

Research Paper – Transportation and the Environment

This paper identifies current roles, assets, and trends associated with protecting and managing the natural and built environment in the transportation planning process. The 2050 LRTP recognizes that environmental management and resource protection are essential to sustaining and preserving the natural and built environments in West Virginia. By considering sustainable improvements to the transportation system, WVDOT provides social, environmental, and economic benefits to the state.

- Decreasing dependence on driving alone will lead to less dependence on fossil fuel energy, lower air pollution levels, and less greenhouse gas emissions.
- Preserving natural assets, such as habitat areas and water resources, will provide ecosystem services like improved water quality, increased flood mitigation, improved stormwater management, improved air quality, and strengthened biodiversity.
- Improving sources of outdoor recreation opportunities will increase tourism, economic development, and overall well-being for residents and visitors alike.

1. Introduction

The environment and transportation are inextricably linked.

WVDOT works diligently to ensure that all transportation projects are conducted in compliance with the National Environmental Policy Act (42 U.S.C. 4321-4371)¹. The National Environmental Policy Act (NEPA) is a law that requires federal transportation agencies to incorporate environmental considerations in their planning and decision-making process utilizing a systematic interdisciplinary approach. The NEPA review process requires transportation agencies to consider potential impacts to the social and natural environment, relative to the identified transportation project. During the review process, federal transportation agencies are required to prepare detailed statements and/or reports assessing the environmental impacts of and alternatives to federal actions affecting the environment.

Agencies are also required to provide opportunities for public review and comment during the environmental review process. Each federal transportation agency has developed their own NEPA procedures relative to the Council of Environmental Quality's (CEQ) regulations. Under the NEPA review process, the lead federal agency is responsible for complying with the requirements of NEPA.

This paper analyzes the current environmental assets, linkages, and trends in West Virginia's transportation system. The following sections are divided into categories that define and describe the relationship between the natural and built environment in the transportation system, centering on NEPA regulations. These sections focus on natural and built assets, environmental resiliency, and the tourism industry in West Virginia and outline the current policies, regulations, and statutes impacting environmental management and transportation systems in West Virginia. Full source information is detailed in **Appendix A** and additional mapping resources are provided throughout the research paper.

¹ U.S. Environmental Protection Agency. National Environmental Policy Act. 2020

1.1 Natural Assets

Air The Clean Air Act (CAA) of 1970 requires the U.S. EPA and states to establish air quality standards, known as the National Ambient Air Quality Standards (NAAQS) (40 CFR part 50)², for pollutants which are considered dangerous to public health and the environment. These six criteria air pollutants are measured in parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air. The six air pollutants include Carbon Monoxide (CO), Lead (Pb), Nitrogen Dioxide (NO₂), Ozone (O₃), Particle Pollution (PM), and Sulfur Dioxide (SO₂).

These pollutants are directly linked with transportation and industrial activity and therefore must be monitored, regulated, and minimized for prolonged periods of time. Ozone occurs most frequently in the summertime, which creates the chemical reaction needed to form Nitrogen Oxides (NO_x) and Volatile Organic Compounds (VOCs). Both pollutants are most often associated with transportation sources, energy generation, or petroleum-based chemicals. PM pollution is produced from drops of liquid and dust and can significantly vary in size. The most common contributors of PM pollution are from vehicles, diesel engines, and energy generation. Overall, these pollutants are directly associated with numerous health problems, including breathing disorders, heart and lung disease, and asthma.

The Clean Air Act and the Air Pollution Control Law of West Virginia (45CSR13, 45CSR14 and 45CSR19) require WVDOT to evaluate and determine that statewide transportation projects programmed into the Statewide Transportation Improvement Program (STIP) are not making West Virginia's air quality worse. The West Virginia Division of Highways (WVDOT) uses evaluation tools to determine motor vehicle emissions from all projects programmed into the TIP and compares those emissions with the state emissions budget. This process is completed with the assistance of state and federal regulatory environmental and transportation agencies.

Another important air quality plan in West Virginia is the Beneficiary Mitigation Plan³. The Beneficiary Mitigation Plan describes the proposed use of West Virginia's Mitigation Trust allocation and targets specific mitigation goals related to NO_x emission. The Plan is intended to provide the public more information on the state's vision for the mitigation funds and addresses principles to maximize public health and environmental benefits related to air quality improvement. Overall, planning for West Virginia's future will require WVDOT to consider the relationship between transportation and the environment in the decision-making process to mitigate further air quality threats to human health and welfare, and minimize environmental degradation.

Water The Clean Water Act (CWA) of 1972 (33 U.S.C. §1251 et seq.) requires the EPA and states to establish a structure for regulating discharges of pollutants into national waters, as well as regulating quality standards for surface waters⁴. Under the CWA, EPA has applied pollution control programs and created national water quality criteria recommendations for pollutants.

Pollution control programs significantly reduce the amount of pollutants and runoff that enter streams and navigable waters. Any waterbodies not meeting these standards are considered impaired and must be included on the 303(d) list of impaired waters. If a waterway is identified on the Section 303(d) list of

² U.S Environmental Protection Agency. NAAQS Table. 2020

³ WV Department of Transportation. Beneficiary Mitigation Plan. 2019

⁴ U.S Environmental Protection Agency. Clean Water Act. 2020

impaired waters, then the state must develop Total Maximum Daily Loads (TMDLs) for each waterway. A TMDL is a calculation used to determine the maximum amount of pollution allowed to enter a waterbody that will allow the waterbody to continue to meet water quality standards for a pollutant⁵. Under the CWA, WVDOH is responsible for developing TMDLs and submitting them to EPA for approval. Afterwards, the EPA reviews the TMDLs and either approves or disproves the water quality standards. West Virginia continues to work with the EPA and other relevant stakeholders to accurately monitor and complete the TMDLs.

Transportation activities and maintenance have a significant impact on water quality, hydrologic conditions, and stormwater management and therefore should be considered during the planning process. Non-point source pollution, such as chemicals, fuel, and other hazardous materials discarded from cars, trucks, trains, and airports are absorbed into the groundwater and can contaminate hydrologic systems. In natural areas, including forests, wetlands, and watersheds, excess rainfall and non-point source pollution is absorbed into the ground and used by surrounding vegetation or is filtered through the soil where it eventually becomes groundwater. These natural stormwater management systems provide invaluable environmental and financial benefits to the transportation system by regulating non-point source pollution and saving WVDOT money by reducing the construction and maintenance costs of built stormwater management best management practices (BMPs).

According to the EPA, transportation directly affects water quality in the following ways:

1. Road construction and maintenance, including the creation of impervious surfaces can adversely affect water quality due to faster rates of runoff, lower groundwater recharge rates, and increased erosion;
2. Pollutants such as vehicle exhaust, oil, and dirt, and deicing chemicals, are deposited to roadways and other impervious surfaces;
3. Leaking underground storage tanks release petroleum to groundwater; and
4. Oil spills, especially in the marine sector affect the water quality of inland waterways and coastal areas.

In order to prepare for future needs, the West Virginia Department of Environmental Protection (WVDEP) and WVDOT should work together to address water quality issues through stormwater management practices and plan for West Virginia's transportation future.

Habitats and Species U.S federal law protects rare animal and plant species, as well as their habitats with the Endangered Species Act of 1973 (16 U.S.C 1531). The Endangered Species Act of 1973 (ESA) provides the protection of species which are at risk of extinction and for the protection of the ecosystems on which they depend. The ESA lists plants and animal species which are endangered or threatened based on the most readily available scientific and commercial data. Federal transportation agencies, in coordination with the U.S. Fish and Wildlife Service and National Marine Fisheries Service, are required to ensure that no federally funded transportation projects jeopardize the existence of any listed species or destroy the species critical habitat.

⁵ U.S Environmental Protection Agency. Overview of Total Maximum Daily Loads. 2020

Soil quality, including soil erosion and soil contamination, is also directly impacted by transportation facilities. The United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) Division is the lead agency that develops and delivers science-based soil surveys that helps federal and state agencies, universities, and the public be good stewards of the land. West Virginia's NRCS Division is comprised of soil scientists that provide technical assistance in understanding soil surveys. According to the West Virginia NRCS Division, soil surveys are the foundation of conservation planning, environmental management, resource assessments, and conservation practice and restorative design⁶. Since highway construction causes alterations of surface grades, thus diminishing the amount of fertile land, while soil contamination can occur with toxic materials, such as fuel and oil from motor vehicles, it is critical to understand where these resources are located beforehand. As a result, understanding soil surveys across the state may directly affect the construction and maintenance of transportation infrastructure.

