

A background collage of various infrastructure-related icons in shades of green and yellow, including bridges, trains, planes, light bulbs, and power lines. The collage is partially obscured by a blue banner at the top and a diagonal band of colored squares (blue, orange, pink, green, blue) that runs across the middle of the page.

REPORT CARD FOR **VIRGINIA** INFRASTRUCTURE

2022

**VIRGINIA SECTION
OF THE
AMERICAN SOCIETY
OF CIVIL ENGINEERS**





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2022 Virginia Report Card Executive Summary

Virginia's infrastructure forms the foundation for health, wealth, and safety for 8.6 million residents, more than 200,000 businesses, and over 100 million annual visitors. The Commonwealth moves people and goods along the critical I-95 corridor. It boasts expanding rail service connecting 127 million pounds of freight and 1.5 million passengers annually between the Northeast Corridor and mid-American transportation nodes. The Port of Virginia shuttles increasing volumes of goods on tracks, rather than trucks, with improved dockside infrastructure. Water systems for collecting rainfall and reducing floods are improving faster than national benchmarks.

Yet, infrastructure in the Commonwealth struggles from challenges like other growing states. Northern Virginia's job creation and workforce cluster provide economic growth and increased tax revenue, but also increase the complexity of operations and maintenance, and demands on transportation systems. Virginia's roads are increasingly clogged with drivers who lack feasible transit connections and comfortable bike routes for essential trips. The Tidewater region is growing fast as well, but the proximity of inland water, in-

creasingly severe weather, and agricultural or industrial land uses pose contamination risks. Communities in rural Southwestern Virginia struggle to expand and upgrade infrastructure systems. Across the Commonwealth, inflation, workforce struggles, and political gridlock threaten infrastructure stewardship.

Infrastructure in the Commonwealth struggles from challenges like other growing states. Northern Virginia's job creation and workforce cluster provide economic growth and increased tax revenue, but also increase the complexity of operations and maintenance, and demands on transportation systems.

Virginia, however, has a lot to celebrate on infrastructure. The Commonwealth is sticking to its ambitious plans for passenger rail expansion drawn up before COVID-19 and they can be further enhanced using historically large funding from 2021's Bipartisan Infrastructure Law. Transit systems in urban, suburban, and rural areas of Virginia lost customers due to the pandemic – and rail transit struggles to pull ridership back up to normal. But bus systems like the Virginia Breeze have already attracted riders more numerous than before COVID. AM-TRAK passenger rail routes in the state are breaking records. An innovative treatment facility in Hampton Roads treats wastewater to drinking water quality standards for injection into the aquifer to control saltwater intrusion and land subsidence – a national model. Traffic deaths in the Commonwealth have steadily increased since 2018 but decision-makers at the Commonwealth Transportation Board are putting safety high on the priority list with their cornerstone budget and planning documents.

About The Report Card for Virginia's Infrastructure

While you may not think about infrastructure every day, civil engineers do because we have pledged to build it, maintain it, and keep the public safe. As an organization of civil engineers who live and work in Virginia, we want to share what its condition is and what can be done to improve it.

Methodology

The purpose of the Report Card for Virginia's Infrastructure is to inform the public and decision makers of the current condition of our state's infrastructure in a concise and easily accessible format of a school report card. Each of the categories of infrastructure covered in the Report Card is assessed using rigorous grading criteria and recent data to provide a comprehensive assessment of the area's infrastructure. ASCE has used the following criteria to discuss and grade the state of the infrastructure:

CAPACITY

Does the infrastructure's capacity meet current and future demands?

CONDITION

What is the infrastructure's existing and near-future physical condition?

FUNDING

What is the current level of funding from all levels of government for the infrastructure category as compared to the estimated funding need?

FUTURE NEED

What is the cost to improve the infrastructure? Will future funding prospects address the need?

OPERATION AND MAINTENANCE

What is the owners' ability to operate and maintain the infrastructure properly? Is the infrastructure in compliance with government regulations?

PUBLIC SAFETY

To what extent is the public's safety jeopardized by the condition of the infrastructure and what could be the consequences of failure?

RESILIENCE

What is the infrastructure system's capability to prevent or protect against significant multi-hazard threats and incidents? How able is it to quickly recover and reconstitute critical services with minimum consequences for public safety and health, the economy, and national security?

INNOVATION

What new and innovative techniques, materials, technologies, and delivery methods are being implemented to improve the infrastructure?

GRADING SCALE



EXCEPTIONAL: FIT FOR THE FUTURE

The infrastructure in the system or network is generally in excellent condition, typically new or recently rehabilitated, and meets capacity needs for the future. A few elements show signs of general deterioration that require attention. Facilities meet modern standards for functionality and are resilient to withstand most disasters and severe weather events.



GOOD: ADEQUATE FOR NOW

The infrastructure in the system or network is in good to excellent condition; some elements show signs of general deterioration that require attention. A few elements exhibit significant deficiencies. Safe and reliable with minimal capacity issues and minimal risk.



MEDIOCRE: REQUIRES ATTENTION

The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies in conditions and functionality, with increasing vulnerability to risk.



POOR: AT RISK

The infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of significant concern with strong risk of failure.



FAILING/CRITICAL: UNFIT FOR PURPOSE

The infrastructure in the system is in unacceptable condition with widespread advanced signs of deterioration. Many of the components of the system exhibit signs of imminent failure.



INCOMPLETE

The infrastructure in the system or network does not have sufficient data to provide a grade.

2022 Report Card for Virginia's Infrastructure

G.P.A.



