

CHAPTER 4

TRANSPORTATION AND SHIPPING

The earliest routes of passage in Ohio were its waterways and the footpaths imprinted by Native American peoples. Native American trails crossed through thick forest, meandered alongside river courses, followed ancient beach ridges, traversed swamps and connected many natural landmarks. These trails were used as migration routes, trade routes, hunting routes and war paths and later guided European explorers, traders and militaries. These trails ultimately aided American pioneers and settlement in Ohio and were used to lay out modern transportation routes. See pages 70-71 for a map and more information about Native American trails.

In the early 1800s, very few improved roads or navigable waterways crossed the Appalachian Mountains into Ohio from the East Coast. Lake Erie, the Ohio River and the Great Black Swamp were also significant barriers that geographically isolated the state. Transporting people and goods was slow and expensive. High delivery costs prevented many farmers and manufacturers in eastern markets from shipping goods into Ohio. In 1802, President Thomas Jefferson signed the Enabling Act of 1802, which authorized Ohio to begin the process of becoming a state (officially admitted in 1803). A provision in the Enabling Act designated five percent of the revenue received from federal land sales (see Chapter 3: History, page 56) be used for road construction. The National Road, the nation's first federally-funded highway, was built between 1811 and 1837. It spanned from Cumberland, Maryland to Vandalia, Illinois and crossed through central Ohio (along much of historic and current U.S. Route 40). By 1818, the trans-Appalachian National Road was complete between its eastern starting point at Cumberland and the Ohio River. Construction into Ohio commenced in 1825, and reached Zanesville in 1830; Columbus in 1833, and; Springfield in 1838. The National Road opened much of Ohio to settlement and provided an important link to eastern markets.

In its first few decades as a state, Ohio's intrastate transportation routes were mostly unimproved dirt and mud pathways through cleared forest. Roads and traces (trails marked by American pioneers) generally followed important Native American trails and prominent features in the landscape. Later, roads were routed advantageously to conserve farmland and to avoid flood-prone areas, and followed survey and property lines. Early modes of transportation included horse-drawn carriages, Conestoga wagons, riding on horseback and walking. Roads were also used to move livestock.

To allow passage through swampland and frequently-saturated terrain, logs were laid side by side to create "corduroy" roads. These roads, albeit bumpy and uncomfortable, allowed heavier vehicles the ability to traverse wetter landscapes without sinking into the mud. The 40-mile Maumee and Western Reserve Road was completed 1825. It connected Bellevue and Perrysburg and was the first road to cross the Great Black Swamp. Poor drainage conditions and the damming effect created by the corduroy corridor itself often submerged sections of the road into the ground. It was often impassable during wet seasons. Today, the general path of the road carries parts of U.S. Route 20 and U.S. Route 23.

Map 4-1: **General Transportation**

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Ohio is centrally located within North America's largest industrial region and is part of a Great Lakes megalopolis. Integral to the movement of people and goods is the state's extensive transportation network, which includes: over 20,000 miles of state-designated highways (interstate highways, U.S. routes and state routes); over 5,300 miles of rail; airports, and; waterborne shipping routes. Ohio ranks ninth in the country with over 262,000 lane miles (Federal Highway Administration (FHWA), 2013) and sixth with over 113.5 billion vehicle miles traveled (FHWA, 2015). In total, the Ohio Department of Transportation (ODOT) owns and maintains more than 49,000 lane miles of paved roadway and 14,000 bridges.

By the mid-1800s, dirt-surfaced roadways were being improved with various materials, including wooden planks. Roads constructed of hewn or sawn timber greatly improved transportation and commerce. Wooden planks were laid side by side (similar to a corduroy road) over the roadway onto a log foundation. To accommodate wagon traffic, road widths ranged from eight feet to 12 feet or more (especially in larger market centers). Drainage ditches were dug along both sides the roadway to prevent water and mud from accumulating under and over the wood. Plank roads were particularly common in northern Ohio due to the area's proximity to timber forests in Michigan and Ontario.

To encourage the expansion of Ohio's road network, the construction of plank roads—among other roads and pikes—was commissioned by the state to authorized turnpike companies. Roadway construction and maintenance was privately funded. Tolls were collected along completed routes by the respective turnpike companies to help with upkeep costs. By the 1830s, there were approximately 300 miles of toll roads in Ohio, including the state's longest, the 106-mile Columbus and Sandusky Pike (completed in 1834). It was operated by the Columbus and Sandusky Turnpike Company and included both wood-planked and corduroy stretches. Like the Maumee and Western Reserve Road, portions were often impassable during wet seasons. Today, the northern section of the pike carries the northern part of State Route 4, while the southern portion carries a part of U.S. Route 23.

Due to deteriorating and warping wood—from sun exposure, precipitation and heavy use—coupled with annual maintenance requirements, high repair costs and lumber needs, plank roads were slowly being replaced by gravel and macadam in the late 1800s. "Macadam" is a type of surface in which multiple layers of crushed stone are compacted into the roadway using iron rollers. The lowest layer consisted of larger base stones while the surface layer consisted of smaller stones and gravel. The compacting process often created stone dust, a byproduct that helped form a binding agent when water was added. This pavement type provided a solid and more durable foundation for heavier vehicles. The National Road was the first road in Ohio—and second in the country—to be macadamized.

Many early automobile manufacturers were based in Cleveland, including the Baker Motor Vehicle Company, the Peerless Motor Vehicle Company, the White Motor Company and the Winton Motor Carriage Company. The increasing number of motor vehicles required significant improvements to roadways. In 1891, Ohio became the first state to pave a street with concrete (in Bellefontaine, Logan County). Soon after, concrete surpassed brick, dirt and other materials as a preferred road surface.

The Ohio Department of Highways—a precursor agency to ODOT—was established in 1905. Between 1900 and 1920, Ohio vastly improved its highway system. The state route numbering system went into effect in 1924. Current state route numbers originate from

that system. A national network of federal highways, or U.S. routes, was established in 1926. Nationwide construction of the Interstate Highway System commenced per the Federal Aid Highway Act of 1956. The interstate system is a network of high-speed, controlled-access highways. Ohio has 21 interstate highways totaling more than 1,500 miles. These include eight primary routes and 13 auxiliary routes. The evolution of Ohio's roads, state highways, federal highways and interstate highways have helped advance intrastate and interstate travel and commerce, led to residential growth and urban sprawl, and have improved economic development.



Cuyahoga River, Cleveland, Cuyahoga County

WATERBORNE TRANSPORTATION

In the early 1800s, Lake Erie was not used as a commercial transportation route. In 1818, the paddlewheel-driven *Walk-in-the-Water* was the first steamship to travel Lake Erie. In its maiden voyage, the 135-foot long steamer sailed from Buffalo to Detroit—making stops in Erie (Pennsylvania), Grand River, Cleveland and Sandusky. The entire trip was completed in nine days, and the ship's travel speed was eight to ten miles per hour. The *Walk-in-the-Water* would later also become the first steamship to sail Lake Michigan (1819). In 1821, it wrecked near Buffalo (no casualties).

Construction of the Erie Canal began in July of 1817 and was completed in October of 1825. The 363-mile canal through New York connected the Hudson River at Albany with Lake Erie at Buffalo. The linkage established the first navigable water route from the Atlantic Ocean to the Great Lakes. Completion of the Erie Canal was critical in northern Ohio's population growth and the rapid development of Lake Erie's ports.

The success of the Erie Canal helped influence the investment and construction of canals in Ohio, including the Ohio & Erie and Miami & Erie canals. The 308-mile Ohio & Erie Canal connected Lake Erie and Cleveland with the Ohio River at Portsmouth (Scioto County). Construction began in July of 1825. It was fully operational in 1833. In western Ohio, the 249-mile Miami & Erie Canal connected Maumee Bay (Lake Erie) and Toledo with the Ohio River at Cincinnati. Construction began in July of 1825 and was completed 1845. The cost to complete both the Ohio & Erie and Miami & Erie canals nearly bankrupted the state; however, the movement of goods along the water routes helped recover Ohio's economy. Revenue from the canals was at its highest in 1855.



Huron Harbor, Huron, Erie County

During this peak, Ohio's canal system consisted of almost 1,000 miles of mainline channels, feeders and side cuts. See pages 76-77 for a map and more information about Ohio's canals.

An alternate connection from Lake Erie to the Atlantic Ocean, via Lake Ontario and the St. Lawrence River, was established in 1829 with the completion of the First Welland Canal in Canada. It crossed the Niagara Peninsula just west of the Niagara River and directly linked Port Colborne on Lake Erie with Port Dalhousie on Lake Ontario. The 28-mile canal navigated a 326-foot elevation change via a series of 40 oak timber locks. The First Welland Canal operated for 25 years before it was replaced in 1853. The Second Welland Canal accommodated larger vessels, allowed for greater draft and had fewer locks (26). Cut stone was used to construct the locks. The 23-mile Third Welland Canal was completed in 1887. At Thorold, the channel was rerouted to the east and away from Twelve Mile Creek, providing a more direct path to Port Dalhousie.

