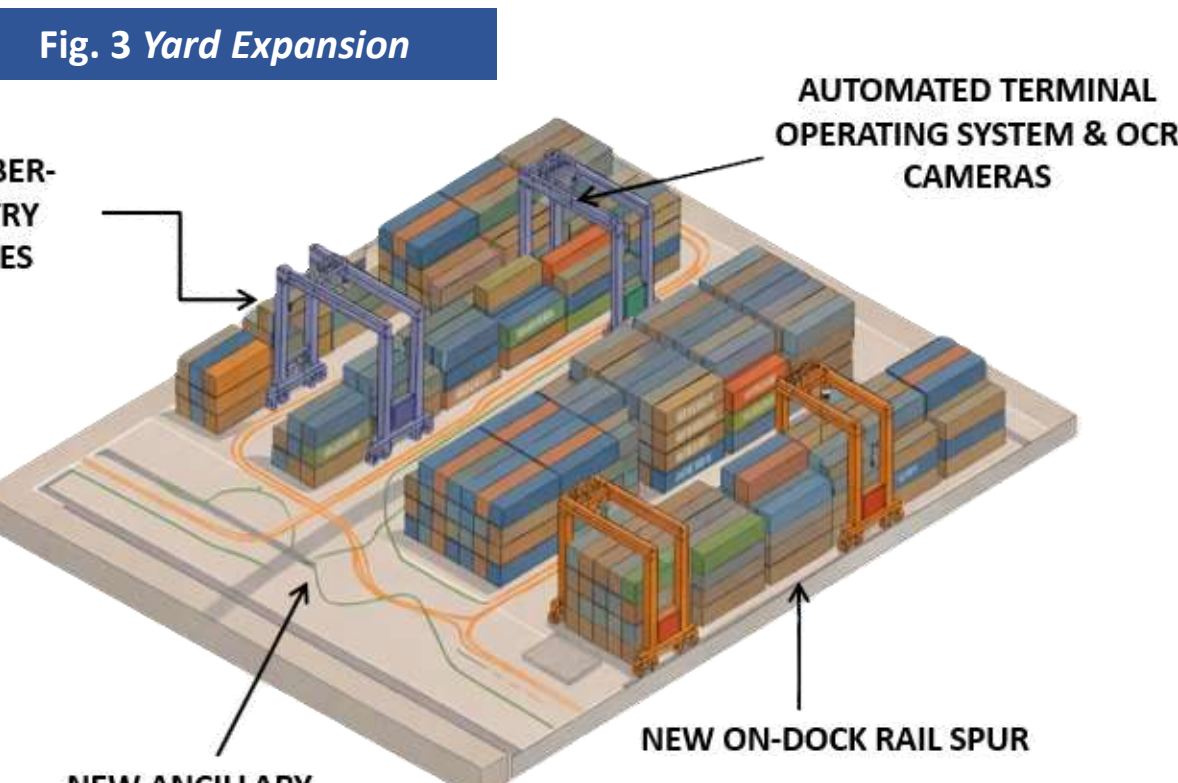
Landside improvements further support faster cargo flow. Expanded truck lanes, upgraded gate systems, and improved intermodal rail access reduce bottlenecks and increase schedule reliability. Efficiency gains at Barbours Cut and Bayport, including nearly doubled gate capacity and major yard expansions, contribute to higher annual TEU throughput.

Long-term planning includes Project 12, future terminal expansions, and continued modernization under the Port Houston 2040 Plan. This will be anchored by the Four C's Strategy: Channel, Cargo, Community, and Change. These strategies prepare the region for 15,000–17,000 TEU vessels, support emerging cargo types, and strengthen Houston's position as a leading Gulf Coast gateway.

Figure 1. Typical Houston Ship Channel Cross Section



Note. Project 11: Segments 1 and 2 – Widening the Houston Ship Channel and Bayport Ship Channel, by Judith, A., Hedderman, C. W., Cheney, D., & Ruchhoeft, R., 2022,



Note. Graphic authored and rendered by Kitara Smolinski using Blender software, 2026