BRIDGES



ROADS



DAMS



SCHOOLS



DRINKING
WATER



SOLID WASTE



PUBLIC
PARKS



STORMWATER



RAIL



TRANSIT



WASTEWATER



Recommendations to Raise the Grade

1. AMBITIOUSLY SEEK FEDERAL FUNDING AVAILABLE FROM RECENT FEDERAL LEGISLATION

The Bipartisan Infrastructure Law and American Rescue Plan Acts of 2021, plus the Inflation Reduction Act and CHIPS+ laws from 2022, provide limited time opportunities to close the infrastructure gaps identified in this report: 1,800 dams without safety identification, deferred parks maintenance scoring \$111 million annually, 52% of school buildings in the Commonwealth over 50 years old.

2. FOLLOW THROUGH ON PLANS TO ADVANCE TRANSPORTATION AND WATER PROJECTS

Virginia's authorized plans at the state and metropolitan level feature actions to raise the grade of every infrastructure category. However, plans to spend money in the next few years won't amount to positive change unless decision-makers at those state and local levels appropriate and allocate the funds during a likely upcoming economic downturn.

3. UTILIZE EQUITY AND CLIMATE CHANGE AS CORE CONSIDERATIONS WHEN IMPLEMENTING INVESTMENT

Many projects are “shovel ready,” but a smaller group is “shovel-worthy.” When making that judgement, historical and present-day equity data – as well as the threats from climate change – should be centered. This begins with technical assistance and cross-jurisdictional collaboration. A central constraint to improving Virginia's infrastructure are the resource and staffing levels at smaller and disadvantaged communities.



ROSSLYN, ARLINGTON, VIRGINIA, USA SKYLINE ON THE POTOMAC RIVER.



Bridges





EXECUTIVE SUMMARY

In 2015, the Virginia Legislature enacted a series of reforms and increased available revenue for its surface transportation program. It also enacted the State of Good Repair (SGR) program that mandates 30% of construction funding be provided for deteriorated pavements and structurally deficient bridges maintained and owned by VDOT and localities. The condition of Virginia's bridges improved significantly since those reforms and thanks to the additional revenue. Of the 21,250 bridges in the Commonwealth, 698 – or about 3% – are considered structurally deficient (SD, or “poor”), much better than the national average of 7.5%. This also marks a dramatic improvement from 2015, in which 1,550 bridges – about 7.5% – were structurally deficient. Looking forward, the state should emphasize preservation projects that keep aging bridges from falling into a state of disrepair.

BACKGROUND

Virginia is home to 21,250 bridges, as summarized in Table 1, including 13,660 bridges that are longer than 20 feet and therefore in the Federal Highway Administration's (FHWA) National Bridge Inventory (NBI). Virginia is one of only a few states in which most

secondary roads and bridges are managed directly by the state highway department. Thus, Virginia has the third largest number of state-owned highway structures in the U.S., after Texas and North Carolina.

TABLE 1. VIRGINIA HIGHWAY STRUCTURES BY RESPONSIBLE OWNER CLASSIFICATION (VDOT, JUNE 1, 2022)

Owner	NBI Bridges			Non-NBI Bridges			All Bridges		
	Non-NHS	NHS*	Total	Non-NHS	NHS*	Total	Non-NHS	NHS*	Total
VDOT	8,737	3,365	12,102	6,017	1,539	7,552	14,737	4,912	19,649
Locality	1,122	346	1,468	27	3	28	1,140	348	1,488
Other	35	55	90	3	1	4	38	56	94
Total	9,894	3,766	13,660	6,047	1,543	7,590	15,941	5,309	21,250