The Welland Canal effectively connected ports on Lake Erie and the upper Great Lakes with the ports on Lake Ontario and the St. Lawrence River. All modifications and modernizations resulted in increased capacity allowances and faster travel times. Eventually, the feasibility and gainfulness of the Welland Canal surpassed that of the Erie Canal. Construction of the fourth and current canal, officially named the Welland Ship Canal, but commonly known simply as the Welland Canal, commenced in 1913 and was completed in 1932 (World War I suspended construction between 1916 and 1919). The canal's mouth on Lake Ontario was relocated to Port Weller, approximately three miles east of Port Dalhousie. The 27-mile deep-draft shipping canal consists of eight concrete locks and was built to accommodate multiple large lake freighters. The 8.3-mile Welland By-Pass was completed in 1973. It straightened the shipping channel between Port Colborne and Port Robinson and bypassed the city of Welland. Today, the Welland Ship Canal is part of the St. Lawrence Seaway. It carries about 3,000 ships (about 40 million tons of cargo) per year and is critically important to waterborne commerce on the Great Lakes.

As waterborne commerce on Lake Erie and the Great Lakes began to thrive, shipbuilding became a major and booming industry in many northern Ohio communities, including Ashtabula, Cleveland, Conneaut, Ellensburg (at the mouth of Arcola Creek), Fairport, Huron, Lorain, Milan, Maumee, Richmond (now Grand River), Sandusky, Toledo and Vermilion. Prior to the 1880s, early ship manufacturers built wooden schooners, scows and other wind-powered merchant ships. In 1882, the first iron-hulled bulk freighter, the 302-foot long steamer, *Onoko* was built and launched in Cleveland. At the time, it was the largest vessel on the Great Lakes and a prototype for all modern commercial freighters. In 1915, the *Onoko* wrecked in Lake Superior, 25 miles east of Duluth (no casualties).

In 1886, the first steel-hulled freighter on the Great Lakes was the *Spokane*, a 324-foot long steamer. It was built and launched in Cleveland. Steel subsequently became the shipbuilding standard. By the 20th century, steel-hulled freighters could haul four times more cargo than iron-hulled vessels. Freighters reached 600 feet in length by 1906, and eventually eclipsed 700 feet in the late 1950s, and 1,000 feet by 1973. Cleveland, Lorain and Toledo emerged as major shipbuilding centers of steel-hulled freighters on the Great Lakes.

RAILROADS

The advent of the railroad reduced travel times and made it easier to ship goods in Ohio. Rail was first supported by communities without direct access to the canal system. Since much of Ohio's canal network connected Lake Erie and the Ohio River—advancing north-south trade—Ohioans were hopeful that rail linkages would benefit east-west travel and commerce.

The first railroad completed in Ohio—and first to operate west of the Allegheny Mountains—was the Erie & Kalamazoo Rail Road. Its construction was authorized by Michigan's territorial government during a time when ownership of the Toledo Strip was still being contested by both Ohio and the Michigan Territory (see Chapter 3: History, page 56). The first 33-mile section of the Erie & Kalamazoo Rail Road was completed in 1836, connecting Toledo and Adrian, Michigan. Freight and passenger cars were originally pulled by horses, until the railroad's first steam engine began service in 1837.

The Mad River and Lake Erie Railroad (MR&LE) was the first chartered railroad in Ohio and first to be chartered west of the Allegheny Mountains (chartered in 1832). In 1835, construction of the railroad commenced in Sandusky after a groundbreaking event near the Sandusky Bay shore. Powered by the steam engine *Sandusky*, the first trip on the MR&LE was made in 1837—carrying passengers a total of 16 miles from Sandusky to Bellevue. Construction of the railroad reached Republic in 1839; Tiffin in 1830; Kenton in 1846, and was completed in its 134.5-mile entirety to Springfield in 1849.

The efficiency and availability of the canals initially slowed railroad construction in Ohio. The Panic of 1837, a national financial crisis that lasted until the mid-1840s, also contributed to the state's slow railroad development. In the late 1840s and 1850s, railroad construction was progressing. Railroad lines and junctions helped establish new communities throughout the state and allowed for greater movement of people and goods. Railroads enabled the port cities on Lake Erie (and on the Ohio River) to grow as Ohio was a natural transit point between the Midwest and Northeast. Ohio's early railroad lines were established primarily within the state boundary or extended



Ashtabula Harbor, Ashtabula, Ashtabula County

just beyond the border. In the mid-1850s, the Baltimore and Ohio Railroad (B&O) was the first railroad to cross the Appalachian Mountains, and in 1857, the Ohio and Mississippi Railroad connected Cincinnati and St. Louis. By 1860, nearly 3,000 miles of track had been laid in Ohio—more than any other state in the country—and the railroad had surpassed the canals as the primary intrastate transportation mode.

By 1900, Ohio had approximately 8,900 miles of railroad. Most of the state's trackage was controlled by either the B&O, the Erie Railroad, the Pennsylvania Railroad or the New York Central Railroad. Rail continued as a primary method of transportation through World War II.

Between the early 1900s and 1930s, electrically-powered railways, known as “interurbans,” were a widespread form of passenger transportation in the United States, especially in Ohio. Prior to the rise of the automobile, many roadways were unpaved and unimproved. The interurban provided a fast and comfortable mode of transportation within and between communities and cities. These railways also were used to haul freight and deliver mail. In 1901, the Lake Shore Electric Railway (LSE) was formed, offering service between Cleveland and Toledo, by way of Lorain, Sandusky, Norwalk and Fremont. The LSE closely paralleled the Lake Erie shore between Cleveland and Sandusky. Many lakeside picnic groves, amusement parks and resort communities were located along the route. To expand weekend ridership, many interurban companies—including the LSE—established similar retreats along or at the end of the routes. The growth of many coastal communities in Lorain and Erie counties can be attributed to the LSE. The Cleveland, Painesville & Eastern Railway was the primary interurban between Cleveland and Painesville, while the Cleveland, Painesville & Ashtabula Railway was a secondary route that connected Painesville and Ashtabula. Like the LSE, both railways paralleled the shore and contributed to the growth of many lakefront communities. See pages 80-81 for a map of interurban routes and other historic rail lines.

The growing trucking industry and the increasing dependency and utility of automobiles in the 1950s, coupled with the nation’s expanding highway network (notably the Interstate Highway system), led to the railroad’s decline from ascendancy. Moving freight and (to a lesser extent) people via railroad remains a very important and vital mode of transportation. Ohio has the fifth highest rail traffic in the country, including coverage by the two largest Class I railroads in the eastern U.S. (CSX and Norfolk Southern).

AIR TRANSPORTATION

Aviation is an important component of Ohio’s economy, history and transportation system. Nearly 97 percent of all Ohio residents live within a 30-minute drive of a system airport. Air transportation contributes to local economies, promotes tourism, helps attract and retain businesses and provides a time-sensitive method of transporting goods and people. Ohio has seven commercial service airports and 97 general aviation airports. These airports provide access to regional, national and international markets. In 2012, commercial airports in Ohio enplaned nearly ten million passengers, including 4.3 million passengers at Cleveland-Hopkins International Airport, the busiest air carrier airport in Ohio. Toledo Express airport enplaned nearly 79,000 people (in 2012). In addition to moving people, Ohio’s commercial service airports also moved 188,000 tons of cargo in 2012. Combined, Ohio’s airports annually produce more than \$13.3 billion in total economic output (ODOT, 2014).

The airports located on Lake Erie’s four largest islands—Kelleys, South Bass, Middle Bass and North Bass—provide vital connections to the mainland. The islands’ four general aviation airports (one on each island) are utilized by residents and tourists on a daily-to-seasonal basis. Privately-owned airstrips are also located on Middle Bass and Rattlesnake (not mapped) islands. The private airstrip on Middle Bass Island is available for public use.



Jackson Street Pier, Sandusky, Erie County

Learn more about the information presented in this chapter:

Ohio Department of Transportation, www.dot.state.oh.us

Ohio Environmental Protection Agency, Lake Erie Dredged Material Program
epa.ohio.gov/dir/dredge.aspx

U.S. Army Corps of Engineers
www.lre.usace.army.mil

A complete list of chapter sources is found in the Appendix.

