

WEST VIRGINIA

The State of West Virginia has a population of 1.85 million residents, ranking 37th in the U.S. in terms of population. Charleston, WV is the state capital and largest population with 51.4 thousand residents. Huntington, WV is the next largest population with 49.1 thousand residents.

The State of West Virginia is home to five commercially navigable river systems. These include all or portions of the Ohio, Monongahela, Little Kanawha, Kanawha, and Big Sandy Rivers. The Ohio River defines West Virginia's northern border with the State of Ohio. The Big Sandy River flows along the western border of the state, of which the first 9 miles support commercial navigation. The entire 91-mile navigable length of the Kanawha River, four navigable miles of the Little Kanawha River and the upper 37 miles of the Monongahela River are all contained in the State of West Virginia.

The rough terrain of much of West Virginia funneled settlement along major rivers, which served as transportation arteries. Populations first concentrated along major rivers, like the Ohio, Monongahela, and Kanawha Rivers, while timber, oil, and coal resources spurred development in the interior of the state. Here, too, waterways were the primary transportation routes. The state's history is tied to waterway development. Early traders used the Potomac River and dreamed of connecting the Potomac Basin to the Ohio River by canal. George Washington's Potowmack Company, founded in 1785, built and operated the first canals that skirted five major falls on the Potomac. It was succeeded by the Chesapeake and Ohio (C&O) Canal which followed the path of the Potomac to reach Harpers Ferry, West Virginia (then part of Virginia), before eventually reaching Cumberland, Maryland.

Canalization of select West Virginian rivers by means of lock and dam construction followed. Lock and dam systems on smaller rivers, such as the Coal (8-lock system), Big Sandy (a 5-lock system), and Little Kanawha Rivers (a 5-lock system), were constructed in the mid to late 19th Century, only to be abandoned in the early 20th Century as rail transportation became more widespread in the state. Larger rivers with higher traffic demands, usually based on coal, timber, salt, and chemicals, went through successive developments, starting first as locks and dams of low crest, fixed-weir construction, to wicket, to high-lift gated structures. For example, the Kanawha River's original navigation system consisted of ten French Chanoine shutter-wicket dams completed in 1898. Coal, salt, timber, and

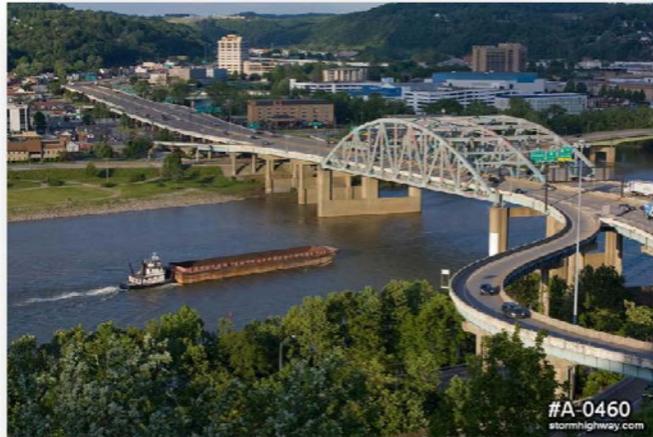


Figure 1. Tow and Barge traversing the Kanawha River near Charleston, WV

chemicals moved on the Kanawha, but starting in the 1920s, West Virginian coal became the dominant commodity moving on the waterway. The wicket dam and lock system was replaced by the Corps in the 1930s with four high lift dams (three on the Kanawha River and one on the Ohio River that provided slack water on the lower Kanawha) using the German roller-gate system. A similar pattern of waterway development occurred on the Monongahela River. In the early 1800s a system of 16 dams and locks was authorized by the Pennsylvania state legislature. In the early 20th century, navigation was extended to Fairmont, West Virginia to serve coal mines in that area. On the Ohio River, canalization was completed in 1929 with the construction of 51 wicket dams and single lock chambers, which have been slowly replaced with higher lift, gated structures – a modernization plan begun in the 1950s. Only Locks and Dams 52 and 53 remain to be replaced with high lift dams.