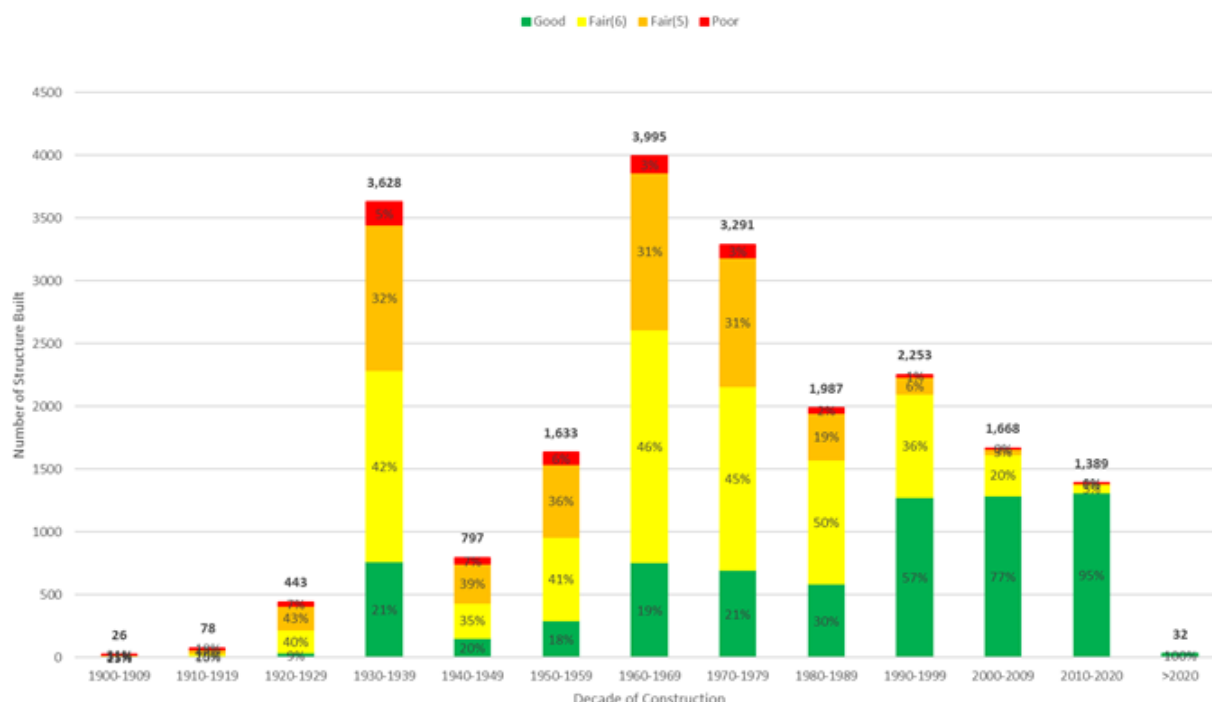
* NHS denotes National Highway System

CONDITION

Figure 1 shows the distribution of bridges by year built, grouped by decade. Though highway agencies routinely build bridges to last 75 years or more today, such was not the case before 2007 when most bridges were designed

for a 50-year design life. Nearly 51% of Virginia's bridges are more than 50 years old and have met or exceeded their expected service life.

FIGURE 1. AGE DISTRIBUTION OF VIRGINIA'S HIGHWAY STRUCTURES (VDOT, 2020B)



**many bridges adopted under the Byrd Act of 1932 are of unknown age and are recorded as having been built in 1932.*

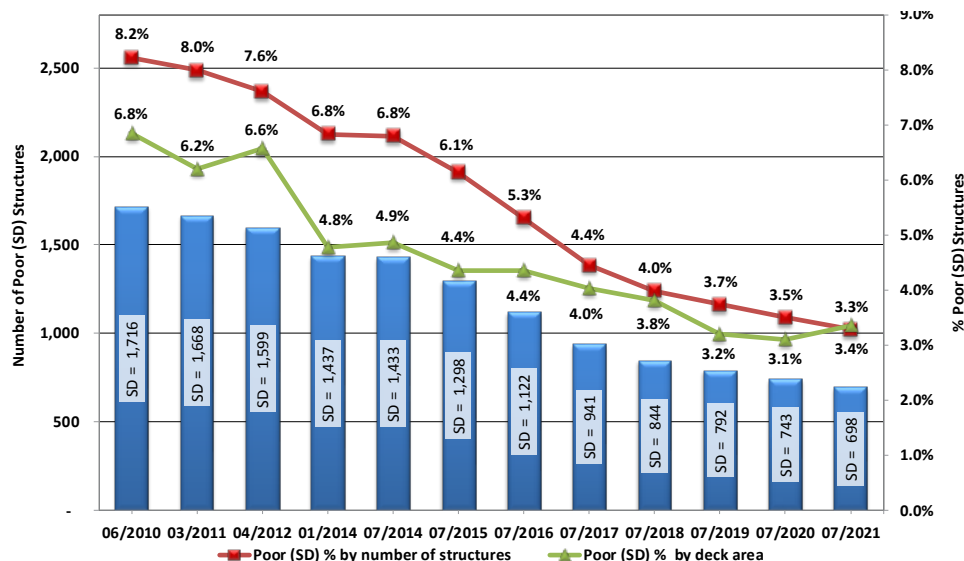
As of July 1, 2021, 698 of the 21,250 bridges in Virginia – or about 3% – are considered structurally deficient (SD, or “poor”). This marks a dramatic improvement from the 2015 report card, in which 1,550 bridges – about 7.5% - were structurally deficient. Over the past five years VDOT has made a significant effort to improve or replace structurally deficient (poor) bridges on all highway systems.

Federal regulations now require that states develop a Transportation Asset Management Plan for their highway infrastructure and report bridges that are in Good or Poor condition, where Good is defined as a bridge having a lowest General Condition Rating (GCR)

of 7 or better and Poor is a bridge having any GCR of 4 or lower. A “Poor” condition rating is equivalent to a structurally deficient rating.

An excerpt from the 2021 VDOT State of the Structures and Bridges Report (VDOT, 2021b) shows the steady progress made in reducing the number of structurally deficient (poor) bridges over the past decade. Improvements have been significant in all metrics, whether measured in terms of total number of structures, percentage of structures by count, or percentage of cumulative deck area of structures.

FIGURE 2. TREND IN POOR BRIDGES IN VIRGINIA OVER THE PAST DECADE (VDOT, 2021A)



CAPACITY

Capacity of bridges can be understood in two ways: 1) traffic capacity and ability to not constrict flow of the traffic on the connected roadway, and 2) structural capacity to carry heavy vehicles such as trucks. The first can be determined from how well a structure conforms to roadway geometry requirements and is addressed in the roads chapter of this report. The latter is determined from load rating and posting.

Load posting is required for bridges that do not have enough capacity to safely carry legal loads. The number of structures posted by highway system are shown in Table 2. As of July 2021, 1,303 bridges and culverts

(approximately 6.1%) in Virginia had been posted to restrict loads. On 609 of these structures, postings limit single unit vehicle loads to less than 20 tons (e.g. tractor trailers), and 97 of the structures to less than 10 tons (e.g. medium-duty pickups). Most (83%) of the load-restricted structures are on secondary routes, which tend to be rural, carry a much smaller proportion of overall traffic volume, and are often not critical to commerce supported by heavy trucks. A 2019 resolution by Virginia's Commonwealth Transportation Board established a performance goal to limit the number posted bridges on the interstate highway system to zero, which has been achieved without interruption.