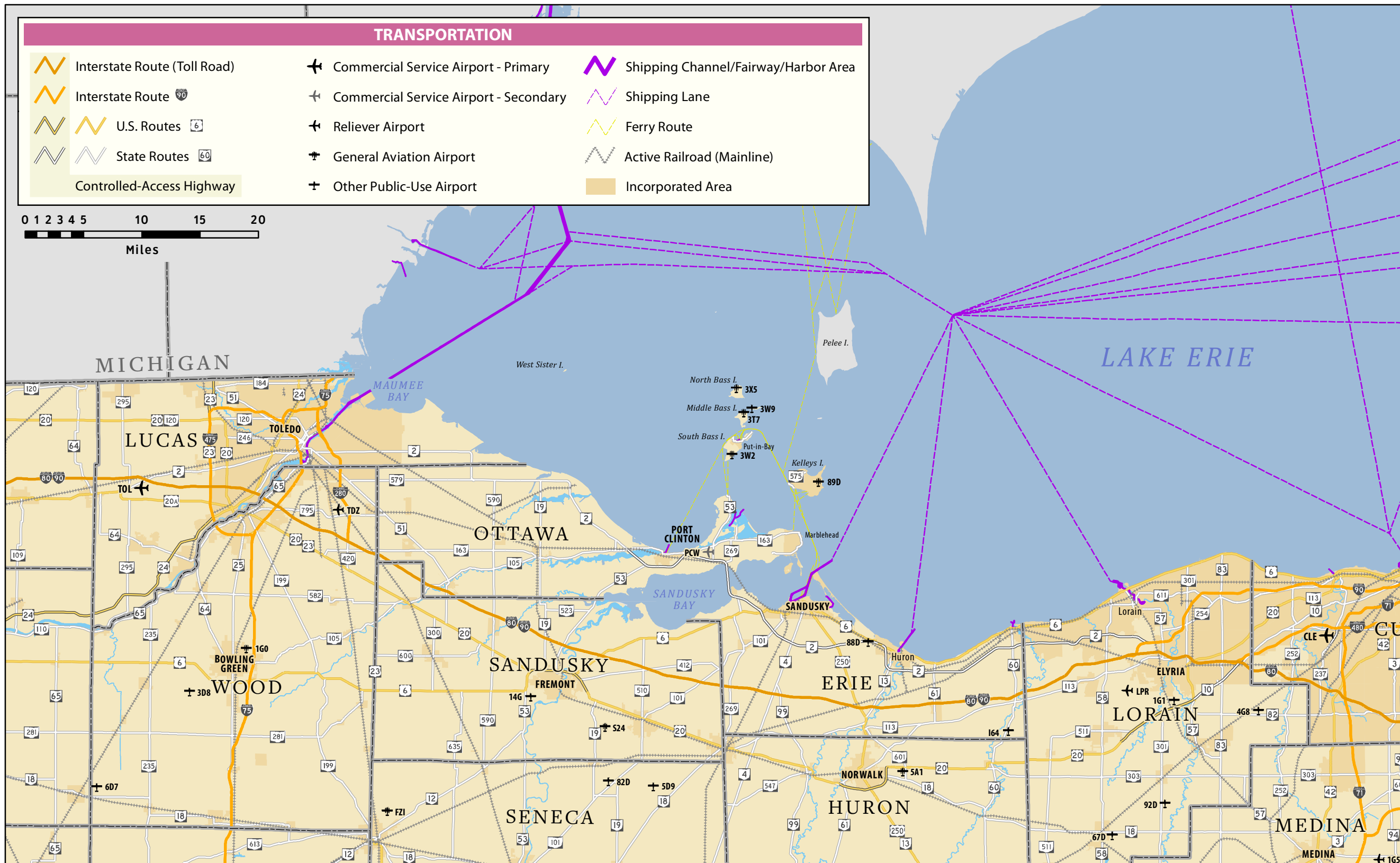
WATERBORNE COMMERCE (2014-2016, cargo volumes in short tons)

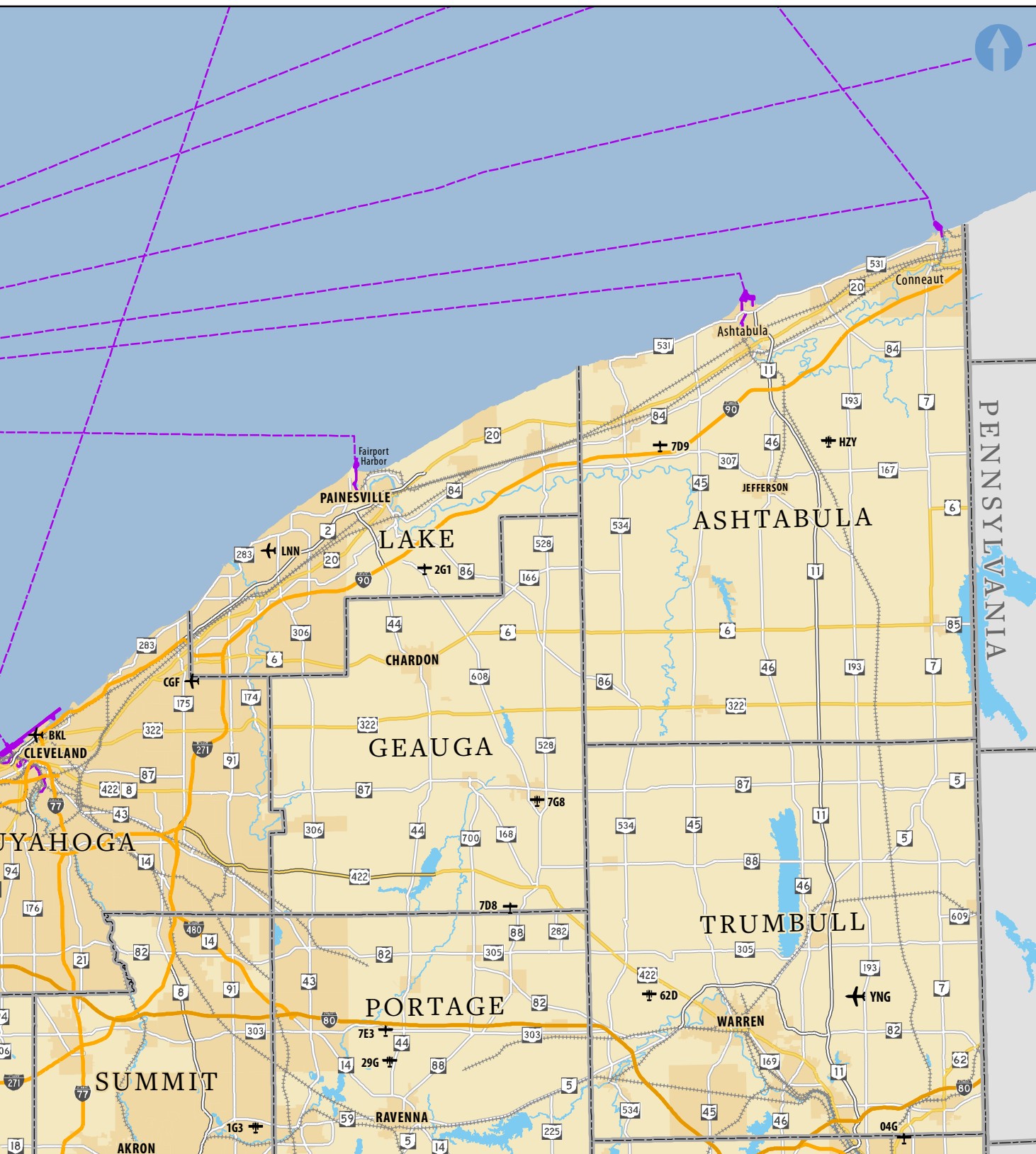
Port	Domestic Traffic				Foreign Traffic				Rank	TOTAL Traffic
	Shipments	Receipts	Intraport	TOTAL	Shipments	Receipts	Intraport	TOTAL		
Toledo	4,190,610	8,789,348	92,170	13,072,128	8,289,965	6,804,950	0	15,094,915	2	28,167,043
Port Clinton	5,476	0	0	5,476	0	0	0	0	12	5,476
Put-in-Bay	442	24,257	0	24,699	0	0	0	0	11	24,699
Marblehead	7,107,821	45,719	0	7,153,540	695,108	170,325	0	865,433	5	8,018,973
Kelleys Island	48,213	39,247	0	87,460	0	0	0	0	10	87,460
Sandusky	2,800,100	121,909	0	2,922,009	3,150,645	326,972	0	3,477,617	6	6,399,626
Huron	47,977	1,159,120	0	1,207,097	0	16,535	0	16,535	9	1,223,632
Lorain	76,537	1,717,027	0	1,793,564	72,863	844,154	0	917,017	8	2,710,581
Cleveland	2,194,937	21,646,470	10,409,760	34,251,167	578,609	4,288,978	0	4,867,587	1	39,118,754
Fairport Harbor	1,460,321	2,990,308	0	4,450,629	36,927	513,828	0	550,755	7	5,001,384
Ashtabula	3,592,683	4,988,870	0	8,581,553	1,254,572	1,523,569	0	2,778,141	4	11,359,694
Conneaut	206,049	10,816,277	0	11,022,326	2,602,417	366,852	0	2,969,269	3	13,991,595
TOTAL	21,731,166	52,338,552	10,501,930	84,571,648	16,681,106	14,856,163	0	31,537,269		116,108,917

COMMODITY TYPES (2014-2016, cargo volumes in short tons)

Port	Coal	Petroleum Products	Chemicals	Limestone	Sand and Gravel	Iron Ore	Manufactured Goods	Food & Farm Products	Other
Toledo	8,642,579	1,056,818	209,973	1,839,216	614,002	8,784,703	1,440,791	4,098,291	1,480,670
Port Clinton	0	3,084	0	2,392	0	0	0	0	0
Put-in-Bay	0	5,504	0	15,363	0	0	0	0	3,832
Marblehead	0	0	0	7,727,934	130,736	0	0	6	160,297
Kelleys Island	0	0	0	0	0	0	0	0	87,460
Sandusky	5,787,536	0	0	101,017	66,089	17,463	17,638	128,089	281,794
Huron	0	0	0	1,207,097	16,535	0	0	0	0
Lorain	116,258	0	60,717	1,809,398	275,280	37,092	0	17,550	394,286
Cleveland	47,995	410,493	49,206	7,175,889	577,265	23,204,608	3,974,190	1,598	3,677,510
Fairport Harbor	0	0	0	3,292,864	132,609	0	0	0	1,575,911
Ashtabula	4,380,360	0	0	4,486,985	24,490	1,235,698	257,690	33,636	940,835
Conneaut	1,522,656	0	0	552,570	15,020	11,719,737	18,140	0	163,472
TOTAL	20,497,384	1,475,899	319,896	28,210,725	1,852,026	44,999,301	5,708,449	4,279,170	8,766,067