West Virginia is the second-leading coal-producing state, and barge transportation is a major factor in moving coal to markets efficiently and economically. Thirty percent of the coal produced in West Virginia is shipped by barge or some combination of barge and truck and/or rail. The majority of the barge shipments are to its neighboring states of Ohio, Pennsylvania, Kentucky and Indiana. West Virginia also ranked highest among origins of coal received in the states of Ohio, Pennsylvania and Kentucky.

In 2013, over 62 million tons of commodities (mostly coal and petroleum) moved by barge to, from, and within West Virginia (Table 1). Docks in West Virginia shipped approximately 35.8 million tons or approximately 57% of total tonnage. The trade imbalance in West Virginia can be mostly attributed to the export of coal out of the State of West Virginia.

Table 1

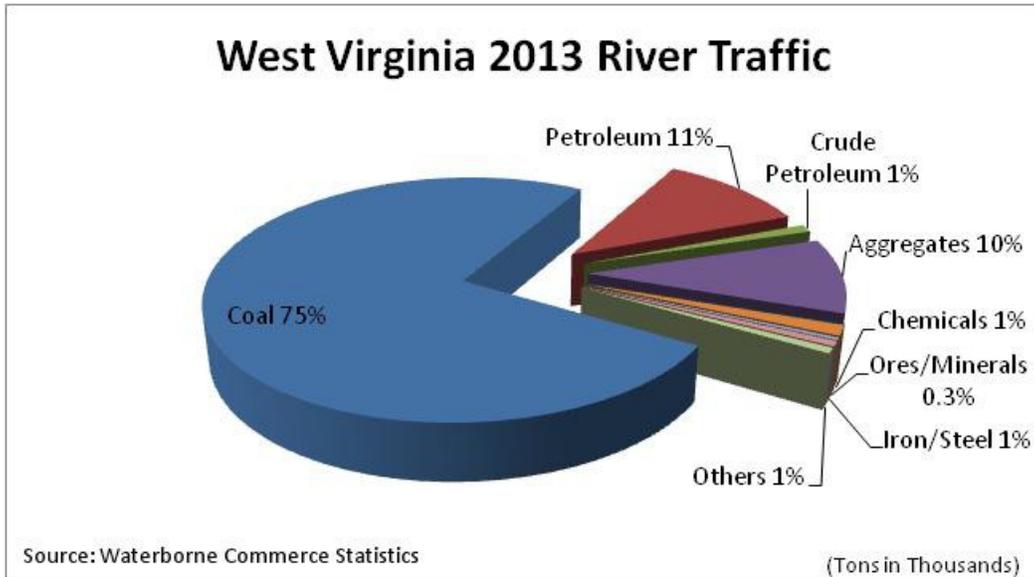
West Virginia 2013				
Commodities Moved To, From and Within the State				
(tons in thousands)				
	Shipped	Received	Within	Total
TOTAL	35,872.6	14,591.9	12,180.4	62,644.9
<i>Source: U.S. Army Corps of Engineers Waterborne Commerce Statistics</i>				

RIVER TRAFFIC

The five commercial navigable rivers in West Virginia provide access opportunities to the Mississippi River, Port of New Orleans and Gulf of Mexico. The Ohio River tributaries of the Kanawha River, Big Sandy River, and Monongahela River provide access deep into the State of West Virginia.

In 2013, the 62 million tons shipped to, from and within West Virginia were worth \$10.7 billion. A sizeable portion of this tonnage, 46.8 million tons (75%), consisted of coal, followed by petroleum with 11% and aggregates at 10%. Of the 35.8 million tons shipped out of the state, 29.6 million tons (82.6%) was coal (Table 2).