TABLE 2. NUMBER OF POSTED STRUCTURES BY HIGHWAY SYSTEM

Interstate	Primary	Secondary	Total
0	179	1,027	1,303

FUNDING

Virginia's bridge funding is administered primarily through five distinct programs: the Highway Maintenance and Operating Fund (HMOF), the State of Good

Repair (SGR) program, the Robert O. Norris Special Structures Fund, the High Priority Projects Fund, and the Infrastructure Investment and Jobs Act (IIJA) funds.

Funding levels for each program vary by year, but the annual averages are approximately \$215 million for the bridge portion of the HMOF, \$225 million for SGR, \$70 million for special structures (in 2019 dollars), and \$115M for the IJA bridge formula funds. Bridges are only part of the mandate for the High Priority Projects Fund, so reliable data are not yet available for the average annual funding levels for bridges under this program. Finally, some of Virginia's bridges are funded through public-private-partnership projects such as Transform 66. These projects provide a significant contribution to Virginia's overall bridge program, but they are instituted on an ad-hoc basis and do not constitute a consistent, predictable source of funding.

VDOT's budget for FY2023 is \$9.2 billion. The majority of revenue comes from the Commonwealth Transportation Fund (51%). This fund consists of state-supplied revenues from fuel taxes, motor vehicle sales/use taxes, retail sales/use taxes, motor vehicle license tax, insurance premiums, and locally administered taxes. MPO funds (11%); federal funding (18%); and other sources (20%) provide the remainder of revenue.

In addition to apportionment from the Federal Highway Administration (FHWA) through the federal Highway Trust Fund, Virginia obtains funding through a statewide gas tax that feeds into its HMOF, which is distributed to VDOT and other Commonwealth agencies and entities. By law, maintenance of the existing system must be funded first, which occurs primarily through the HMOF.

In addition, two regions, Northern Virginia and Hampton Roads, have dedicated regional tax programs allocated specifically to the Northern Virginia Transportation Alliance and the Hampton Roads Transportation Accountability Commission for transportation improvements in those regions.

Capital needs are programmed through the Six-Year Improvement Program (SYIP), which is updated annually. The current Six-Year Financial Plan adopted by the Commonwealth Transportation Board (CTB) totals \$17 billion to highway projects for FY 2022-2027.

OPERATION & MAINTENANCE

In 2015, the Virginia legislature enacted the State of Good Repair (SGR) program. The program mandates that 30% of construction funding be provided for deteriorated pavements and structurally deficient bridges maintained and owned by VDOT and localities. SGR requires funds be distributed proportionately between VDOT and localities, based on assessed needs. The funds are used to address repairs on bridges deemed structurally deficient on the National Bridge Inventory on interstate and primary

highways. Each district receives between 5.5% and 17.5% of the total available SGR funds in any given year based on the SGR needs. This dedicated funding stream ensures that Virginia's aging bridges will have a significant source of funding for reconstruction of bridges that reach the end of their service lives. The program has enabled Virginia to make considerable progress toward reducing the number of structurally deficient bridges in its inventory, as shown in the chart below:

Programming Status of National Bridge Inventory Structurally Deficient (Poor) Bridges					
Owner	In Construction Program			Not Yet Programmed	
	Number of Projects	Allocated Funds		Number of Projects	Percentage of NBI Bridge Inventory
		SGR Allocations	Total Project Allocations		
VDOT	215	\$1,271M	\$1,709M	263	1.9%
Localities	66	\$170M	\$272M	26	0.2%
Total	281	\$1,441M	1,981M	289	2.1%

Specific projects in the program are identified in VDOT's SYIP and in the annually produced State of the Structures and Bridges Report.

Special Structures

In 2019, the Virginia legislature enacted the Statewide Special Structure Fund as defined by §33.2-1532 of the Code of Virginia, known as the *Robert O. Norris Bridge and Statewide Special Structure Fund*. This fund is used to

support 25 of the largest and most significant structures in Virginia's inventory. The list includes 6 tunnels, 9 movable bridges, and 10 large, fixed-span structures. These structures have very large funding needs to match their complexity and importance to the transportation network. By establishing this specially managed fund, Virginia ensured that these critical parts of its highway system get the funding and attention they need.