1.2 Built Assets

Community Section 4(f) of the Department of Transportation Act of 1966 [Section 4(f)] (49 U.S.C. 303) requires that federal transportation agencies are prohibited from using publicly owned parks, recreation areas, wildlife and waterfowl refuges, or public and private historic properties, unless it is unfeasible and no other alternatives are available to avoid impacting the property⁷. Section 4(f) is significant in the transportation system because it allows publicly owned parks and recreational areas, waterfowl and wildlife refuges, and historic sites to be preserved and minimizes the amount of harm done to the property. Parks, trails, and recreational facilities not only benefit water quality and species habitat, but also provide public health and quality of life benefits to the community.

Historic and Cultural West Virginia's historic, archaeological, and natural resources offer a variety of features relative to the state's historic identity. The National Historic Preservation Act (including Section 106 Process), National Register of Historic Places, Section 4(f) of the Department of Transportation Act, 36 CFR Part 800, and Archaeological and Historic Preservation Act all require that historic and cultural resources be considered during the development of all transportation projects. Some of the historic properties considered during the environmental review process include buildings, sites, structures, objects, and districts. Since transportation projects, such as road widenings and realignments, may negatively impact or destroy historic resources, it is important to consider historic preservation and revitalization during the planning and design of transportation projects.

Industrial Sites The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (U.S. Code § 9606), along with the Superfund Amendments and Reauthorization Act (SARA), establish national policy and procedures for identifying and cleaning up sites contaminated with hazardous substances⁸. The CERCLA Act also provides for liability of the persons responsible for hazardous wastes on each site and established a trust fund to provide cleanup if no responsible party could be identified.

⁶ U.S. Department of Agriculture. West Virginia Natural Resources Conservation Services. 2020

⁷ U.S. Department of Transportation. Section 4(f) Regulations and Guidance. 2020

⁸ U.S. Environmental Protection Agency. Overview of Superfund Sites and CERCLA. 2020

TRENDS, DRIVERS, AND OPPORTUNITIES



In 1996, the West Virginia Legislature passed the Voluntary Remediation and Redevelopment Act (VRRRA) (WV Code § 22-22) to encourage the cleanup and redevelopment of brownfields. West Virginia's Office of Environmental Remediation administers the Brownfields Section and Superfund Section programs and has a mission to provide for clean, safe, and productive West Virginia communities by assessing and remediating environmental resources and restoring contaminated properties for beneficial use⁹. Besides brownfields and superfund sites, the other prominent industry in West Virginia is coal mining. The Surface Mining Control and Reclamation Act of 1975 (SMCRA) is a law focused on regulating surface coal mining operations, along with the acquisition and reclamations of abandoned mines¹⁰. In West Virginia, the WVDEP's Division of Mining and Reclamation assures West Virginia is compliant with SMCRA and other applicable state laws and regulations relative to the reclamation of mining sites.

These industrial sites are important to the transportation planning process, particularly regarding future right-of-way acquisition. Identifying the contaminated sites is important for WVDOT because the Department may be required to accept financial responsibility for the sites if a transportation project impacts the site. Unfortunately, environmental remediation sites may adversely affect the financial feasibility of the transportation project and cause significant project delay due to substantial clean-up requirements, if necessary. Therefore, identifying these sites and understanding their potential environmental impacts is key to maintaining the WVDOT system.

1.3 Environmental Resiliency

The Federal Highway Administration (FHWA) defines resiliency as the ability to anticipate, prepare for, and adapt to changing conditions in order to withstand, respond to, and recover rapidly from disruptions¹¹.

The Fixing America's Surface Transportation (FAST) Act of 2015 provides long-term funding for surface transportation for states and local governments, including new highways and transit lines. It focuses on resilience as a planning factor for state and metropolitan long-range transportation plans and emphasizes the importance of a "performance-driven, outcome-based approach to planning", mandating that statewide planning concentrate on "the resiliency and reliability of the transportation system."¹²

The USDOT and FHWA have developed the Vulnerability Assessment Scoring Tool (VAST) to help state departments of transportation and other organizations implement a vulnerability assessment of their transportation assets¹³. The tool covers climate-based stressors, including increased temperature and extreme heat, precipitation-driven flooding, wind, drought, dust storms, wildfires, winter storms, and changes in freeze/thaw and permafrost.

Weather-related impacts affect every aspect of a transportation system from maintenance and mobility, to life-cycle costs. In order to prepare for these major weather events, it is essential that WVDOT

⁹ WV Department of Environmental Protection. Office of Environmental Remediation. 2020

¹⁰ U.S. Department of the Interior. Surface Mining Control and Reclamation Act Laws, Regulations, and Guidance. 2020

¹¹ U.S Department of Transportation. Federal Highway Administration. Climate Change Adaptation Guide for Transportation Systems Management, Operations, and Maintenance. 2020

¹² U.S Department of Transportation. FAST Act. 2015

¹³ U.S Department of Transportation. Vulnerability Assessment Scoring Tool. 2015

develop a resilient transportation system to meet long-term economic, social, and environmental goals to better prepare for a wide range of unpredictable weather events. By incorporating resiliency into the transportation system, WVDOT can increase the viability and reliability of the state's infrastructure. The West Virginia Legislature passed House Bill 2935¹⁴, which established a joint legislative committee to address flooding and created a new state office focused on resiliency. The WV State Resiliency Office (SRO) was established in April 2017 to coordinate all economic and community resiliency planning and implementation efforts, including but not limited to flood protection programs. The office is also responsible for updating the state's flood protection plan and recommending legislation to reduce and/or mitigate flood damage.

1.4 Environmental Tourism

The West Virginia Tourism Office is an agency within the West Virginia Department of Commerce and is dedicated to promoting West Virginia as a world-class travel destination by increasing the state's economic impact through tourism. The West Virginia Tourism Development Act was first passed in 2004 to "encourages the creation and/or expansion of tourism development projects so companies and entrepreneurs can better take advantage of the wealth and beauty the state has to offer."¹⁵ The Tourism Development Tax Credit program allows businesses to receive a 25 percent tax credit from consumers sales and service taxes collected on the gross receipts from daily operations. Certain projects are also eligible to receive a 35 percent tax credit if the project is on an abandoned surface mine or is on/adjacent to a state or national forest or park. This tax credit requires companies to invest at least \$1 million for a project, remain open for at least 100 days per year, attract at least 20 percent of their visitors from out-of-state and allocate no more than 50 percent of the project for lodging.

¹⁴ WV Legislature. House Bill 2935. 2017

¹⁵ WV Development Office. Tourism Development Act. 2020

2. Where Are We Today?

2.1 Natural Assets

Air The WVDEP's Division of Air Quality operates ambient air quality sampling sites throughout West Virginia. The sampling sites assess air quality levels to determine compliance with the National Ambient Air Quality Standards and sets Air Non-Attainment Areas for counties not reaching their air quality goals. As of early 2020, when this research started, only two counties (Brooke and Marshall) in West Virginia were considered in air non-attainment areas for Sulfur Dioxide emissions¹⁶.

As of October 2020, West Virginia is meeting all the U.S. Environmental Protection Agency's health-based NAAQS for the first time since 1978, when the EPA made their initial nonattainment designations under the 1970 Clean Air Act.¹⁷

The EPA tracks and manages a Toxics Release Inventory (TRI), which includes certain toxic chemicals that may negatively impact human health and the environment. According to the TRI chart¹⁸, air pollution emissions from different industry sectors in West Virginia have been slowly decreasing since 2007.