Figure 2



The majority of petroleum and aggregate traffic consisted of trade with West Virginia’s western neighbor, Kentucky. Of the 4.5 million tons of petroleum products shipped, approximately 4 million tons had a destination in Kentucky. Likewise, of the 5.3 million tons of aggregates received, 5.2 million tons originated from Kentucky and Indiana. The state received more than 14.5 million tons, with coal again being the largest commodity. Over 12.1 million tons moved within the state, of this total, over 10 million tons was coal.

There are two coal-fired power plants, operated by Appalachian Power, that sit on the Kanawha River around Charleston, WV. Both actively use the waterway as their main supply of coal. The John Amos coal-fired facility, received over three million tons of coal in 2011 by water, over half of their total consumption; the Kanawha River plant received approximately 600 thousand tons. Additionally, Appalachian Power operates three hydro-power facilities at London, Winfield, and Marmet Locks and Dams. Two coal-fired power plants sit on the Upper Monongahela River in West Virginia. The Fort Martin Power Station, operated by FirstEnergy, received nearly three million tons of coal supplied by the waterway in 2011. An additional five coal-fired power plants of various sizes sit on the West Virginia side of the Ohio River. The Kanawha, Ohio, and Monongahela rivers in West Virginia are also home to several cogeneration facilities that receive limited quantities of coal for power production in industrial processes. Docks at these facilities allow easy, effective, and efficient access to intrastate traffic of coal. The State of West Virginia exported approximately 463 trillion Btu of electricity as of 2011, most of this from coal-fired electric utility power plants.

Even though petroleum products (including crude petroleum) shipped or received on West Virginia Waterways ranked 2nd in terms of West Virginia tonnage, it ranked 1st in value terms, shipping or receiving 7.5 million tons of product worth \$6.8 billion. Most of this activity is linked to a 240,000 barrel per day Marathon Petroleum Corporation in Catlettsburg, KY, which borders West Virginia. The refinery

sends light petroleum products by pipeline to a nearby West Virginia docks for transloading onto tanker barges. The Ergon Inc refinery near Newell, WV also contributes with a capacity of 20,000 barrels per calendar day. Ergon, West Virginia Inc. is uniquely capable of producing highly refined paraffinic specialty products and fuels from local Appalachian grade crude.

Table 2

West Virginia 2013 River Traffic					
Commodities Moved To, From and Within the State					
(tons in thousands; values in millions of dollars)					
Commodity	Shipped	Received	Within	Total	Value
Coal	29,660.1	6,597.0	10,619.6	46,876.7	\$2,954
Petroleum	4,579.2	855.9	1,477.6	6,912.7	\$6,421
Crude Petroleum	**	**	**	650.5	\$391
Aggregates	817.0	5,390.6	65.4	6,273.0	\$52
Grains	0.0	0.0	0.0	0.0	\$0
Chemicals	**	774.6	**	852.7	\$642
Ores/Minerals	18.2	189.7	0.0	207.9	\$70
Iron/Steel	87.3	331.0	0.0	418.3	\$169
Others	0.0	453.2	0.0	453.2	\$96
TOTAL	35,872.6	14,591.9	12,180.4	62,644.9	\$10,794
<p><i>**Insufficient barge operators to release this tonnage.</i></p> <p><i>Commodity values are not calculated for foreign movements.</i></p> <p><i>Source: U.S. Army Corps of Engineers Waterborne Commerce Statistics, 2012 NDSU Commodity Valuation Analysis</i></p>					

STATE & OTHER TRADING PARTNERS

West Virginia docks shipped commodities by barge to 14 other states, and received commodities from 15 other states. As shown in Table 3, the leading state shipped to was Pennsylvania, receiving more than 12 million tons, mostly coal (88%). Other notable states shipped to are Ohio, Louisiana and Indiana with high percentages consisting of coal (93%, 87%, and 95%, respectively).

The leading state shipping by barge to West Virginia was Kentucky, which transported 5.1 million tons, mostly aggregates (51%). Shipments to Louisiana consisted of one million tons of West Virginia coal, most of which is transloaded into deep draft vessels serving the international market or Gulf Coast electric utilities.