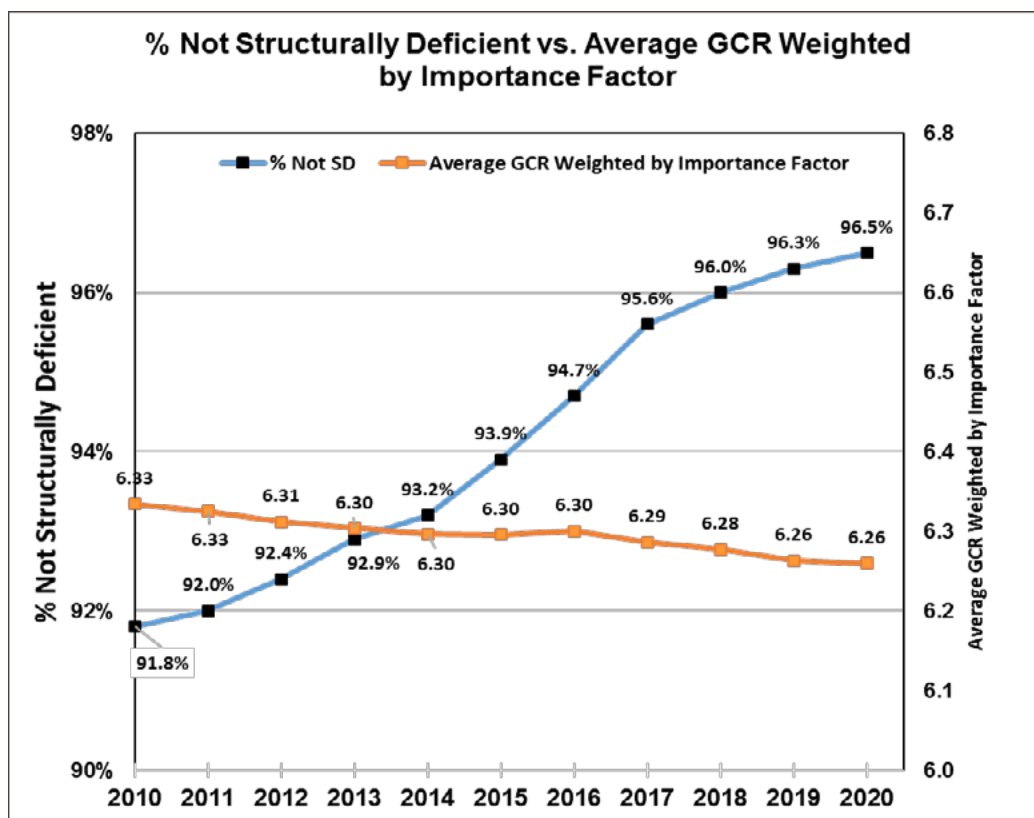
FUTURE NEED

As noted earlier, much progress has been made in recent years to decrease the number of structurally deficient/poor condition bridges, particularly on interstate and primary routes. However, structurally deficient bridges are only a fraction of Virginia's bridge inventory, so their status says very little about the other 97% of bridges in the Commonwealth.

In order to develop a data-driven approach to the management of its assets, VDOT performed its Comprehensive Review in 2019. This effort was a statewide, long-term review of its investment strategy with particular focus on bridges and pavements. The

effort sought to determine if VDOT was investing its funds and measuring its performance in the most appropriate manner. It also sought to establish meaningful performance measures and performance targets based on acceptable levels of service.

As shown in the chart below, while the percentage of structurally deficient bridge has been improving, this has been accompanied by a decline in average general condition rating (GCR), which suggests that an exclusive focus on structurally deficient bridges is not a sustainable approach over the long term.



The study found that Virginia's total funding could provide an acceptable level of service for the next 50 years if it changed its investment strategy. Prior to 2019, Virginia spent about 75% of its available bridge funding on structurally deficient bridges and 25% on preservation. The study found that this allocation needed to be reversed, and that 75% should apply to preservation, and 25% should

be applied to structurally deficient bridges. Adoption of this approach meant that current funding levels of \$113 million for interstate structures, \$158 million for primary structures, and \$113 million for the secondary structures are acceptable. However, if the "worst first" approach were continued, the long-term projections of overall bridge condition would suffer.

PUBLIC SAFETY

Agencies that own bridges take their jobs very seriously and maintain safety as the number one priority. VDOT exemplifies this commitment through its careful execution of the National Bridge Inventory Standards safety inspection, load rating, and weight posting programs and through proactive preservation and maintenance

programs. While structures do occasionally reach poor condition or SD status, those structures are monitored closely and earmarked for repair, rehabilitation, or replacement as needs and funding dictate. Bridges that are deemed by VDOT bridge engineers to be potentially unsafe are restricted or closed to safeguard the public.

RESILIENCE

VDOT has designated hurricane evacuation routes and structures in coastal regions are designed to withstand significant impacts of flooding and storm surge. Chapter 33 of the VDOT Manual of the Structure and Bridge Division addresses considerations of climate change and

coastal storms. Its provisions build on prior efforts to extend service life of structures through more durable materials, but now include consideration of environmental factors such as sea-level rise, temperature change, and increases in rainfall intensity and storm surge,

INNOVATION

Through the Virginia Transportation Research Council, a partnership of VDOT and the University of Virginia since 1948, VDOT has invested millions of dollars per year over decades to enhance the state of the practice in highway transportation. Research relevant to bridges includes innovative materials to improve durability, structural efficiency, construction quality, and economy. Among many other innovations, VDOT has been a leader in implementing:

- high-performance concrete – all concrete used in VDOT highway structures is required to include supplementary cementitious materials designed to reduce permeability and shrinkage cracking. VDOT is also using fibers to improve serviceability and ductility.
- corrosion-resistant reinforcement and prestressing – every interstate and high-volume primary bridge requires corrosion-resistant reinforcement in its bridge deck. All coastal structures require stainless or carbon-fiber composite prestressing in piles to resist corrosion.

- integral design of superstructures to eliminate deck joints – VDOT has been using integral and semi-integral designs and retrofitting existing simple-span structures to eliminate deck joints to extend service life.
- elastomeric concrete deck joints – VDOT has conducted proof-of-concept implementation of elastomeric concrete to provide flexible deck joints that resist cracking.
- laser-ablation steel coating removal – VDOT has funded applied research into the application of laser ablation technology to efficiently and safely remove lead-based paint from structural steel bridge superstructures without need for extensive containment.