Water West Virginia has over 9,000 streams covering approximately 32,260 miles across the state¹⁹ (**Figure 1**). To better manage these streams, West Virginia is divided into 32 watersheds²⁰ and placed into one of five hydrologic groups to address water quality monitoring and management. The watersheds with waters located west of the eastern continental divide flow into the Ohio River and the waters east of the eastern continental divide flow towards the Potomac River into the Chesapeake Bay²¹. According to the West Virginia Integrated Water Quality Monitoring Assessment Report²², as required under the CWA, the 2016 Section 303(d) listed impaired waters are provided in the table below by hydrologic group and mapped in **Figure 2**. WVDEP is currently developing an updated integrated report for 2018/2020 based on data collected through June 2019. More information is available [here](#).

Hydrologic Group	Number of Streams	Stream Miles
Hydrologic Group A	145 streams	630 miles
Hydrologic Group B	380 streams	696 miles
Hydrologic Group C	254 streams	1,252 miles
Hydrologic Group D	208 streams	1,367 miles
Hydrologic Group E	325 streams	1,457 miles
Total	1,312 streams	5,402 miles

¹⁶ U.S. Environmental Protection Agency. Air Quality Greenbook. 2020

¹⁷ Gov. Justice announces entire state of West Virginia now meeting national air quality standards for the first time since 1978, Press Release - 10/21/2020

¹⁸ U.S. Environmental Protection Agency. TRI Search Plus. 2020

¹⁹ National Wild and Scenic Rivers System. West Virginia Waterways. 2020

²⁰ WV Department of Environmental Protection. WV Watersheds Map. 2017

²¹ WV Department of Environmental Protection. WV Watersheds. 2020

²² WV Department of Environmental Protection. Water Quality Monitoring Assessment Report. 2016

TRENDS, DRIVERS, AND OPPORTUNITIES



The WVDEP's Division of Water and Waste Management conducted a water quality analysis at 26 fixed monitoring stations located at or near the mouths of the state's larger rivers and near major industrial facilities or other potential sources of impairment²³. Over the course of two trend periods, including a long-term period from 1970-2012 and a short-term period from 1996 to 2012, WVDEP was able to analyze 24 water quality parameters across the state. The long-term results indicated that nearly all of the monitoring stations show an increase for alkalinity and pH and a decrease in total phosphorus, total suspended solids, and aluminum, iron, manganese, and lead. The short-term results indicated water hardness and dissolved oxygen are increasing statewide. According to the study, West Virginia's streams and rivers are still recovering from the acid rain impacts and coal mining impacts of the 20th century. Increasing trends in total dissolved solids, alkalinity, water hardness, and other heavy metals are most apparent in the southwestern part of the state in heavily mined regions.

Figure 2 West Virginia Streams and Waterways

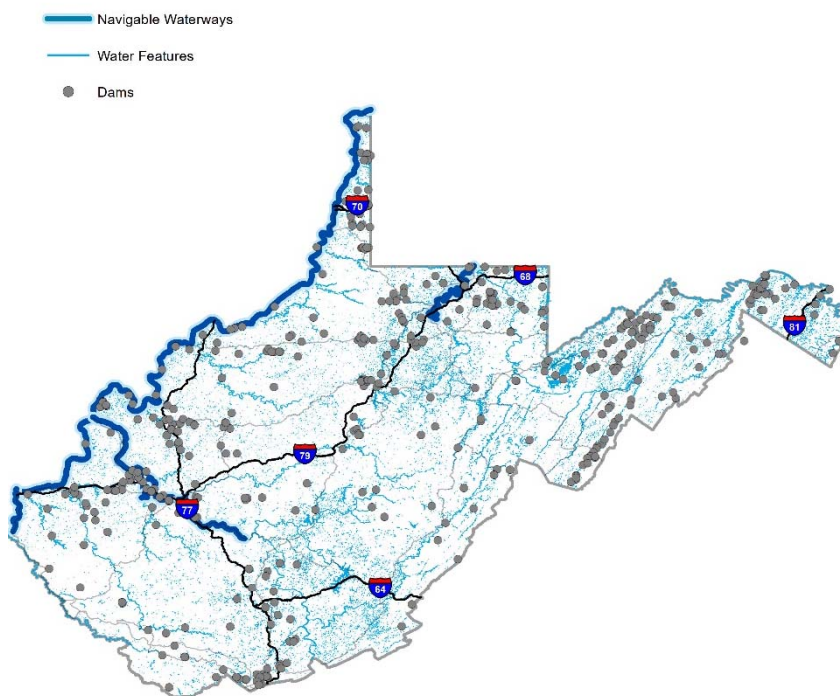
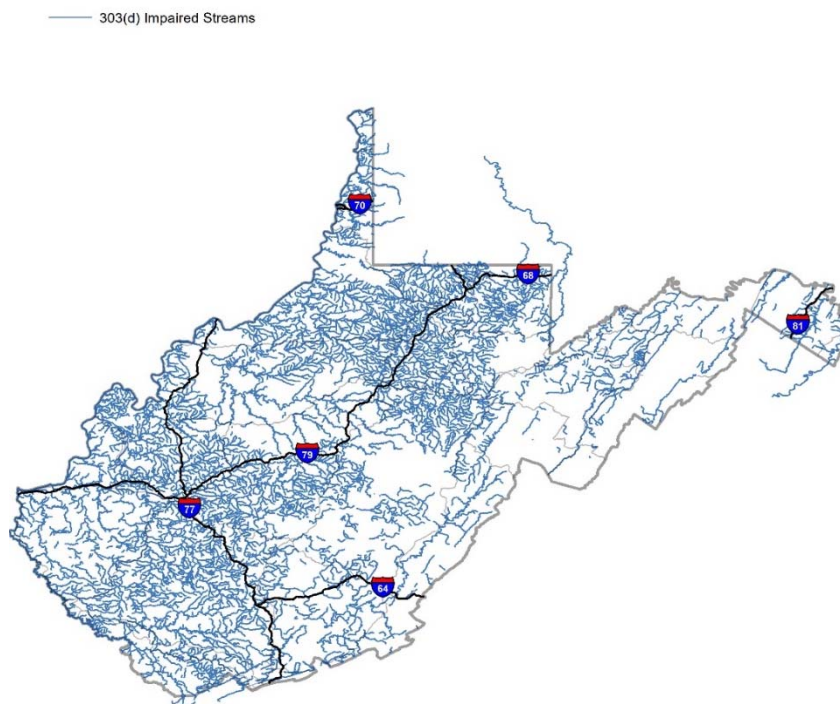


Figure 1 West Virginia Impaired Streams



²³ WV Department of Environmental Protection. Water Quality Trend Analysis in WV. 2015

Habitats and Species The West Virginia Division of Natural Resources (WVDNR) does not currently have state-level threatened or endangered species legislation. However, there are fifteen species of animals and four species of plants located in West Virginia listed as endangered and five species of animals and two species of plants which are listed as threatened according to the Endangered Species Act²⁴. As of 2020, the following threatened or endangered species are listed for the state of West Virginia:

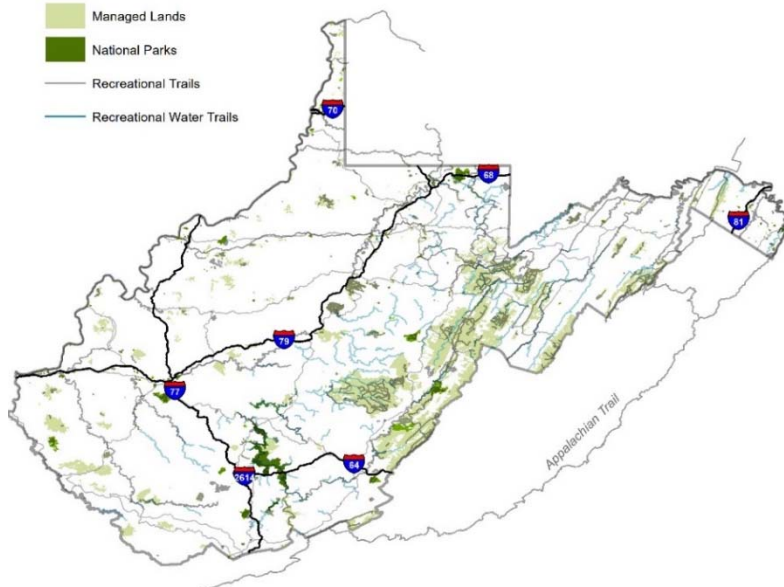
Federally Endangered Species in WV	
Virginia big-eared bat	Guyandotte River crayfish
Indiana bat	Rusty patched bumble bee
Candy Darter	Shale barren rockcress
Diamond darter	Running buffalo clover
Pink mucket pearly mussel	Harperella
Catspaw	Northeastern bulrush
Northern riffleshell	Sheepnose
James spiny mussel	Snuffbox
Fanshell	Rayed bean
Clubshell	Spectaclecase
Federally Threatened Species in WV	
Flat-spined three-toothed land snail	Big Sandy crayfish
Cheat Mountain salamander	Virginia spiraea
Madison Cava isopod	Small whorled pogonia
Northern long-eared bat	

2.2 Built Assets

Community Parks, trails, and recreational facilities benefit water quality and species habitat, while also supporting public health and quality of life. WVDOT works with WVDNR to maintain access to 50 state parks, state forests, and recreational trails (see **Figure 4**) under their jurisdiction²⁵. These state-owned outdoor facilities offer a variety of recreational amenities including a diversity of outdoor activities, museums and historic sites, and scenic train rides. Transportation access should help build appreciation for and maintain and improve the sensitive ecology and unique history of these places.