GENERAL TRANSPORTATION





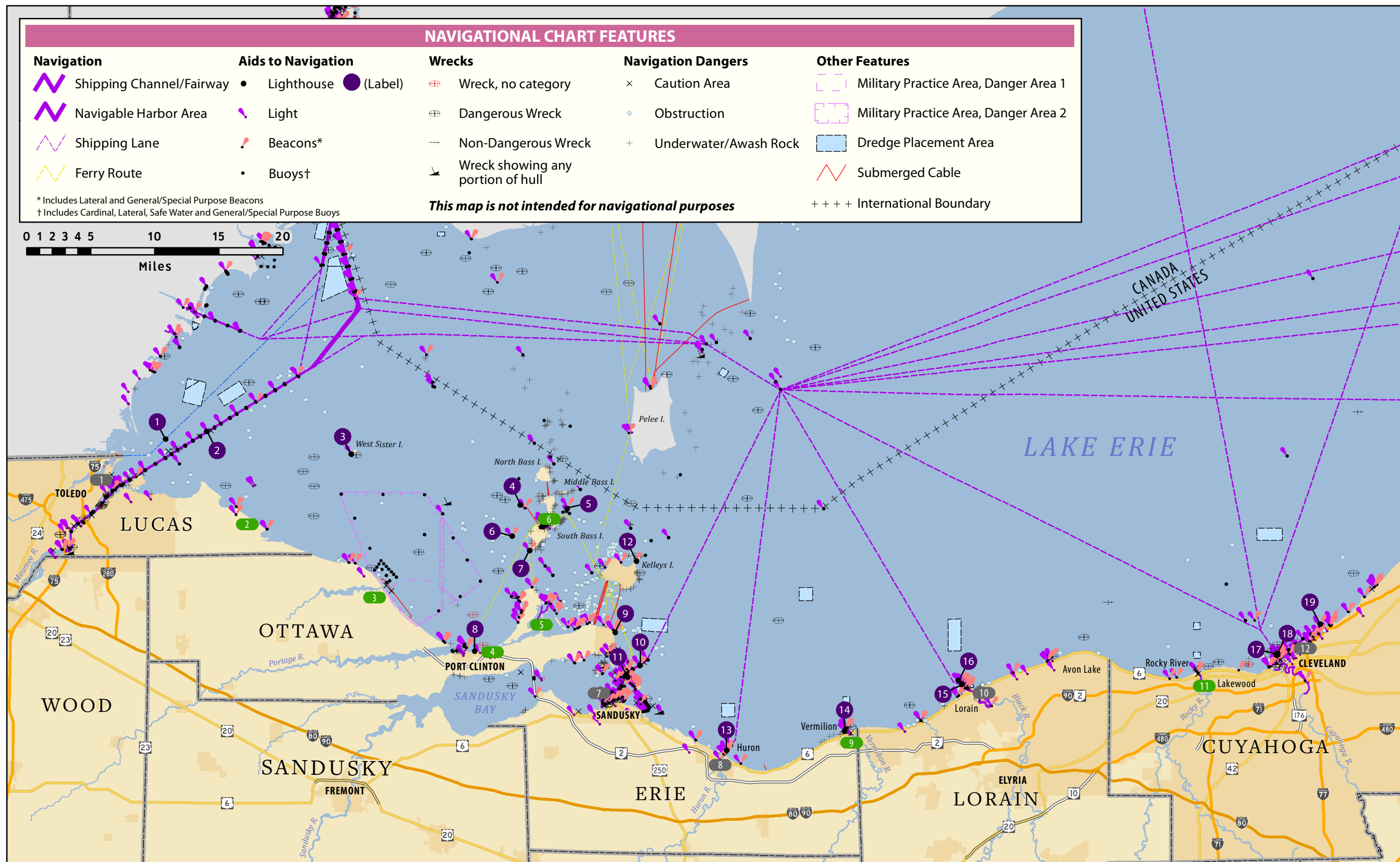
Ohio is centrally located within the nation's largest industrial region. Fifty-nine percent of the combined U.S. and Canadian populations are located within 600 miles of Ohio. Integral to the movement of goods and people is the state's extensive transportation network, which includes: over 20,000 miles of state-designated highways (interstate highways, U.S. routes and state routes); over 5,300 miles of rail; airports, and; waterborne shipping routes. Ohio ranks ninth in the country with over 262,000 lane miles (Federal Highway Administration (FHWA), 2013) and sixth with over 113.5 billion vehicle miles traveled (FHWA, 2015). In total, the Ohio Department of Transportation (ODOT) owns and maintains more than 49,000 lane miles of paved roadway and 14,000 bridges.

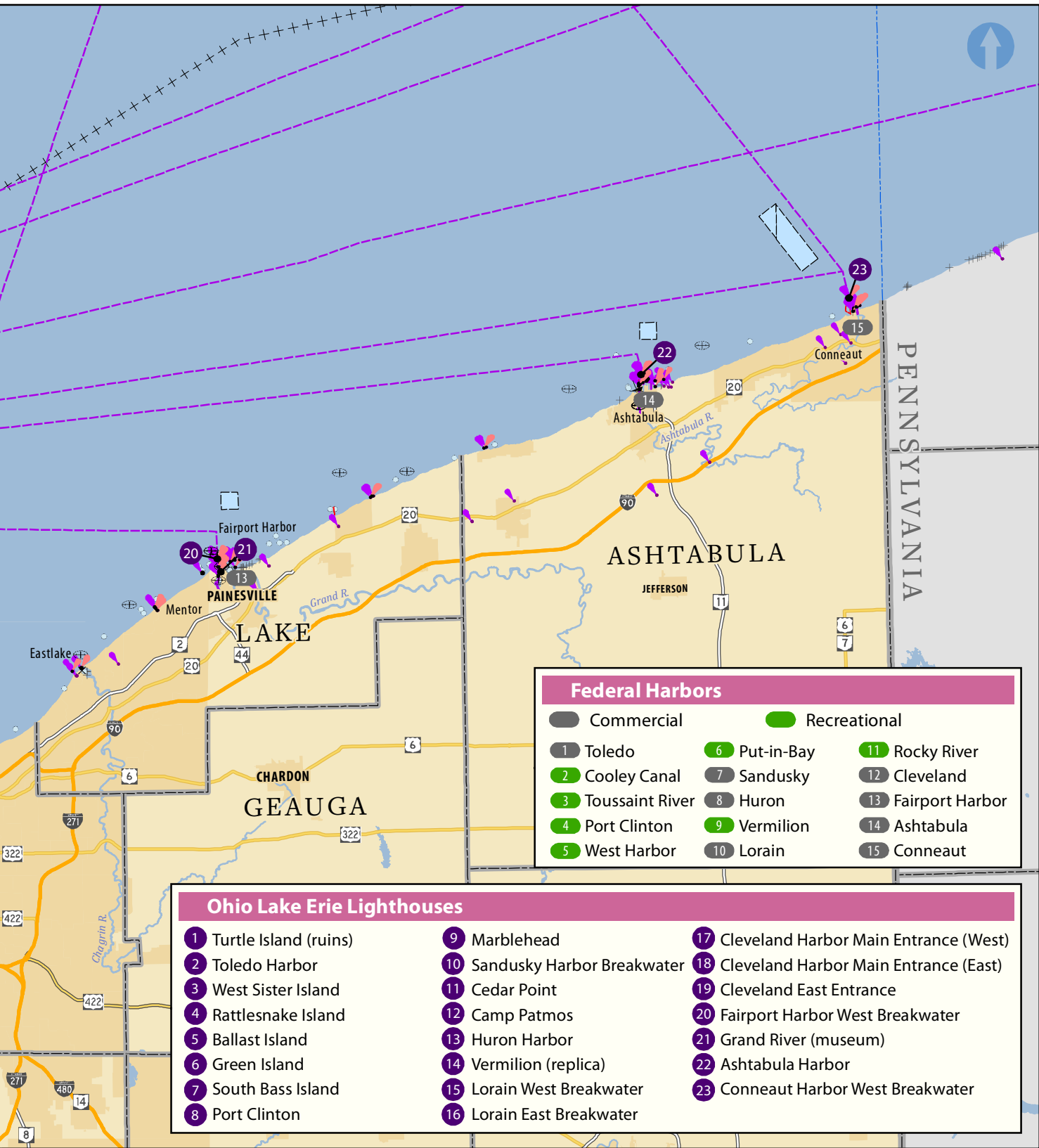
Ohio has 21 interstate highways totaling more than 1,500 miles. These include eight primary routes and 13 auxiliary routes. According to ODOT, traffic on Ohio's interstate highways exceeded 92 million vehicle miles traveled in 2016. Interstate 90 runs west-east through the northern part of Ohio and connects Toledo and Cleveland. It is a transcontinental freeway and the U.S.'s longest interstate (just over 3,000 miles long). It spans from Seattle to Boston. Between the Indiana state line and Elyria, I-90 runs concurrently with I-80 and is part of the Ohio Turnpike, a toll road. East of Elyria, I-90 branches to the northeast and roughly parallels the Lake Erie shore to Buffalo. Interstate 80 also runs west-east through Ohio's northern tier. Much of its length is part of the Ohio Turnpike. It is the nation's second-longest interstate (just over 2,900 miles), connecting San Francisco to the New York Metropolitan Area. Ohio's three primary south-to-north interstate highways include I-75, I-71 and I-77. Interstate 75, which carries the greatest amount of truck traffic in the Lake Erie Watershed, connects Cincinnati and Toledo. In its entirety, it spans nearly 1,800 miles from the Miami area to Sault Ste Marie, Michigan. The 345-mile I-71 runs diagonally from Louisville, through Cincinnati and Columbus, to Cleveland. The 613-mile I-77 enters Ohio at Marietta and travels north through Canton and Akron before ending in Cleveland.