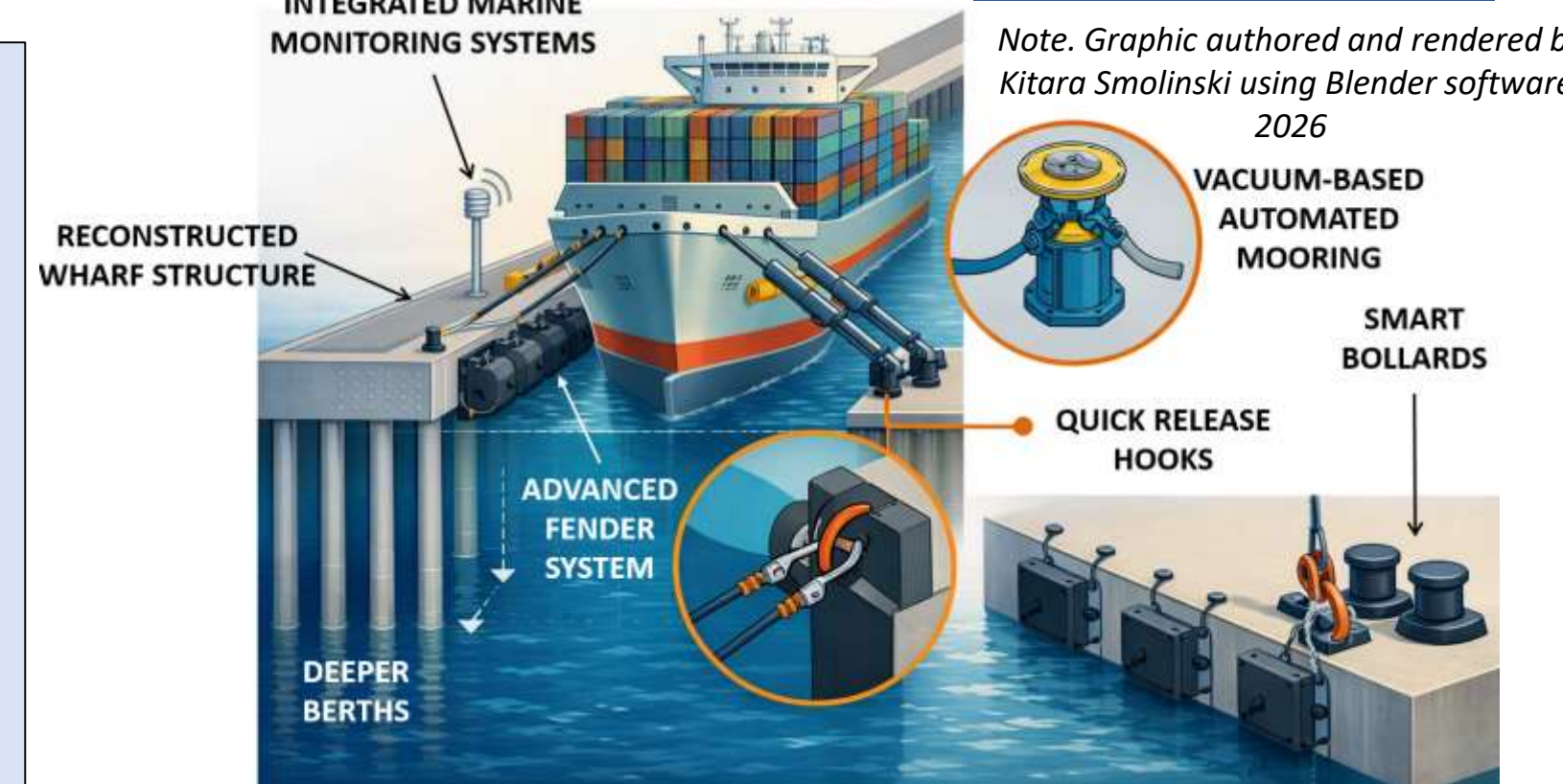
Yard & Landside Expansion

Terminals are undergoing major yard expansions to support higher cargo volumes and faster truck flow. Bayport is adding 47 acres of new yard space, upgraded utilities, and expanded gate systems. Additional RTGs, hybrid yard cranes, and continuous pavement-replacement programs strengthen container-handling capacity. Barbours Cut has nearly doubled gate throughput and invested heavily in traffic-flow improvements. Higher-capacity slabs, improved truck lanes, and expanded intermodal rail access support faster landside operations and reduce congestion across the terminal.