Figure 3 West Virginia Parklands



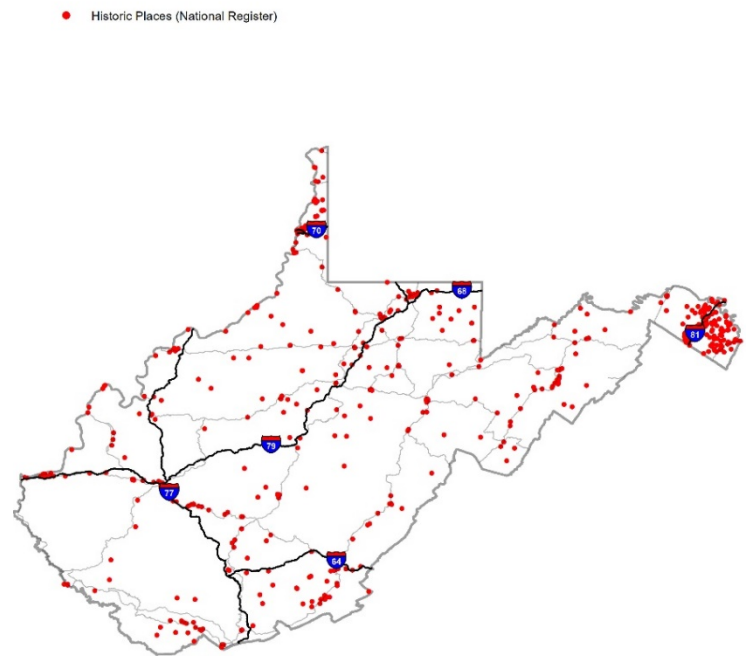
²⁴ WV Department of Natural Resources. Rare and Endangered Species List. 2020

²⁵ WV State Parks. State Parks in West Virginia. 2020

Historic and Cultural

The West Virginia State Historic Preservation Office (WVSHPO) provides an interactive map which identifies the National Register of Historic Places sites in the state²⁶. The interactive map is designed to provide professional consultants, state/federal agency employees, and the public with an opportunity to make informed decisions regarding the locations of cultural resources in West Virginia. While there are numerous National Historic Register Places located throughout the state, a significant portion of the sites have been identified and are concentrated in the Eastern Panhandle, near Harper's Ferry (**Figure 5**). Some of the historic properties considered during the environmental review process include buildings, sites, structures, objects, and districts.

Figure 5 West Virginia Historic Sites



Industrial Sites

Superfund Sites

Identification of contaminated sites is important for WVDOT because the Department may be required to accept financial responsibility for the site if a transportation project impacts the site. The EPA currently lists ten Superfund Sites on the National Priorities List across West Virginia²⁷. The National Priorities List provides a list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action. The ten Superfund Sites are located in Harrison, Jackson, Kanawha, Marion, Marshall, Mason, Mineral, Monongalia, Putnam, and Wood counties. The ten Superfund Sites in West Virginia are listed below and provided in **Figure 6**.

Region	EPA ID	Site Name	NPL Status
3	WV0170023691	Allegany Ballistics Laboratory (US Navy)	Final
3	WVD054827944	Big John Salvage - Hoult Road	Final
3	WVD047989207	Fike Chemical, INC.	Final
3	WVD024185373	Hanlin-Allied-Olin	Final
3	WVD000850404	Ordnance Works Disposal Areas	Final
3	WVSFN0305428	Ravenswood PCE	Final
3	WVD000800441	Sharon Steel Corp (Fairmont Coke Works)	Final
3	WVD988798401	Vienna Tetrachloroethene	Final
3	WVD980713036	West Virginia Ordnance (US Army)	Final
3	WVN000306876	North 25th Street Glass and Zinc	Final

²⁶ WV Department of Cultural Resources. Interactive Cultural Resources Map. 2020

²⁷ U.S. Environmental Protection Agency. Superfund Sites in West Virginia. 2020

TRENDS, DRIVERS, AND OPPORTUNITIES

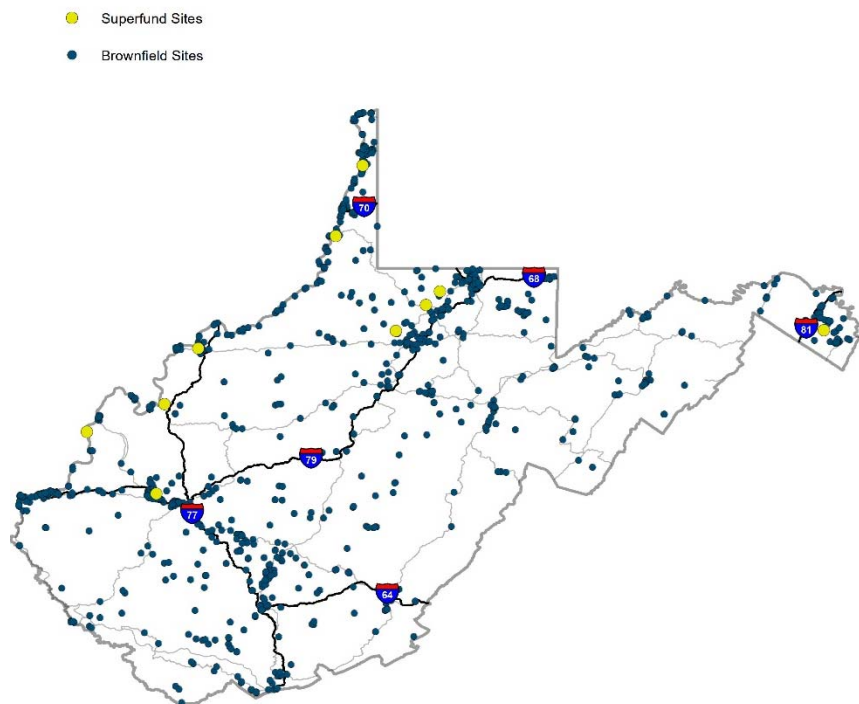


Brownfield Sites

The EPA provides two interactive maps, *Cleanups in my Community*²⁸ and *NEPAAssist*²⁹, which shows all the identified brownfield properties across the state. A brownfield is a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. According to the “Cleanups in my Community” map, most of the brownfield properties are spread across West Virginia, with concentrations located in Hancock, Brooke, Ohio,

Jefferson, Berkeley, Fayette, Raleigh, and Cabell counties (**Figure 6**). Similarly, the *NEPAAssist* map indicates at least 250 identified brownfield sites in West Virginia.

Figure 6 West Virginia Superfund and Brownfield Sites



Active and Abandoned Mining Sites

Coal extraction, production, and transport is a significant aspect of West Virginia’s economy that also brings the potential for environmental impacts. The WVDEP provides an interactive mapping tool, *West Virginia DEP Mining Data Tools*³⁰, which maps the mining permits, surface mining, and underground mining operations in the state. According to the mapping tool, the coal industry within West Virginia is distributed across the state’s two producing regions (Northern and Southern). The most active southern counties include McDowell, Mingo, Logan, Boone, Wyoming, Kanawha, Fayette, and Raleigh. The most active northern counties include Marshall, Ohio, Monongalia, Marion, Harrison, Upshur, Barbour, and Preston. Historically, Southern West Virginia mines accounted for well over two thirds of coal produced in the state, while recent trends show both regions were producing roughly equivalent levels of coal tonnage. Future production between the two regions is market driven - Northern West Virginia’s coal output is shipped to domestic coal-fired power plants, in which consumption is likely to remain steady, while Southern West Virginia coal benefits from strong export demand for premium met and thermal coal reserves, which fluctuate based on worldwide market shifts.