There are approximately 4,000 miles of U.S. Routes in Ohio, including U.S. Route 20 (US 20) and US 6, which run about 300 miles and over 250 miles, respectively, across northern Ohio. Nationally, US 20 is 3,237 miles long and US 6 is 3,207 miles long. They are the longest two U.S. Routes in the country. In Ohio, US 6 closely parallels the Lake Erie shore between Sandusky and Cleveland, while US 20 roughly parallels the shore in Cuyahoga, Lake and Ashtabula counties.

Ohio has over 15,000 miles of state routes. The 227-mile State Route 2 (SR 2) is a major west-east highway that runs from the Indiana state line to Painesville, via Toledo, Sandusky and Cleveland. Much of it roughly parallels the shore. Portions of SR 2 have been upgraded to controlled-access freeways. Five of Ohio's ten longest state routes have northern terminuses at Lake Erie, including: SR 7 (the state's longest at over 350 miles); SR 3; SR 4; SR 60, and; SR 13. These highways end in Conneaut, Cleveland, Sandusky, Vermilion and Huron, respectively.

MARITIME TRANSPORTATION AND NAVIGATIONAL AIDS





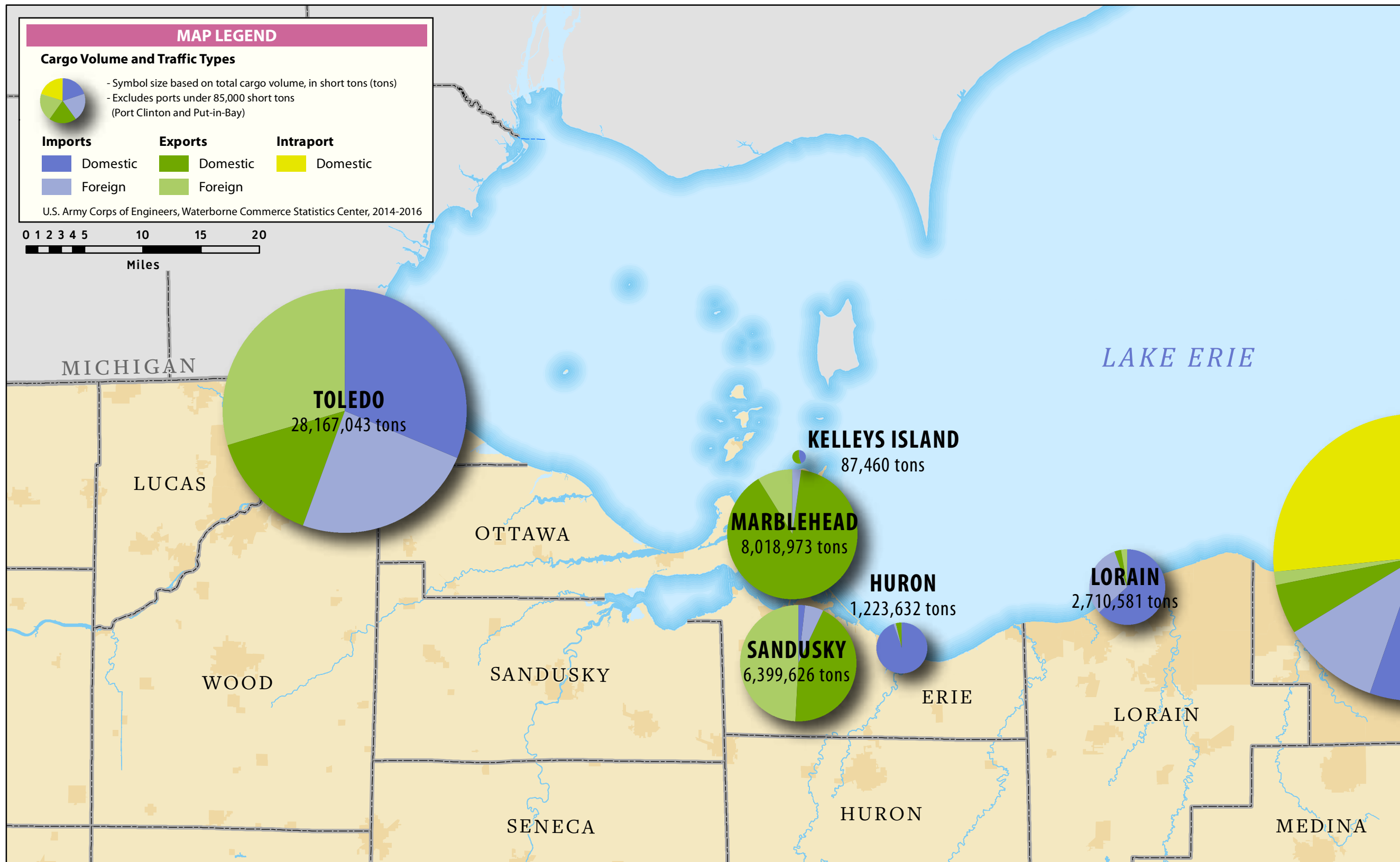
Lake Erie is part of the Great Lakes Navigation System (GLNS), which connects all five Great Lakes and stretches from Duluth, Minnesota to the Gulf of St. Lawrence (Atlantic Ocean). The GLNS is critically important to waterborne transportation and shipping in the U.S. and Canada. A continuous 27-foot deep draft waterway is maintained along its entire 2,400-mile distance. The GLNS includes a non-linear network of 140 federal Great Lakes harbors (60 deep draft/commercial and 80 shallow draft/recreational). There are 15 federal Lake Erie harbors in Ohio, including eight commercial harbors and seven shallow draft/recreational harbors. On the map, gray and green identification labels denote federal commercial and federal recreational harbors, respectively. Some shallow draft harbors support commercial transportation services (such as ferries and/or water taxis) and/or commercial fishing operations. Federal commercial ports on the Great Lakes send and receive shipments to and from other ports throughout the world. Additional GLNS facilities include two operational locks, over 100 miles of federal breakwaters and jetties and over 600 miles of maintained navigation channels. The U.S. Army Corps of Engineers (USACE) helps maintain the GLNS, through channel dredging, harbor dredging and infrastructure construction and maintenance.