Mooring Equipment Upgrades

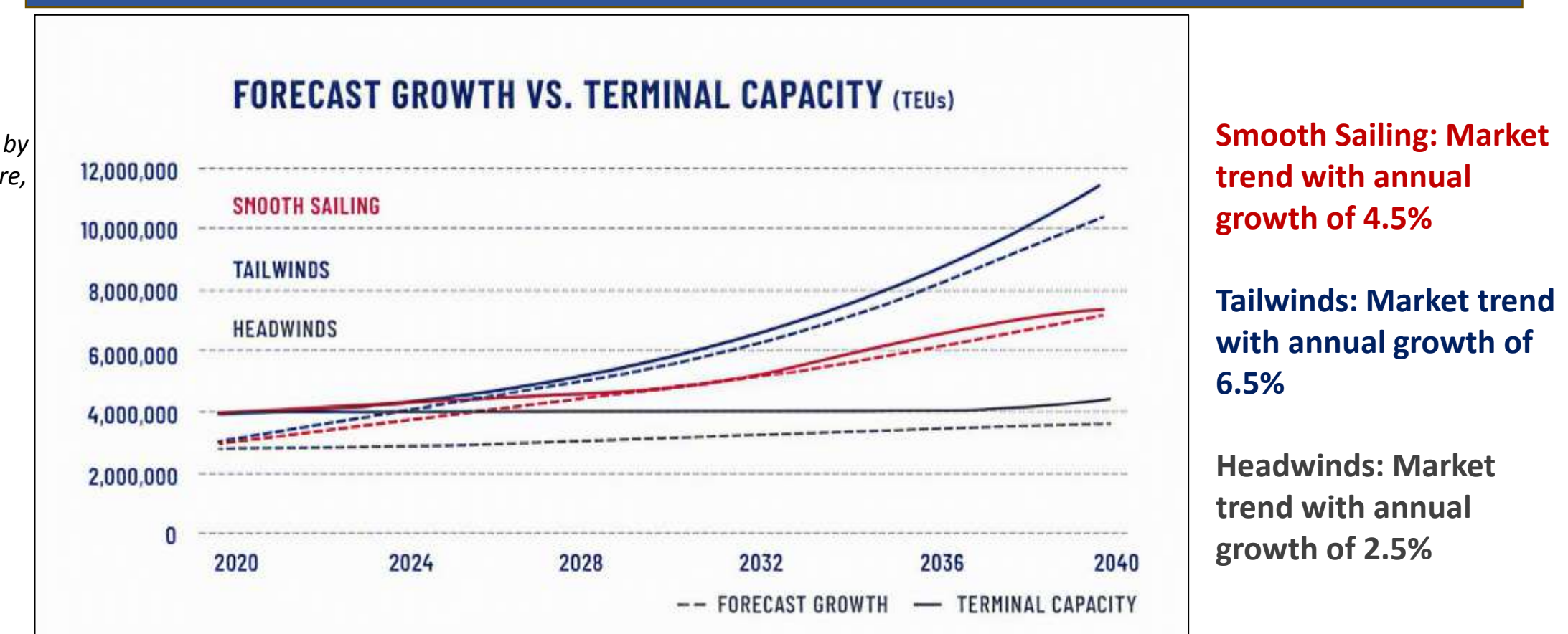
Modernized mooring systems are being installed to safely accommodate larger vessels with higher windage profiles. New 150–200-ton bollards, reinforced fender systems, and deeper berths improve docking safety and reduce turnaround time. Automated mooring technologies, including quick-release hooks, load monitoring, and docking aid systems, streamline vessel arrival and departure. These upgrades support more predictable pilot maneuvering, reduce berthing delays, and align terminal capabilities with the widened and deepened Project 11 channel.

Fig. 4 Mooring Upgrades



Note. Graphic authored and rendered by Kitara Smolinski using Blender software, 2026

Figure 5. Port of Houston Forecast Graph – 2040 Plan



Note. From Port Houston 2040 Plan, by Port Houston, 2020

CONCLUSION

Project 11 expands and modernizes the Houston Ship Channel to handle larger vessels, reduce congestion, and improve vessel scheduling. Upgrades to berths, cranes, mooring systems, and yard facilities increase cargo throughput and shorten turnaround times. Infrastructure improvements and advanced equipment enhance long-term operational reliability. As future projects like Project 12 and terminal expansions move forward, Port Houston is preparing for next-generation vessels and new cargo demands. These investments ensure the channel remains a competitive, high-capacity gateway for global trade.

Building Tomorrow's Port: Terminal Evolution After Channel Modernization

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Reference Page