2.3 Environmental Resiliency

Both the U.S. and West Virginia’s economies depend on the maintenance of transportation infrastructure to keep the supply and demand of goods and raw materials moving. However, climate

²⁸ U.S. Environmental Protection Agency. Cleanups in My Community Map. 2020

²⁹ U.S. Environmental Protection Agency. NEPA Assist Tool. 2020

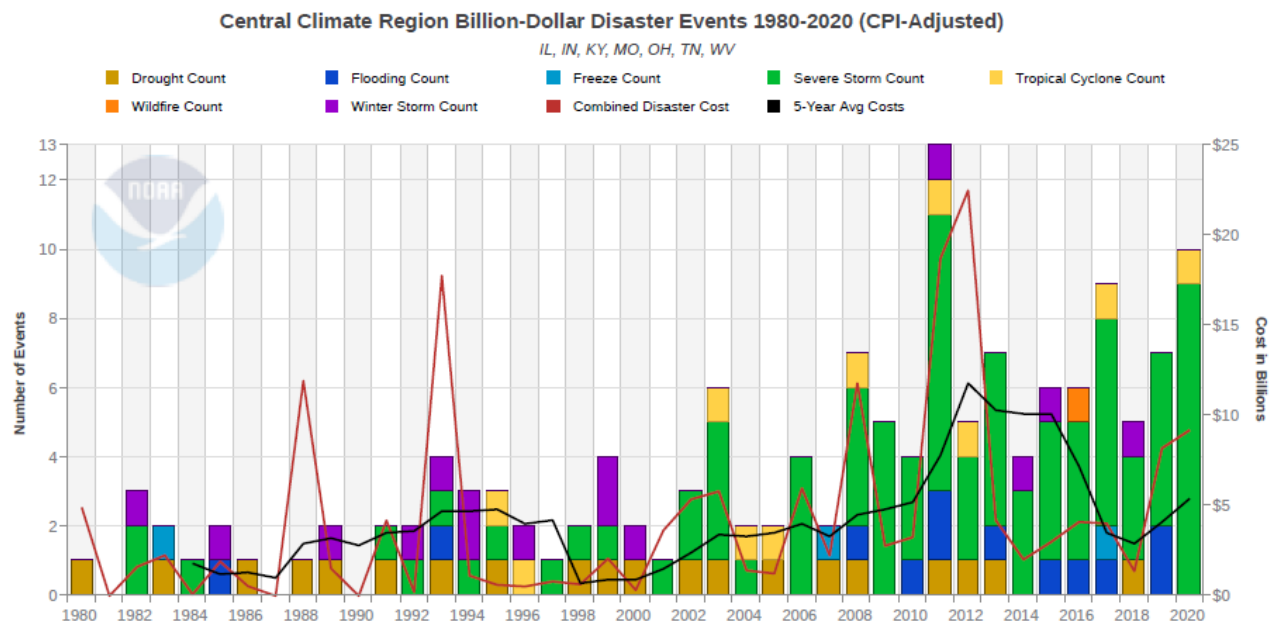
³⁰ West Virginia Department of Environmental Protection, Mining Data Tools. 2020

TRENDS, DRIVERS, AND OPPORTUNITIES



change and natural disasters have posed a significant risk to the safety, reliability, and sustainability of transportation infrastructure. As weather becomes increasingly unpredictable and natural disasters continue to increase in frequency and duration, it is imperative that WVDOH consider how these hazards impact the transportation system in West Virginia, especially roads, bridges, tunnels, rails, and other transportation facilities. The most frequent natural hazards West Virginia faces are floods and drought, landslides, mudslides, and severe storms.

The frequency of the most significant events is increasing within West Virginia's climate region, as described in the below figure from the NOAA National Centers for Environmental Information³¹, which are leading transportation agencies to more proactively invest to protect infrastructure and manage resilience and recovery to these events.



In June 2016, West Virginia experienced one of the deadliest floods it has seen in the last few decades. Over a period of 24 hours, over ten inches of rainfall fell in the southern part of the state. West Virginia Emergency Management (WVEM) reported 23 fatalities across the state, including 15 in Greenbrier County, six in Kanawha County, and one each in Jackson and Ohio counties³². According to the Federal Emergency Management Agency (FEMA), a State of Emergency was declared in 44 of West Virginia's 55 counties and 12 of the counties received a Presidential Disaster Declaration. Flash floods from the intense storm caused almost \$53 million in property damage, \$46 million in roadway damage, and impaired infrastructure across the state with more than 1,500 homes and businesses destroyed and 2,500 more damaged³³. According to the National Weather Service, the Elkview River in Kanawha County rose more than 27 feet in a 24-hour period, which is the highest crest since recordkeeping began more than 125 years ago.

³¹ NOAA. National Centers for Environmental Information, Billion-Dollar Weather and Climate Disasters: Time Series. 2020

³² CNN. "West Virginia flooding leaves at least 24 dead". 2016

³³ FEMA, Understanding Flood Dangers in Central West Virginia, Lessons Learned from the June 2016 Flood. 2020.

TRENDS, DRIVERS, AND OPPORTUNITIES



Storms, such as the 2016 floods, indicate the need for proactive planning efforts to prepare for climate change and resiliency issues in the transportation system. According to the National Centers for Environmental Information, over 2,300 flood events have occurred in West Virginia since January 1993, resulting in an estimated \$1.8 billion in property damages and 103 deaths³⁴.

WVDOT has begun taking steps to address resiliency in long-range planning but integrating additional steps will proactively help WVDOT

prepare for impending challenges and develop strategies to address these inevitable weather-related events. WVDOT's 2019 TAMP has developed a Risk Management Assessment, which focuses on "proposed remedies for increasing resilience and reducing vulnerability."³⁵ Due to the aftermath of the 2016 floods, FEMA also provided funding to improve a digital flood mapping tool that expands across the state. The West Virginia Flood Tool is designed to provide floodplain managers, insurance agents, developers, real estate agents, local planners, and citizens with the tools to make informed decisions regarding flood risk³⁶.

Finally, WVDOT has developed a \$50 million dollar program, Medical Access Roads Project (MARP), comprised of multiple projects looking at removing the impediments and increasing access to medical facilities on transportation routes through maintenance improvements. Some of the projects are working to eliminate high water flooding concerns in areas of the state by providing new paving, drainage, and intersection designs to increase hospital accessibility. During extreme weather events, emergency response personnel have difficulty responding to calls due to drainage issues and infrastructure damage. The MARP Program is indirectly working to address environmental resiliency issues across the state and improve transportation infrastructure to prepare for future weather events. While these proactive strategies are beneficial, WVDOT should work to couple them with additional mitigation strategies, such as future regulations, ordinances, and land use practices to minimize risk from flood hazards on a statewide basis.

2.4 Environmental Tourism

West Virginia's \$4.6 billion tourism industry continues to grow each year as a result of the increasing number of outdoor amenities offered across the state. This travel-generated spending is a vital part of the economy across the state, and often accounts for the primary source of earnings and employment for multiple regions in West Virginia. From 2017 to 2018, West Virginia's travel spending increased by 6.5 percent from \$4.3 billion to \$4.6 billion³⁷. According to a 2018 survey completed by Longwoods International, nine percent of all trips taken in the state were in pursuit of outdoor recreation activities and six percent of those trips included using campground/trailer park/RV park accommodations. Of these overnight travel trips, 17 percent were to national and state parks; 13 percent were for hiking and

³⁴ West Virginia Division of Highways, Transportation Asset Management Plan. 2019.

³⁵ West Virginia Division of Highways, Transportation Asset Management Plan. 2019.

³⁶ West Virginia Department of Emergency Management Flood Tool. 2020.