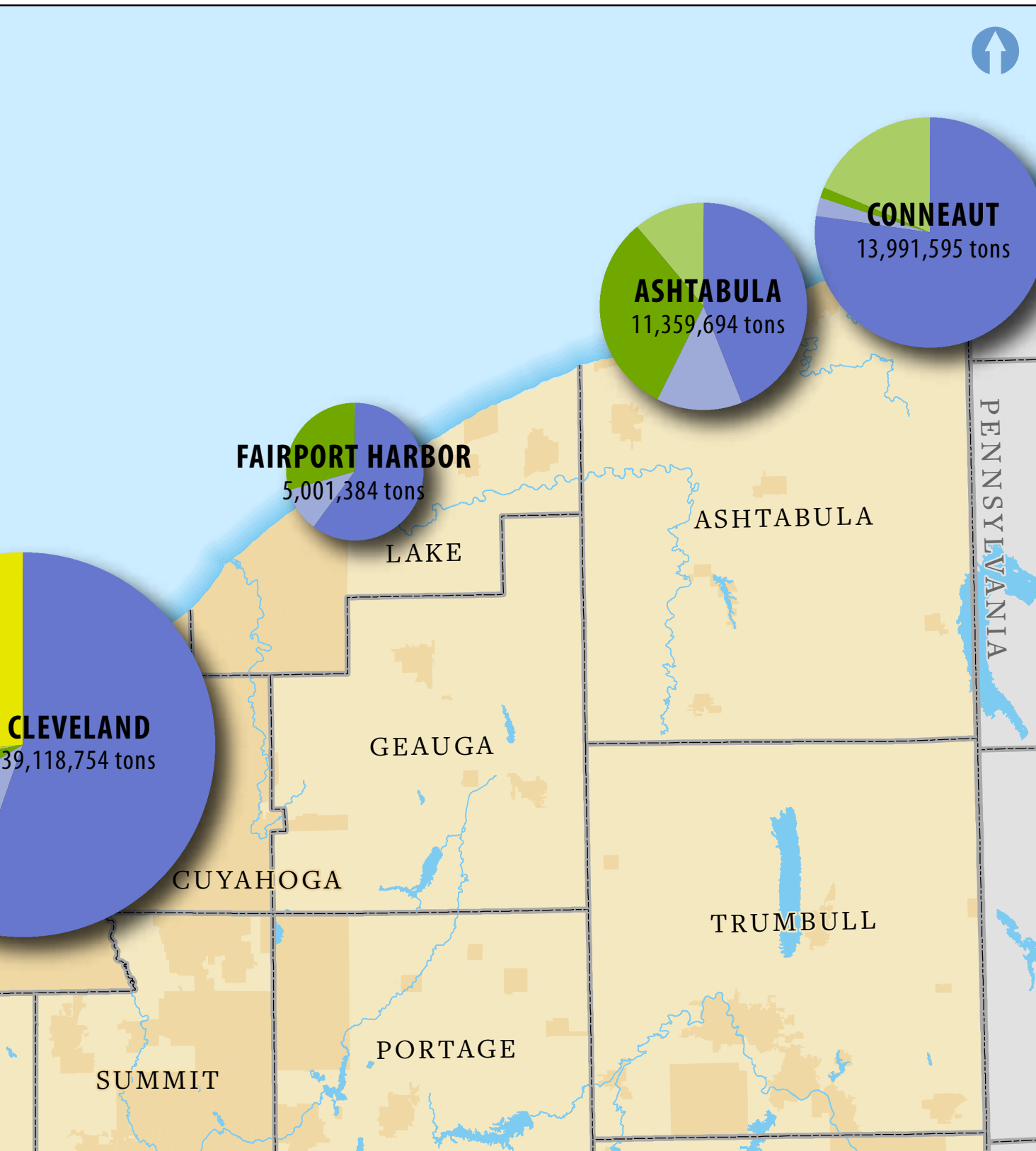
This map shows common nautical chart features, such as navigation routes, aids to navigation and various hazards, among other features. Typical nautical charts also include water depth information, lakebed/seafloor bottom features and characteristics, anchorage locations, hazard depths, navigation depths and other features important for safe and economic waterborne navigation. Federal regulations require most commercial vessels to carry nautical charts while transiting U.S. waters. ***This map is not intended for navigational purposes.***

The National Oceanic and Atmospheric Administration (NOAA) provides nautical charts for most of the country, including 145 charts for the Great Lakes. Map scales vary based on geographic area. The U.S. Coast Survey—a precursor agency to NOAA—began charting the nation’s waters in the mid-1830s. Currently, the NOAA Office of Coast Survey creates and maintains nautical charts for U.S. coastal waters, the Great Lakes and waters surrounding U.S. territories. The data featured in this map are from NOAA’s Electronic Navigational Charts, available for download from the NOAA Office of Coast Survey webpage. The U.S. Coast Guard (USCG) maintains a comprehensive inventory of navigational aids.

This map highlights 23 lighthouses in Ohio. All active lights are automated and operated by the Coast Guard, except for the privately-maintained Camp Patmos, Port Clinton, Rattlesnake Island (not recognized by the USCG) and Vermilion lights. Three of the mapped lighthouses are inactive: Turtle Island Light; Cedar Point Light, and; the Grand River Light (Fairport Harbor Marine Museum). The Port Clinton Light was restored and relocated to Waterworks Park in 2016. It, along with the Vermilion Light, was reactivated in 2016. The Marblehead Light, constructed in 1821, is the oldest continuously-operating lighthouse on the Great Lakes (1822).

WATERBORNE COMMERCE, FREIGHT VOLUME





Lake Erie is central to Ohio's economic viability in today's global market. Waterborne commerce moves millions of tons of cargo annually through Ohio's port cities. Commercial navigation on the Great Lakes is an economically efficient method to transport raw materials, agricultural products, manufactured goods and other commodities. Ohio's major commercial port facilities are located at Toledo, Marblehead, Sandusky, Huron, Lorain, Cleveland, Fairport Harbor, Ashtabula and Conneaut.

According to the U.S. Army Corps of Engineers Navigation Data Center, between 2014 and 2016, over 116 million short tons* (tons) of cargo moved through Ohio's Lake Erie ports (see the Waterborne Commerce table on page 89). Cargo volume includes domestic shipments (exports), domestic receipts (imports), foreign shipments, foreign receipts and domestic intraport movement. Commodity tonnage was greatest at Cleveland with over 39 million tons of cargo, followed by Toledo with over 28 million tons of cargo.

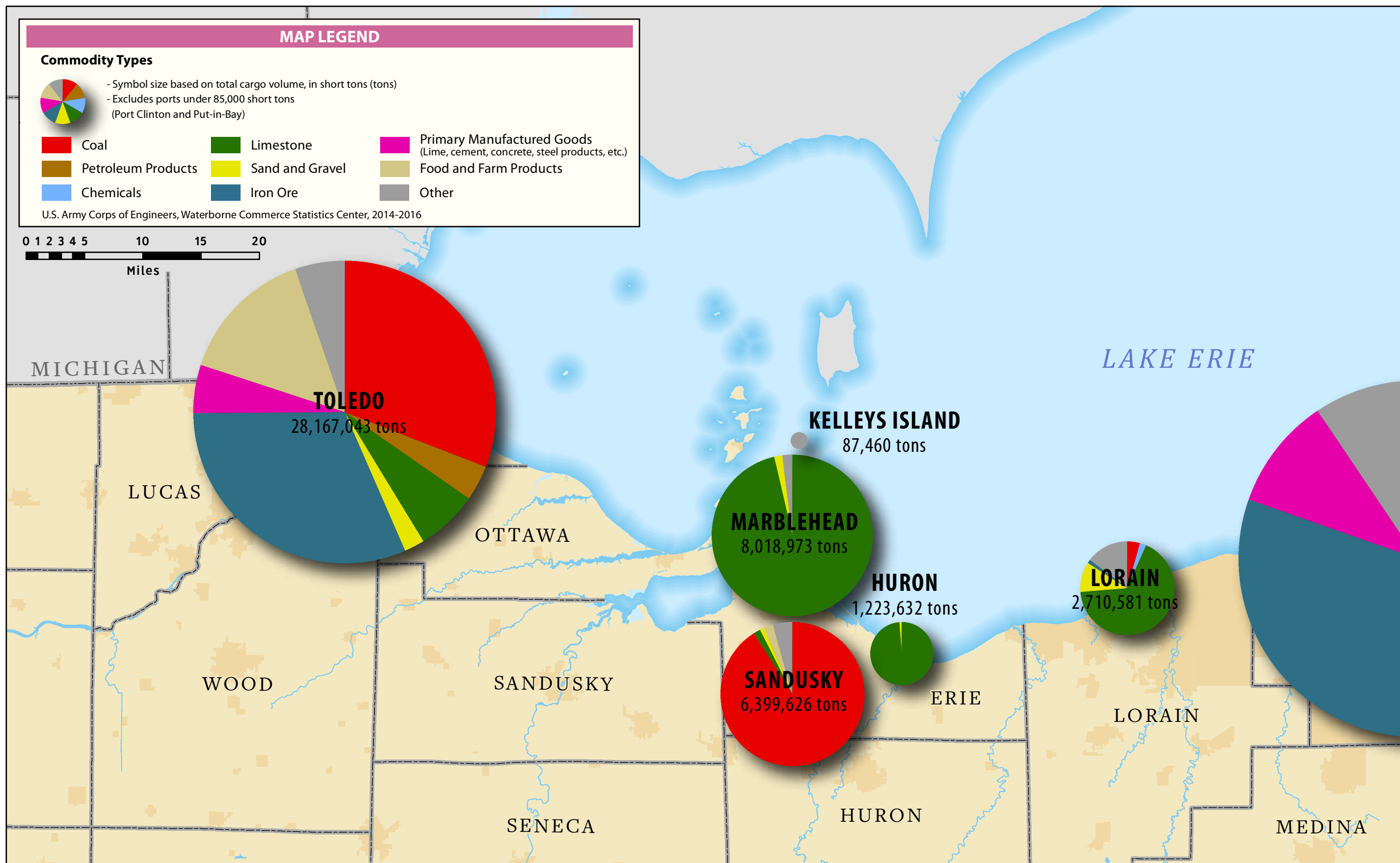
Domestic commerce includes "coastwise," "lakewise" and "internal" traffic. **Coastwise** traffic involves commodity carriage over the oceans or Gulf of Mexico. This includes any movement of goods between Great Lakes ports and ocean ports. Waterborne shipping between U.S. Great Lakes ports is considered **lakewise** traffic. The Great Lakes are regarded as a distinct waterway system and not part of an inland system. **Internal** traffic categorizes commodity movement on inland waterways, such as the Ohio and Mississippi rivers. The carriage of goods on both the Great Lakes and inland waterways is also considered internal traffic. Foreign commerce includes both overseas and Canadian traffic.