Bridges



RECOMMENDATIONS TO RAISE THE GRADE

- Focus on system preservation and direct the majority of its funding to preserving existing structures rather than address them at the end of their service lives. More specifically, change the existing funding structure so that 75% of available support for bridges is directed to preservation and 25% is directed toward structurally deficient bridges.
- Institute statewide programs to systematically address fair bridges on high volume roads.
- Continue to prioritize innovative bridge maintenance and design.

SOURCES

Virginia Department of Transportation (2018), *State of Good Repair (SGR) Program Bridge Prioritization Formula*, August 2018.

Commonwealth Transportation Board (2019), Agenda item # 9 - RESOLUTION OF THE COMMONWEALTH TRANSPORTATION BOARD - *Approval of Comprehensive Review Report related to the Robert O. Norris Bridge and Statewide Special Structures Fund and Asset Condition Performance Targets*, Commonwealth of Virginia, December 11, 2019.

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Virginia Department of Transportation (2020a), *Virginia Bridges* spreadsheet, (unpublished), courtesy A. Matteo, filename "Virginia Bridges 2020-02-10.xls", February 2020.

Virginia Department of Transportation (2021b), *State of the Structures and Bridges Fiscal Year 2020*, June 2020, www.vdot.virginia.gov/info/bridges/state-of-the-structures-and-bridges



Dams





EXECUTIVE SUMMARY

There are 2,634 state-regulated dams in the Commonwealth of Virginia. They're pillars of water supply, flood control, irrigation, and recreation. Inspection of and emergency planning for these structures – particularly the 359 high hazard potential dams – is crucial. Over 50% of all state regulated high hazard dams have been inspected annually since 2017, a significant improvement from 2008 to 2012, when just 25% of high hazard potential dams were inspected each year. Ninety seven percent of the high hazard inventory have Emergency Action Plans, higher than the national average of 81%. Additionally, funding for state dam safety inspections has increased over the past decade. However, the average age of Virginia's dams as of 2020 is 74 years old, significantly older than the national average of 57 years. We don't have age data for most Virginia dams, meaning the problem could be much worse than known. Meanwhile, there are 1,842 dams in the state that report an undetermined hazard classification.

CAPACITY AND CONDITION

Dams play a central role in the Commonwealth's economy with 118 (4%) used for water supply, 264 (10%) for flood

control, 268 (10%) for irrigation and 1,127 (43%) for recreation.

TABLE 1 - VIRGINIA DAMS BY HEIGHT

Height	Number	Percentage
Less than 25 feet	1272	48%
25 to 50 feet	1183	45%
50 to 100 feet	136	5%
Greater than 100 feet	43	2%
TOTAL	2634	100%

Nearly three quarters of the dams in the Commonwealth are earth dams and more than 90% of the dams are less than 50 feet in height (Table 1).

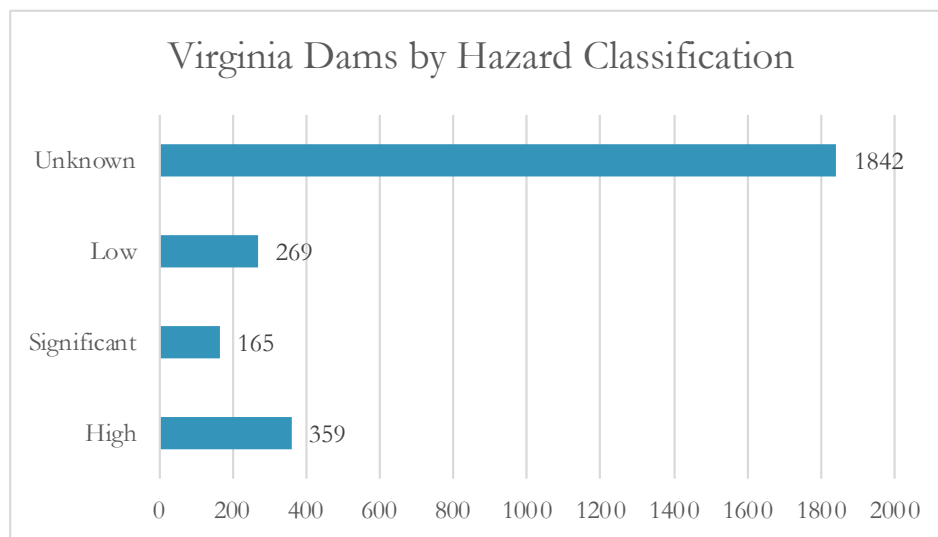
Dams are classified based on their hazard potential or anticipated downstream consequences in the event of failure. The failure of a dam that is classified as high-hazard-potential if anticipated to cause a loss of life. As of 2022,

there are 359 state-regulated high-hazard potential dams in Virginia. The number of high-hazard potential dams is increasing as development steadily encroaches on once rural dams and reservoirs.

Dams can also be classified as significant-hazard potential or low-hazard potential. Significant hazard potential means a failure would likely cause significant economic damage, but not necessarily loss of life. There are 165 dams that are classified as significant hazard in Virginia.

Dams where failure or mis-operation would result in no probable loss of human life and low economic losses are given a low hazard potential rating. The Commonwealth is home to 269 low hazard potential dams.

Importantly, 1,842 of the Commonwealth's dams have an undetermined hazard classification. That means we don't have enough information to determine the risks downstream to the dam.



Dam age is not available for almost 95% (2,616) of the dams in the Commonwealth. Of the 143 dams where age is known, 76% (109) are more than fifty years of age – which is generally held to be the design life of a dam.