³⁷ Dean Runyan Associates. West Virginia Travel Impacts 2000-2018. 2019

TRENDS, DRIVERS, AND OPPORTUNITIES



backpacking; 13 percent were for swimming; and eight percent were for camping³⁸. Additionally, of the day travel trips taken, 11 percent were to national and state parks, nine percent were for hiking and backpacking; five percent each were for swimming and fishing; and four percent were for camping. As West Virginia begins to invest more in tourism promotion, it will directly impact the state's overall image, stimulate development, and indirectly benefit public health.

Outdoor recreation and green space can improve mental and physical health, as well as encourage more active lifestyles. The West Virginia Tourism Office promotes outdoor recreation amenities across the state, including aerial sports, caving, camping, golf, hunting & fishing, snow sports, stargazing, trails, and water sports.

According to the 2019 West Virginia Tourism Office Annual Report, the West Virginia Legislature appropriated an additional \$14 million in general revenue for FY20 to promote tourism in the state³⁹. This funding allowed for a significant increase in promotional efforts, of which \$1.5 million was directly appropriated for State Parks and Recreation advertising to further promote the state's recreational tourism industry. The Tourism Development Tax Credit program has also generated two additional recreational businesses, including the Rustic Ravines in Genoa and the Grand Patrician Resort in Milton. The Rustic Ravines' anticipated investment is \$2.1 million and offers cabin rentals, ATV rentals, camping, ziplining, hiking, hunting, and many more outdoor recreation activities. The Grand Patrician Resort is a luxury hotel and resort with an anticipated investment of \$64.5 million, which offers equestrian trails and stables, as well as outdoor landscapes and trails. Both of these businesses are anticipated to generate significant revenue and continue to bolster the tourism industry in the state.



2.5 Summary

Federal and state laws and regulations guide WVDOT through planning, programming, implementation, and operations and maintenance activities to mitigate impacts on the natural and built environment, while also ensuring the transportation system is resilient to environmental disruptions and supportive of West Virginia's renowned environmental tourism economy.

Given the diversity of West Virginia's natural and built environment, and the importance of these assets to West Virginia's quality of life and economy, WVDOT will continue to prioritize activities to protect these assets and facilitate environmental tourism so the public can continue to experience West Virginia's natural and cultural heritage. WVDOT is proactively working with partners to ensure that the transportation system remains resilient to increasing risks from a changing climate.

³⁸ Longwoods International, West Virginia 2018 Visitor Research. 2019

³⁹ West Virginia Tourism Office, 2019 Annual Report. 2020.

3. Where Are We Going?

3.1 Current Trends

Numerous trends will influence the future of transportation and the environment, including environmental factors, technological advancements, and social and political movements. The U.S. economy and West Virginia's economy greatly depend on a robust transportation system and supply chains to distribute goods and people efficiently and effectively to their final destinations. WVDOT will need to consider multiple objectives and life-cycle costs when deciding on future transportation investments. In order to prepare for the future of transportation planning, it is important to review current trends in transportation and incorporate strategies in long-term planning initiatives to prepare for the future. Two of the leading trends impacting transportation planning and the relationship to the environment are climate change and technological advancement.

Climate Change

The United States, as well as West Virginia, is at a pivotal point in terms of its environmental future. Climate change poses a severe threat to the reliability and capacity of transportation infrastructure across the county with increased temperatures, severe storm events, and rising sea levels causing infrastructure damage. Climate change impacts will likely increase the life-cycle costs and increase the risk of delays, disruptions, damage, and failure across multiple transportation systems. While most transportation infrastructure being constructed is expected to withstand at least the next 50 years, it is important to understand how climate change will affect these investments. Some of the potential impacts to transportation systems caused by climate change related weather events are described in the table below⁴⁰.

Weather-Related Cause	Potential Transportation Impacts
Increase in average temperatures	Softens and expands pavement - causing rutting and potholes
	Increases stress on bridge joints
	Increases life-cycle costs of roads, highways, bridges, and culverts
	Increases winter precipitation leading to frozen grounds
	Rail tracks expand and buckle- requiring track repairs and speed restrictions to avoid derailments
	Affects aircraft performance -causing cargo restrictions, flight delays, and cancellations
Increase in severe storm events	Disrupts traffic flow due to roadway flooding
	Delays construction activities due to extreme weather
	Weakens and washes out soil and culverts that support roads, tunnels, and bridges
	Saturates soils causing more landslides and washouts
	Damages airport facilities, including airstrips, due to flooding
	Harbor facilities (docks and bridges) may have to be raised and fortified for higher tides and storm surges
Increase in drought events	Increases likelihood of wildfires that reduces visibility and threatens roads and infrastructure
	Reduces soil permeability

⁴⁰ U.S. EPA, Climate Impacts on Transportation. 2017

TRENDS, DRIVERS, AND OPPORTUNITIES



States across the country have begun addressing climate change, the environment, and resiliency in all transportation-related planning decisions by incorporating policies and regulations into long-range transportation planning documents. Neighboring states and municipalities such as North Carolina (NC Moves 2050⁴¹), Ohio (Access Ohio 2045⁴²), and Delaware Valley Regional Planning Commission (Connections 2045- Plan for Greater Philadelphia⁴³) have already incorporated environmental resilience and climate change related goals, recommendations, policies, and strategies in their long-range transportation plans. West Virginia should continue to consider climate change and environmental resiliency in the decision-making process and incorporate these considerations in all future transportation planning documents.

Technological Advancement

Technology is rapidly changing and with it comes advancements that improve the safety, efficiency, and effectiveness of transportation systems and reduce its environmental impacts on the ecosystem. Two of the most prominent technological advancements impacting the transportation system are alternative fuel vehicles and autonomous vehicles.

Alternative fuel vehicles and autonomous vehicles have become increasingly popular over recent years and present an opportunity to transform the transportation networks impact on the environment. Alternative fuel vehicles directly benefit the environment by reducing energy use, fuel dependence, and GHG emissions. Electric vehicles (EVs) are powered by an electric motor using electrical energy that is stored in rechargeable batteries or other devices. Other vehicles are also being fueled by biogas/biofuels, natural gas, and propane. Over the next several decades, the presence of these types of vehicles are expected to increase on highways and public roadways. The US Energy Information Administration estimates that EVs will comprise 19% of US market share by 2050⁴⁴, while other industry estimates have estimated the worldwide share of EV sales by 2040 at over 50%.⁴⁵ While this extent of an EV market through 2040 and beyond could significantly decrease emissions from the tailpipe, the charging infrastructure could place additional pressures on the electrical grid. Therefore, a well-planned infrastructure network will be essential to accommodate these types of alternative fuels and technologies.

West Virginia has already begun accommodating for these different types of vehicles by incorporating infrastructure at some of their state parks. Destination Universal and Tesla Electric vehicle charging stations are available at Blackwater Falls, Cacapon, Canaan Valley, Chief Logan, Hawks Nest, Pipestem, Stonewall, Twin Falls and Tygart Lake and are free to use for both overnight guests and daytime visitors⁴⁶. West Virginia should continue facilitating this type of infrastructure across the state and make these types of vehicles available in a safe and efficient way by accommodating for and regulating them on public roads and highways.

⁴¹ North Carolina Department of Transportation. NC Moves 2050. 2020

⁴² Ohio Department of Transportation. Draft Access Ohio 2045. 2020

⁴³ Delaware Valley Regional Planning Commission. Connections 2045. 2018

⁴⁴ U.S. Energy Information Administration. Annual Energy Outlook. 2019

⁴⁵ Bloomberg NEF. Electric Vehicle Outlook. 2020

⁴⁶ WV State Parks. Electric Vehicle Charging Stations. 2020

3.2 Needs

Assessing West Virginia's future needs is necessary to achieve long-term environmental management and resiliency goals in the state's transportation system. Some of West Virginia's most significant environmental needs, as they relate to transportation, are described below.