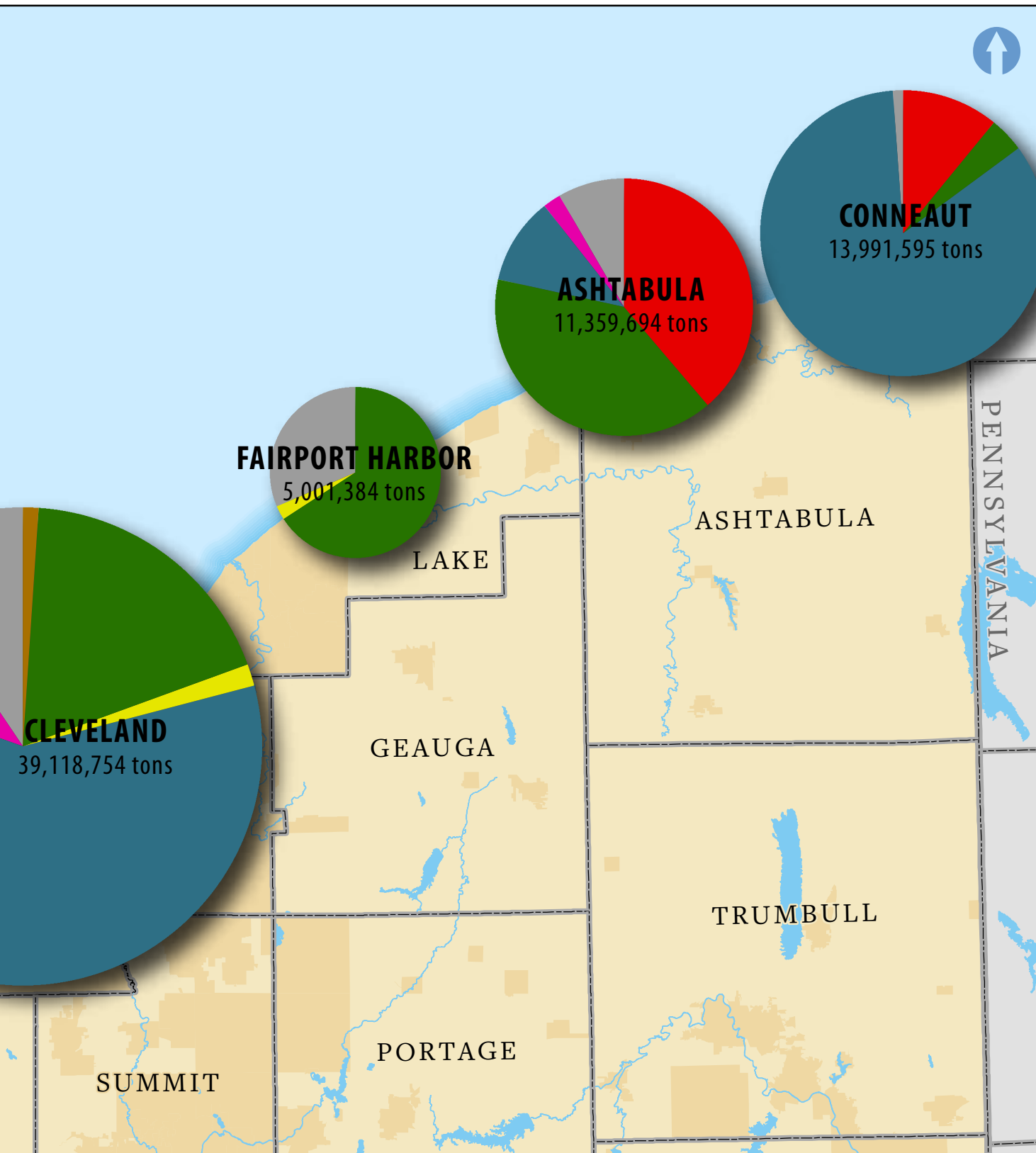
More than 84.5 million tons (73 percent of Ohio's total Lake Erie waterborne cargo) was domestic traffic. Cleveland handled the most domestic cargo (over 34 million tons), followed by Toledo and Conneaut (about 13 million and 11 million tons, respectively). At Cleveland, over 21.6 million tons—or 63 percent—were received while only 2.2 million tons were shipped. An additional ten million tons were moved within the port, which is referred to as "intraport." Conneaut received the second-most domestic commodity tonnage with nearly 11 million tons of cargo. Marblehead exported the most tonnage of domestic cargo (over seven million tons), followed by Toledo and Ashtabula (approximately four million and 3.6 million tons, respectively).

More than 31.5 million tons, or 27 percent of Ohio's total Lake Erie waterborne port cargo, was foreign traffic. Toledo handled over 15 million tons—nearly half of all foreign cargo along Ohio's Lake Erie shore—including over eight million tons of exported commodities and almost seven million tons of incoming goods. Cleveland moved the second-most tonnage of foreign cargo with nearly five million tons, followed by Sandusky with nearly 3.5 million tons. In 2014, the Cleveland-Europe Express, which began cargo runs between Cleveland and Antwerp, Belgium, became the first regularly-scheduled container service on the Great Lakes.

* One short ton equals 2,000 pounds

WATERBORNE COMMODITIES





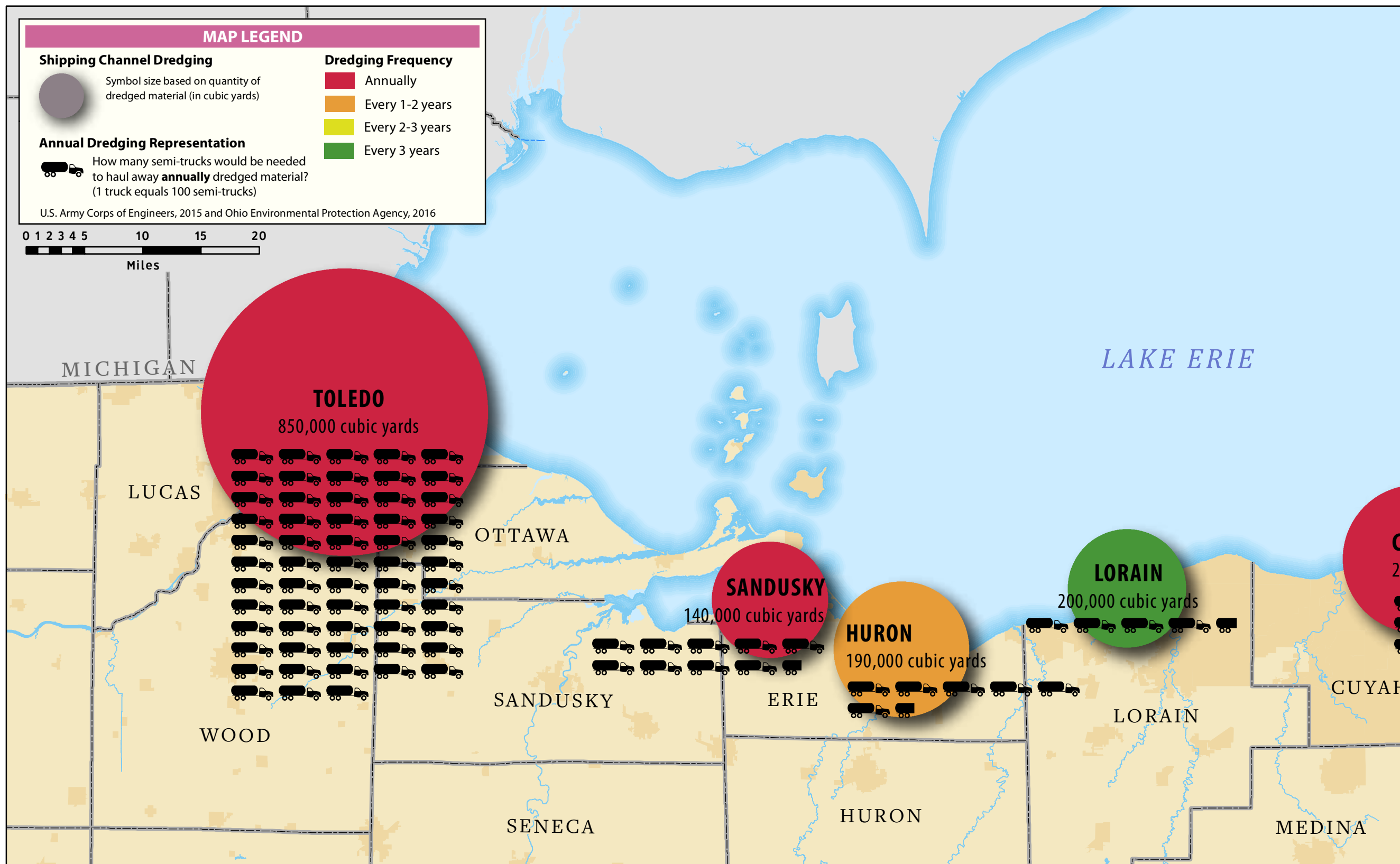
The U.S. Army Corps of Engineers Navigation Data Center (NDC) provides detailed data on the movement of waterborne vessels and commodities at ports and harbors in the United States. According to the NDC, between 2014 and 2016, an average of nearly 39 million short tons* (tons) of cargo moved through Ohio's Lake Erie ports (see the Commodity Types table on Page 89).