Dam and spillway capacity can lag especially for older dams that were built before the development of more modern analytical methods such as NOAA Atlas 14 and NWS Hydrometeorological reports which consider the occurrence of new, more powerful storms that have occurred since the original design criteria was developed.

Inspection is crucial to dam safety. 92% of the state-regulated high hazard potential dams were inspected in 2020 and 72% were inspected in either 2018 or 2019. Over 50% of all state regulated high hazard dams have been inspected annually (every year) since 2017. This shows significant improvement compared with approximately 25% of all high hazard dams being inspected annually from 2008-2012. However, it is still not an ideal 100% annual inspection rate as required by

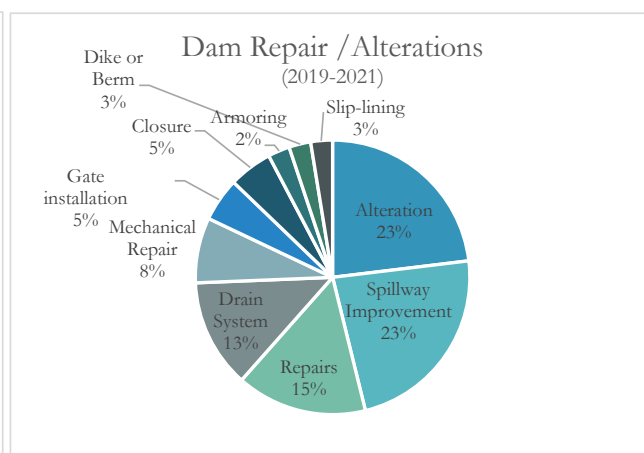
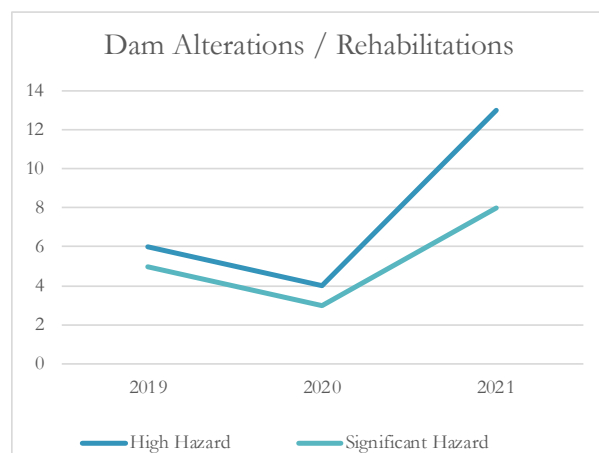
state law and suggests limited resources and diligence on the owners' part may be a challenge.

Beginning in 2010, the Association of State Dam Safety Officials (ASDSO) in conjunction with the various states, began to collect data on incidents and failures. The ASDSO database shows there have been 29 recorded incidents in dams in the Commonwealth. There were 16 incidents in 2018 and five in 2019. Importantly, 12 of the 29 incidents had high hazard risks downstream. In 2020, there were several incidents including the Spring Valley Dam near Roanoke and the College Lake Dam in Lynchburg. State records as of June 2022 show a total of 72 incidents since January 1, 2010, including 23 incidents since January 1, 2019.

One challenge in assessing the condition of dams in the Commonwealth is the remarkable insufficiency of the dam database. There are significant number of dams where key characteristics of the dam such as ownership, age, and hazard classification are unknown. 80% of the dams in

the Commonwealth have an undetermined construction date. Additionally, dam purpose, hazard classification and ownership information is missing for more than 20% of the dams. For many dams, the data paucity could mean they were built prior to Virginia Dam Safety Program's initiation in the early 1980s.

Some dams in the Commonwealth have been modernized or rehabilitated in recent years. Based on Record Report submittals to Virginia government from 2019 to 2021, a total of 23 High Hazard Dams and 16 Significant Hazard dams had alterations completed including Spillway Improvements (9), Repairs (6), and installing a drain system (5).



OPERATION AND MAINTENANCE

Responsibility for dam regulation rests primarily with the Virginia Department of Conservation and Recreation (DCR). In 2020, DCR had a budget of \$1.59 million. Regulated dams are issued either Regular Operation and Maintenance Certificates (6-year duration) or Conditional Operation and Maintenance Certificates which are good for two years. Conditional Certificates are issued when studies, inspections, alterations or other items are out of compliance with State regulations.

Other agencies responsible for dam operation and maintenance include dams that were constructed as

part of hydroelectric facilities. These structures have a revenue stream and are generally well maintained by utility companies. Some smaller dams constructed with highway projects as stormwater management facilities are operated and maintained by the Virginia Department of Highways. Meanwhile, a large number of dam structures in the Commonwealth are owned by private properties. Private dam owners often lack adequate resources to maintain their dam structures, and many of these receive irregular maintenance. The State works with such owners to inform them of funding opportunities and assist them in developing a feasible compliance schedule.