Operations and Maintenance of Infrastructure

The transportation network includes a significant amount of infrastructure other than the right-of-way corridor including, wastewater and stormwater systems, private utilities, and drinking water systems. West Virginia, like many other states, needs to maintain and improve its infrastructure by integrating efficient practices that will promote long-term sustainability. During the 2016 floods, the transportation infrastructure in West Virginia was hit extremely hard and included roadway washout, damaged bridges and culverts, and general maintenance needs. Underinvestment in road construction, maintenance, and reconstruction has led to a decline in transportation infrastructure. Maintaining the quality of roadways, highways, and other transportation infrastructure is an ongoing process and will require additional planning, coordination between agencies, and a sustained increase in financial resources in order to provide an adequate transportation system for the residents and visitors of West Virginia.

Inventory Mapping

Environmental Inventory mapping is essential to addressing future transportation needs and environmental management. The state of West Virginia currently operates a GIS database known as MapWV⁴⁷ and the WVDEP also operates its own version of an environmental GIS database, referred to as the WVDEP GIS Viewer V2.1⁴⁸. While both databases provide some interactive mapping tools for environmental resources in West Virginia, the database is incomplete. Many environmental resources in the state have not been inventoried, mapped, updated, and/or made available to the public. Unfortunately, providing ecosystem services and addressing environmental management is difficult to complete if the resources are not comprehensively inventoried. Understanding where these environmental assets are located in the state will allow WVDOT to better prepare for future weather events, identify environmental resources for transportation-related projects, and better plan for environmental resiliency.

3.3 Challenges

The transportation industry and the environment have a contentious relationship. While transportation is an essential part of the economy, it can have detrimental impacts both directly and indirectly on the natural and built environment. Some of the challenges in West Virginia are described below.

Funding

A fully functional transportation system requires sustained funds to address capital, operating, and long-term maintenance expenses. While funding from fuel taxes, automobile privilege taxes, motor vehicle registration and license fees are some of the major sources for transportation funding in the state, these funds are not guaranteed. In addition to federal formulary funding, WVDOT should seek out available competitive federal funding to take advantage of federal funding assistance and grant programs to support transportation programs and infrastructure maintenance across the state. Agencies such as the U.S Department of Transportation, the Federal Highway Administration, the Federal Railroad

⁴⁷ West Virginia GIS Technical Center. Map West Virginia. 2020

⁴⁸ West Virginia Department of Environmental Protection. WVDEP GIS viewer V2.1. 2020

TRENDS, DRIVERS, AND OPPORTUNITIES



Administration, and the Federal Transit Administration provide several federally administered grant programs each year to assist transportation projects, rail infrastructure, and safety improvements across the country. The available federal funding grants programs are included below.

- Infrastructure for Rebuilding America Grants (INFRA)⁴⁹
- Better Utilizing Investments to Leverage Development (BUILD)⁵⁰
- Transportation Infrastructure Finance and Innovation Act (TIFIA)⁵¹
- Surface Transportation Program (STP)⁵²
- Consolidated Rail Infrastructure & Safety Improvements Program (CRISI)⁵³
- Federal-State Partnerships for State of Good Repair Grant Program (SOGR)⁵⁴

The popular grant programs associated with the FAST Act are likely to be renewed or reformatted within the next surface transportation reauthorization, anticipated to occur in 2021. Through participation on AASHTO and other organization, WVDOT should monitor infrastructure grant opportunities in future COVID-19 related stimulus bills as well as the direction for reauthorization. WVDOT should allocate available state funds to provide match for existing and future grant programs, as well as monitor and submit applications for strategic and ready projects when applicable.

Environmental Resiliency

With precipitation patterns changing each year and extreme weather events becoming more frequent, adapting the transportation system to proactively meet these growing challenges will be monumental towards achieving environmental sustainability. Weather-related impacts to transportation infrastructure can affect the entire transportation system, including maintenance, operations, and life-cycle costs. Addressing the environmental needs of the state, including water, air, and habitat is essential given the multiple roles and responsibilities WVDOT currently has relative to these resources.

Current transportation and water infrastructure systems are not sufficient enough to handle the increasing frequency of extreme weather events. Within the past 25 years (1991 to 2016), every county in West Virginia has experienced at least 14 floods. WVDOT is responsible for the management of thousands of highway miles and facilities, which are subject to environmental standards. By studying and anticipating these types of events, WVDOT can develop strategies to preserve long-term assets and incorporate best management practices systemwide.

⁴⁹ U.S. Department of Transportation. Infrastructure for Rebuilding America Grants (INFRA)

⁵⁰ U.S. Department of Transportation. Better Utilizing Investments to Leverage Development (BUILD)

⁵¹ U.S. Department of Transportation, Build America Bureau. Transportation Infrastructure Finance and Innovation Act (TIFIA)

⁵² U.S. Department of Transportation, Federal Highway Administration. Surface Transportation Program (STP)

⁵³ U.S. Department of Transportation, Federal Railroad Administration. Consolidated Rail Infrastructure & Safety Improvements Program (CRISI)

⁵⁴ U.S. Department of Transportation, Federal Railroad Administration. Federal-State Partnerships for State of Good Repair Grant Program (SOGR)

4. Future Direction / WVDOT Opportunities

The forces impacting WVDOT future direction as it relates to protecting environmental assets have a multiplicative impact – for example, traditional funding sources are becoming less productive while expenses are increasing as a result of system preservation needs.

Funding – A fully functional transportation system requires sustained funds to address capital, operating, and long-term maintenance expenses. Primary sources of revenue for funding general maintenance and construction of the WVDOH roadway network and for providing match dollars for Federal funds are derived from fuel taxes, automobile privilege taxes, motor vehicle registration and license fees. **As the vehicle fleet continues to become more efficient, including electric vehicles, fuel tax revenues will stabilize and then decrease relative to economic growth.**

Resiliency – Current transportation and water infrastructure systems are not sufficient to handle the increasing frequency of extreme weather events. WVDOT is responsible for the management of thousands of highway miles and facilities. **By studying and anticipating these types of events, WVDOT can develop strategies to preserve long-term assets and incorporate best management practices systemwide. WVDOT also continues to implement incident and emergency management practices to ensure that the system is resilient to the impact of these events.**

Some of West Virginia’s most significant environmental needs, as they relate to transportation, include operations and maintenance of infrastructure and inventory mapping.

Infrastructure Operations and Maintenance – West Virginia, like many other states, needs to maintain and improve its infrastructure by integrating efficient practices that will promote long-term sustainability. Maintaining the quality of infrastructure is an ongoing process and will require additional planning, coordination between agencies, and a sustained increase in financial resources. This includes more environmentally sensitive maintenance procedures including road treatments in advance of winter weather, maintenance and cleaning of stormwater management facilities, more efficient lighting, and use of solar panels to power highway infrastructure.

Inventory Mapping – Environmental inventory mapping is essential to understanding future transportation needs and environmental management. West Virginia currently provide some interactive mapping tools for environmental resources, but the database is incomplete. Many environmental resources in the state have not been inventoried, mapped, updated, and/or made available to the public. Understanding where these assets are located will help WVDOT to better prepare for weather events, identify environmental resources, and better plan for environmental resiliency.

The following policies and goals provide a framework to better address environmental management, resiliency planning, and transportation needs in West Virginia:

1. **Preserve transportation assets by improving the fiscal planning, prioritization, and implementation processes.**

- Seeking out federal funding programs and grants to supplement funding for transportation projects, maintenance, and infrastructure needs
- Make data-driven asset management and project prioritization a core component of the transportation planning process

TRENDS, DRIVERS, AND OPPORTUNITIES



- Incorporating targeted approaches in the maintenance program to track system progress
- Develop new partnerships and agreements with local governments, transportation agencies, utility providers, and other stakeholders to improve knowledge and operations of the transportation system
 - Enhance public education and awareness through the West Virginia State Resiliency Office and West Virginia Department of Environmental Protection.
 - Pursue opportunities to develop public-private partnerships to focus on air, water, and habitat challenges.