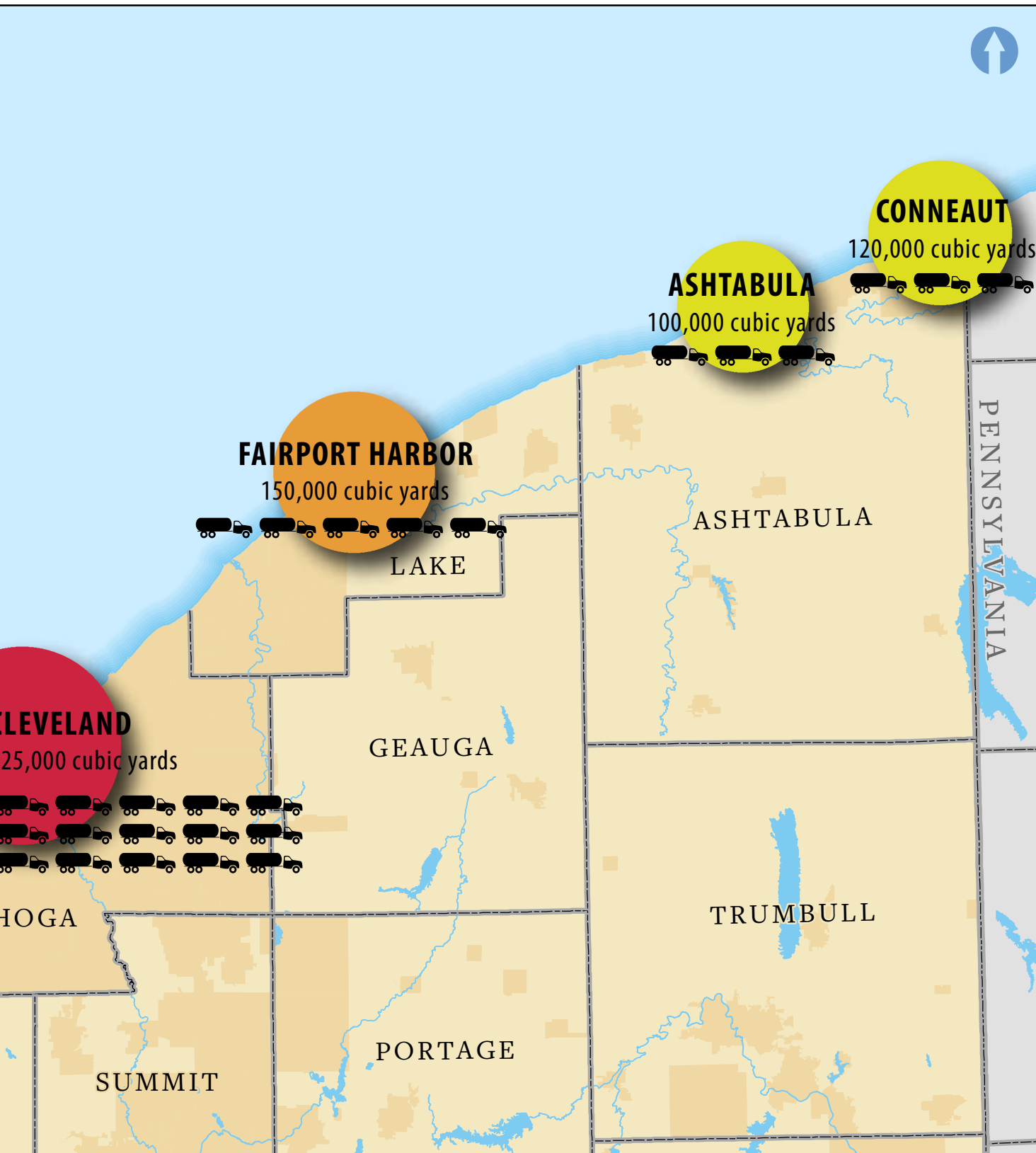
The greatest commodity volumes that move through Ohio's Lake Erie ports on an annual basis are mined products. Between 2014 and 2016, iron ore, limestone, coal and sand and gravel accounted for more than 95.5 million tons, or 82 percent, of Ohio's total Lake Erie waterborne cargo. Iron ore makes up nearly 39 percent (nearly 45 million tons) of the total Lake Erie cargo. Cleveland handled the most iron ore (over 23.2 million tons), followed by Conneaut, and Toledo (11.7 million and 8.7 million tons, respectively). Cleveland's three-year iron ore volume accounted for nearly 60 percent of its total tonnage. The second-most moved mined commodity is limestone. Ohio's Lake Erie ports moved over 28 million tons of limestone, or nearly one quarter of all waterborne cargo. All ports moved quantities of limestone, except Kelleys Island. Marblehead handled the most (7.7 million tons), followed closely by Cleveland (over 7.1 million tons). Marblehead's three-year limestone volume accounted for over 96 percent of its total cargo tonnage. Ashtabula and Fairport Harbor also moved substantial amounts of limestone (nearly 4.5 million tons and over 3.2 million tons, respectively). Coal is the third-most moved mined commodity, with over 20 million tons handled. Toledo moved over 8.6 million tons of coal, or 42 percent of the state's total Lake Erie coal cargo, followed by Sandusky (over 5.7 million tons) and Ashtabula (over 4.3 million tons). Other mined products—not illustrated on the map—include salt and gypsum. These are included under the "Other" category.

Additional notable commodity cargoes include primary manufactured goods, food and farm products, petroleum products and chemicals. Primary manufactured goods consist of cement, concrete, lime, metals and steel products, among other goods. Between 2014 and 2016, over 5.7 million tons of manufactured goods were moved at Cleveland, Toledo, Ashtabula, Conneaut and Sandusky. Nearly four million tons, or approximately 70 percent, was handled at Cleveland. Food and farm products include agricultural goods, such as grains (barley, oats, rye, wheat, etc.) and produce (corn, soybeans, etc.), beverages, including alcohol, and other food products. Over four million tons of food and farm products were moved at Toledo, Sandusky, Ashtabula, Lorain and Cleveland. Nearly 96 percent of all food and farm cargo was moved through Toledo. Petroleum products include gasoline, fuel oil and petroleum coke (or coke), among other petroleum-derived commodities, such as asphalt, tar and pitch. Ninety-nine percent of all petroleum goods were moved through Toledo and Cleveland (over 1.4 million tons, combined). Chemical goods primarily consist of fertilizers, but also include acids, metallic compounds and plastics, among other products. Over 65 percent of all chemical commodities were moved through Toledo (nearly 210,000 tons).

* One short ton equals 2,000 pounds

FEDERAL COMMERCIAL HARBOR DREDGING





Dredging is the removal of rock, sand, gravel, silt, mud and clay from the bottom of navigable waterways, shipping channels, recreational channels, marinas and harbors. It is required to create or maintain sufficient depths to ensure safe navigation for waterborne commerce and recreation. Sediment removal is done by mechanical scraping/scooping or by hydraulic pumping. Historically, materials dredged from federally-authorized harbors and channels have either been placed in confined disposal facilities (CDFs) or placed in the open waters of Lake Erie. Dredged material from recreational channels and marinas is commonly placed along the shore if it is mostly sand, in federally-designated off-shore areas if it is finer material, or on the upland. Enacted in 2015, Senate Bill 1 prohibits most open-lake placement of dredge material from major ports and harbors after July 1, 2020. By reducing the adverse impacts caused by the placement of potentially contaminated materials into open water areas, this measure aims to improve Lake Erie's water quality.

CDFs are dredge impoundment sites used to place moderately-contaminated materials. In-water CDF sites are located at Toledo, Huron, Lorain and Cleveland. Open mudflats and sand flats typically take shape at these facilities, thus enabling vegetation to grow and providing habitat for a variety of birds, butterflies, reptiles and common woodland mammals. Uncontaminated material can be used in many ways, including: beach and nearshore nourishment; habitat creation and restoration; landscaping; road construction; land reclamation; landfill cover, and; manufacturing marketable products, such as concrete, brick and topsoil.

The U.S. Army Corps of Engineers maintains a continuous 27-foot deep draft waterway along the Great Lakes Navigation System (2,400 miles). Maintenance includes dredging operations at 140 federal harbors. There are 15 federal harbors in Ohio, including eight commercial harbors (see map on page 92). Each harbor is located at a major tributary mouth and therefore receives a continuous accumulation of sediment from the upper reaches of the watershed. Commercial harbor areas must be dredged regularly to maintain authorized and navigable channel depths and keep waterborne commerce moving. Every year, nearly 1.5 million cubic yards of dredged material is removed from Ohio's federal commercial harbors.

In this map, the quantity of material required to be dredged (in cubic yards) from each commercial harbor is represented by graduated circles (labels included). The greater the amount of required material to be dredged, the larger the circle. Harbor dredging frequency is shown using color-coded circles. Cleveland, Sandusky and Toledo harbors require annual dredging (red). Fairport Harbor and Huron harbors require dredging every one to two years (orange). Ashtabula and Conneaut harbors require dredging every two to three years (yellow). Lorain Harbor requires dredging every three years (green). Frequency of dredging and the amount of sediment dredged at each harbor can fluctuate based on many factors.

The truck graphic provides a visualization to help show how many semi-trucks it would require to hypothetically haul away dredged harbor material. One truck equals 100 semi-trucks.