Table 3

West Virginia 2013 Commodities Shipped to and from Other States					
Shipments To	Tons (in thousands)	Top Commodity (% of Total)	Shipments From	Tons (in thousands)	Top Commodity (% of Total)
Pennsylvania	12,578.9	Coal (88%)	Kentucky	5,158.4	Aggregates (51%)
Ohio	12,471.9	Coal (93%)	Ohio	3,070.2	Coal (74%)
Louisiana	4,380.8	Coal (87%)	Pennsylvania	2,335.9	Coal (85%)
Kentucky	4,032.7	Petroleum (70%)	Indiana	1,737.3	Aggregates (85%)
Indiana	1,052.9	Coal (95%)	Louisiana	1,052.2	Chemicals (36%)

Source: U.S. Army Corps of Engineers Waterborne Commerce Statistics

There were 136 manufacturing facilities, terminals, and docks in West Virginia that shipped and received tonnage in 2013. The Port of Huntington, which includes 100 miles of the Ohio River (miles 256.8 to 356.8) in Cabell, Kanawha and Wayne Counties, and the navigable parts of the Kanawha and Big Sandy Rivers, shipped and received over 46.8 million tons of commodities in 2013.

MAJOR PORTS

The major ports shown below are not necessarily point specific port locations, but are generally an agglomeration of docks within a single municipality or collection of municipalities recognized by a state or states for the purpose of being designated as a port.

Huntington – Tristate – The Port of Huntington - Tristate, which includes acreage in Ohio, West Virginia and Kentucky, shipped and received 46.8 million tons in 2013. Of which over 28 million tons were shipped/received to/from West Virginia, as shown in Table 4. The port encompasses terminals located between miles 256.8 through 356.8 on the Ohio River and also the Kanawha and Big Sandy Rivers. The entire port contains 72 docks, 10 fleeting areas, and two locks and dams.

Table 4

West Virginia 2013 - Top Port (tons in thousands)				
Port	Port Type	Type Rank	Port Tons Within State	Total Port Tons
Huntington - Tristate	River	1	28,721.5	46,831.1

Tonnages represent only tons shipped or received in the state and port, and not necessarily the total port tonnage.

Source: USACE Waterborne Commerce Statistics

LOCKS AND DAMS

Of the 13 navigation locks and dams in West Virginia, seven are projects on the Ohio River. The Ohio River locks and dams begin with New Cumberland in the northern panhandle of West Virginia flowing southwest until ending with Robert C Byrd approximately 35 miles upstream of Huntington, WV and 10 miles downstream of the Ohio/Kanawha River confluence. The Ohio River flows southwest in this reach with the locks and dam increasing in total tonnage as their miles below Pittsburgh increases. In order of tonnage and miles below Pittsburgh the Ohio River locks and dams are: Robert C Byrd, Racine, Belleville, Willow Island, Hannibal, Pike Island, and New Cumberland.

There are three locks and dams on each of the two other navigation systems in West Virginia. Winfield, Marmet and London lock and dam are on the Kanawha River navigation system connecting Charleston, West Virginia with the Ohio River and then on to New Orleans and the Gulf of Mexico via the Mississippi River. Morgantown, Hildebrand and Opekiska locks and dams are on the Monongahela River, which flows northward into Pennsylvania eventually meeting up with the Allegheny River to form the Ohio River.

As can be seen in Table 5 traffic direction is balanced on the Ohio River at and below Hannibal lock and dam, until reaching Robert C Byrd L&D, which has an increase in upbound tonnage. Above Hannibal in the West Virginia panhandle region the Ohio River traffic consists of mostly upbound traffic heading to Pittsburgh, PA. Kanawha River traffic is predominately downbound at all locks and dams.