2. Integrate energy and technological advancements to preserve and protect the state's ecosystem services.

- Supporting energy diversification and renewable energy generation by increasing the use of renewable energy sources (solar, wind, geothermal) as alternative energy sources to decrease dependence on fossil fuels
- Mitigating harmful effects of mining and/or discontinued mining operations to create adaptive reuse opportunities
- Increasing use of energy-efficient construction materials as well as electric vehicles, autonomous vehicles, and alternative fuel vehicles
- Addressing increased need and demand for alternative transportation options in line with demographic shifts

3. Manage risks by improving environmental resiliency.

- Supporting the use of green infrastructure and stormwater applications as an opportunity for sustained environmental resiliency
- Preserving and adding green space along floodplains to manage extreme weather events
- Supporting wildlife, pollinator, and endangered species by preserving and strengthening habitats in right-of-way corridors
- Inventory and create a vulnerability assessment tool, similar to FHWA's VAST tool, to categorize and prioritize transportation infrastructure needs (i.e. culverts, bridges, channels)
- Coordinate with West Virginia Emergency Management to utilize the West Virginia Flood Mapping tool to prepare for and prevent damages from natural disasters and extreme storm events

4. Increase economic diversification through the efficient management of environmental resources and the support of tourism opportunities.

- Preserving the natural resources in WV in order to create economic diversification, through tourism, as WV transitions from coal dependence
- Coordinate with West Virginia Office of Tourism to increase advertising for outdoor opportunities
- Maintain state of good repair on transportation infrastructure systems in relation to outdoor recreation facilities

Appendix A: References

1. U.S. Environmental Protection Agency. National Environmental Policy Act. 2020. <https://www.epa.gov/nepa/what-national-environmental-policy-act>
2. U.S. Environmental Protection Agency. NAAQS Table. 2020. <https://www.epa.gov/criteria-air-pollutants/naaqs-table>
3. WV Department of Transportation. Beneficiary Mitigation Plan. 2019. https://transportation.wv.gov/highways/programplanning/comment/VW-Settlement-Mitigation-Plan/Documents/FINAL_VWmitigationPlan_WV.pdf
4. U.S. Environmental Protection Agency. Clean Water Act. 2020. <https://www.epa.gov/laws-regulations/summary-clean-water-act>
5. U.S. Environmental Protection Agency. Overview of Total Maximum Daily Loads. 2020. <https://www.epa.gov/tmdl/overview-total-maximum-daily-loads-tmdls>
6. U.S. Department of Agriculture. West Virginia Natural Resources Conservation Services. 2020. <https://www.nrcs.usda.gov/wps/portal/nrcs/main/wv/soils/>
7. U.S. Department of Transportation. Section 4(f) Regulations and Guidance. 2020. <https://www.transit.dot.gov/regulations-and-guidance/environmental-programs/section-4f-department-transportation-act>
8. U.S. Environmental Protection Agency. Overview of Superfund Sites and CERCLA. 2020. <https://www.epa.gov/superfund/superfund-cercla-overview>
9. WV Department of Environmental Protection. Office of Environmental Remediation. 2020. <https://dep.wv.gov/dlr/oer/Pages/default.aspx>
10. U.S. Department of the Interior. Surface Mining Control and Reclamation Act Laws, Regulations, and Guidance. 2020. <https://www.osmre.gov/lrg.shtm>
11. U.S. Department of Transportation. Federal Highway Administration. Climate Change Adaptation Guide for Transportation Systems Management, Operations, and Maintenance. 2020. https://ops.fhwa.dot.gov/publications/fhwahop15026/app_d.htm
12. U.S. Department of Transportation. FAST Act. 2015. <https://www.transportation.gov/fastact>
13. U.S. Department of Transportation. Vulnerability Assessment Scoring Tool. 2015. <https://toolkit.climate.gov/tool/vulnerability-assessment-scoring-tool-vast>
14. WV Legislature. House Bill 2935. 2017. http://www.wvlegislature.gov/Bill_Status/bills_text.cfm?billdoc=HB2935%20SUB%20ENR.htm&yr=2017&sesstype=RS&billtype=B&houseorig=H&i=2935
15. WV Development Office. Tourism Development Act. 2020. <https://westvirginia.gov/tourism-development-act/>
16. U.S. Environmental Protection Agency. Air Quality Greenbook. 2020. https://www3.epa.gov/airquality/greenbook/anayo_wv.html
17. Gov. Justice announces entire state of West Virginia now meeting national air quality standards for the first time since 1978, Press Release - 10/21/2020. <https://governor.wv.gov/News/press-releases/2020/Pages/Gov.-Justice-announces-entire-state-of-West-Virginia-now-meeting-national-air-quality-standards-first-time-since-1978.aspx>
18. U.S. Environmental Protection Agency. TRI Search Plus. 2020. <https://edap.epa.gov/public/extensions/TRISearchPlus/TRISearchPlus.html#>

- ## WVDOT 2050 Multimodal Long-Range Transportation Plan

TRENDS, DRIVERS, AND OPPORTUNITIES



37. West Virginia Department of Emergency Management Flood Tool. 2020. <https://www.mapwv.gov/flood/>
38. Dean Runyan Associates. West Virginia Travel Impacts 2000-2018. 2019 https://wvtourism.com/wp-content/uploads/2019/10/2019.10.15-Travel-Impacts_Final_Web-1.pdf
39. Longwoods International, West Virginia 2018 Visitor Research. 2019 https://wvtourism.com/wp-content/uploads/2019/11/2019.09.25-Lets-Talk-Data_Part-1.pdf
40. West Virginia tourism Office, 2019 Annual Report. 2020. https://wvtourism.com/wp-content/uploads/2020/03/WVTO-2019-Annual-Report_Web.pdf
41. U.S. EPA, Climate Change Impacts on Transportation. 2017. https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-transportation_.html
42. North Carolina Department of Transportation. NC Moves 2050. 2020. <https://www.ncdot.gov/initiatives-policies/Transportation/nc-2050-plan/Pages/default.aspx>
43. Ohio Department of Transportation. Draft Access Ohio 2045. 2020. <https://www.transportation.ohio.gov/wps/portal/gov/odot/programs/access-ohio-2045/access-ohio-2045>
44. Delaware Valley Regional Planning Commission. Connections 2045. 2018. <https://dvrpc.org/LongRangePlan/>
45. U.S. Energy Information Administration. Annual Energy Outlook. 2019. <https://www.eia.gov/todayinenergy/detail.php?id=38112#:~:text=EIA%E2%80%99s%20Annual%20Energy%20Outlook%202019%20%28AEO2019%29%2C%20which%20will,prices%2C%20economic%20activity%2C%20and%20technology%20and%20resource%20estimates.>
46. Bloomberg NEF. Electric Vehicle Outlook. 2020. <https://about.bnef.com/electric-vehicle-outlook/>
47. WV State Parks. Electric Vehicle Charging Stations. 2020. <https://wvstateparks.com/electric-vehicle-charging-stations/>
48. West Virginia Department of Environmental Protection. WVDEP GIS viewer V2.1. 2020. <http://www.mapwv.gov/>
49. West Virginia Department of Environmental Protection. WVDEP GIS viewer V2.1. 2020. https://tagis.dep.wv.gov/wvdep_gis_viewer/
50. U.S. Department of Transportation. Infrastructure for Rebuilding America Grants (INFRA). 2020. <https://www.transportation.gov/buildamerica/financing/infra-grants/infrastructure-rebuilding-america#:~:text=INFRA%20discretionary%20grants%20support%20the%20Administration%E2%80%99s%20commitment%20to,increasing%20accountability%20for%20the%20projects%20that%20are%20built>
51. U.S. Department of Transportation. Better Utilizing Investments to Leverage Development (BUILD). 2020. <https://www.transportation.gov/BUILDgrants>
52. U.S. Department of Transportation, Build America Bureau. Transportation Infrastructure Finance and Innovation Act (TIFIA). 2020. <https://www.transportation.gov/buildamerica/financing/tifia>
53. U.S. Department of Transportation, Federal Highway Administration. Surface Transportation Program (STP). 2020. <https://www.fhwa.dot.gov/specialfunding/stp/>
54. U.S. Department of Transportation, Federal Railroad Administration. Consolidated Rail Infrastructure & Safety Improvements Program (CRISI). 2020. <https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/consolidated-rail-infrastructure-and-safety-2>

TRENDS, DRIVERS, AND OPPORTUNITIES



55. U.S. Department of Transportation, Federal Railroad Administration. Federal-State Partnerships for State of Good Repair Grant Program (SOGR). 2020. <https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/federal-state-partnership-state-good-repair-1>
56. U.S. Department of Transportation. Fast Act. 2015. <https://www.transportation.gov/fastact>