Table 5

West Virginia 2013 Lock Tonnage (tonnage in thousands)				
Lock	Waterway	Upbound	Downbound	Total
Robert C Byrd L&D	Ohio	26,523.5	17,152.8	43,676.3
Racine L&D	Ohio	21,730.6	20,404.0	42,134.6
Belleville L&D	Ohio	21,755.6	19,363.4	41,119.0
Hannibal L&D	Ohio	18,602.8	21,407.6	40,010.4
Willow Island L&D	Ohio	19,475.9	18,816.8	38,292.8
Pike Island L&D	Ohio	26,039.7	6,730.7	32,770.4
New Cumberland L&D	Ohio	25,898.9	6,413.1	32,311.9
Winfield L&D	Kanawha	6,158.1	6,610.1	12,768.2
Marmet L&D	Kanawha	739.8	7,457.4	8,197.2
London L&D	Kanawha	7.6	1,209.6	1,217.2
Morgantown L&D	Monongahela	67.2	69.3	136.5
Opekiska L&D	Monongahela	0.5	0.3	0.8
Hildebrand L&D	Monongahela	0.3	0.3	0.6

Source: Lock Performance Monitoring System

RIVER SYSTEM

The State of West Virginia borders 277 miles of the Ohio River's 981-mile length. The state of West Virginia also contains the entire 91-mile navigable length of the Kanawha River, four navigable miles of the Little Kanawha River, and the upper 37 miles of the Monongahela River. The Big Sandy River flows along the western border of the state; the lower ten miles are navigable slackwater provided by the Greenup Locks and Dam on the Ohio River.

By water volume, the Ohio River is the largest tributary of the Mississippi River, which provides access to the Port of New Orleans and Gulf Coast. Of all West Virginia waterways, the Ohio River ranks first in total tonnage with 45 million tons. The Kanawha River ranks second moving a total of 14.3 million tons (Table 6).

Table 6

West Virginia 2013 Top 5 Waterways (tons in thousands; values in millions of dollars)		
Waterway	Tons	Value
Ohio River	45,003.2	\$ 9,327
Kanawha River, WV	14,302.3	\$ 1,908
Monongahela River, PA and WV	5,233.0	\$ 338
Big Sandy River, Tug and Levisa Forks, KY and WV	3,498.0	\$ 291
Little Kanawha River, WV	184.1	\$ 4
<i>Commodity Values not calculated for foreign/coastal movements.</i>		
<i>Sources: USACE Waterborne Commerce Statistics, 2012 NDSU Commodity Valuation Analysis</i>		

SOURCE

- Cover Picture; <http://stormhighway.com/charleston/kanawha-river-barge-fort-hill-a-0460.php>
- West Virginia Population accessed at <http://www.city-data.com/states/West-Virginia-Population.html>
- U.S. Census accessed at <http://www.census.gov/compendia/statab/2012/tables/12s0014.pdf>
- West Virginia Department of Transportation accessed at <http://www.transportation.wv.gov/ports/Pages/WVPorts.aspx>
- Energy Information Administration accessed at <http://www.eia.gov/state/rankings/?sid=WV#series/48>
- Navigation on the Upper Potomac River and Tributaries accessed at <http://www.whilbr.org/assets/uploads/NavigationOnTheUpperPotomac.pdf>
- West Virginia Survey of Commodity Flows 2007 accessed at http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/commodity_flow_survey/2007/states/west_virginia/html/table_06.html
- Marathon Petroleum Corporation accessed at http://www.marathonpetroleum.com/Careers/Why_MPC/Locations_Across_the_United_States/Catlettsburg_Kentucky/
- Ergon Inc. accessed at <http://ergon.com/>
- The West Virginia Encyclopedia accessed at <http://www.wvencyclopedia.org/articles/1422>

- Louisville District, U.S. Army Corps of Engineers, "History of Navigation Development on the Ohio River," accessed at <http://www.lrl.usace.army.mil/Missions/CivilWorks/Navigation/History.aspx>