FUNDING

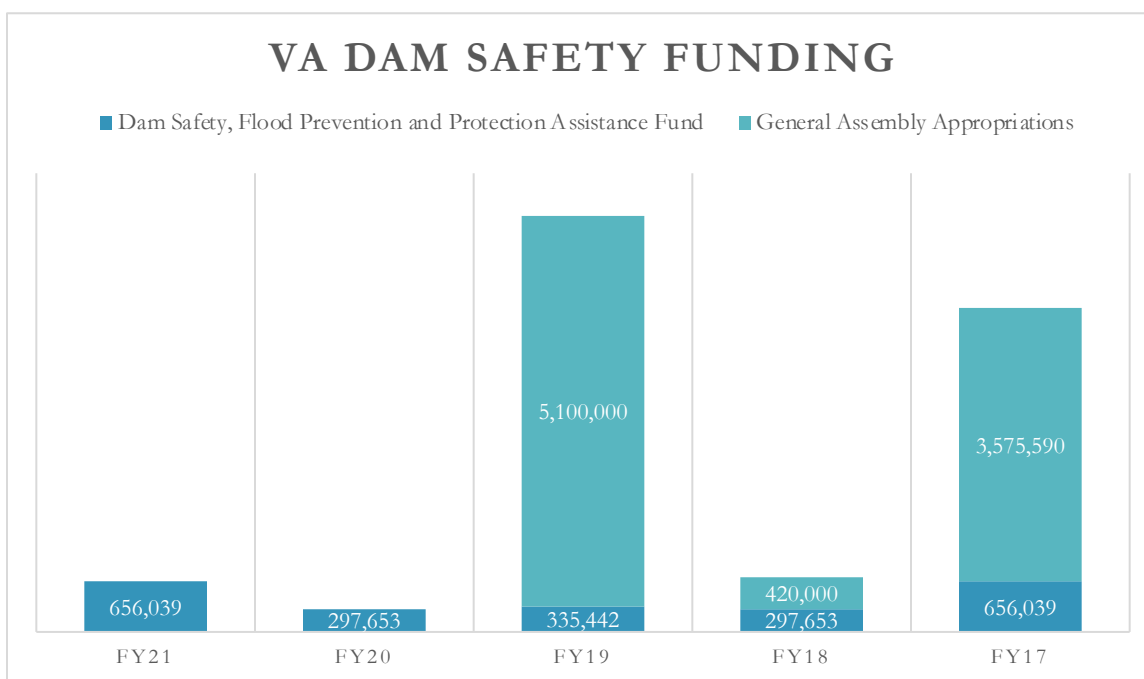
Unfortunately, information to determine necessary funding for superior dam safety is old. A 2011 report by DCR identified 117 high hazard dams that do not meet minimum standards for public safety. Twenty-one of those structures were owned by the Commonwealth, 37 were owned by water conservation districts, 23 by local governments, 33 were privately owned and 3 were owned by utilities. The total cost of bringing the dams owned by a governmental entity up to standard in 2011 was estimated

to be \$168 million. Adjusting these costs to 2020 suggests a cost of \$211 million to bring these dams up to minimum standards. Meanwhile, a 2016 ASDSO report found the cost of remediating all Virginia dams was estimated to be \$1.12 billion (\$1.37 billion in 2020 dollars).

The Commonwealth has some limited funding and financing available for dam repair through the Virginia Dam Safety Flood Prevention and Protection Assistance Fund. The fund helps public and private dam owners

protect the public by reducing the risk of dam failures and flooding. The Virginia state legislature approves support for the fund, and not all categories of funding are available

each year. Total state grant approval by year is included in the chart below.



A 2020 ASDSO report notes that the State budget is \$2,072 per regulated dam compared to a national average of \$756 per dam. High-hazard potential dams in Virginia receive \$4,801 per year, compared to the national average of \$4,875 per year of dams in that category.

Over the last 10 years, funding has not increased significantly, but the number of dams of large enough for

regulation has increased. The Commonwealth continues to have a slightly lower number of state-regulated high-hazard dams per full time equivalent staff person than the national average, but an above average of number of all state regulated dams per full time equivalent per staff person. State Funding for 2021 totaled \$1.7 Million. Though not included in State funding, the High Hazard Potential Dam Grants and other FEMA grants managed by the State support state dam safety efforts.

FUTURE NEED

The overwhelming number of high hazard dams that do not meet safety standards are owned by governmental entities (state, water conservation districts or local governments). Bringing these dams up to the required standards is a key future need.

The average age of Virginia's dams as of 2020 is 74 years old, significantly older than the national average of 57 years. Dam age is not necessarily a reflection of hazard

potential, but it is an indication that most dams have not been built to current standards or understandings of the changing climate. Furthermore, at the time of their construction, they may have been considered low hazard potential, so they may not be able to withstand the increasingly frequent and severe weather events.

PUBLIC SAFETY

In 2010, 200 of the Commonwealth regulated high hazard dams had an Emergency Action Plan (EAP). As of 2022, A total of 244 dams – 68% of the state high hazard inventory – have EAPs that are up-to-date (defined by state code as having been written or updated within the past 6 years). A total of 347 dams – 97% of the high hazard inventory – have EAPs that were updated within the last 12 years. This is higher than the national average which reports 81% of dams having an EAP. Additionally, between 2013 and 2018, 40% of the EAPs had been exercised. Conducting regular exercises is important because it aids in making sure the EAP remains up to date and effective.

RESILIENCE

On May 21, 2020, heavy rains caused flooding which threatened the Spring Valley Dam near Roanoke. The dam is a reinforced earth structure 430 feet in length with a height of 29 feet. The reservoir holds 80 acre-feet of water. Data from the state database DSIS indicates the dam was built in 1965 and is owned and operated by Spring Valley Lake, LLC

At 1:00 AM, residents in 13 homes were evacuated. An additional 60 structures, including a hotel, were

The State has undergone a number of efforts to contribute to public safety through systems that can provide early warnings as well as situational awareness. These capabilities contribute to public safety by leveraging modern technologies.

also evacuated in southeast Roanoke. By morning, the Regional Dam Engineer from DCR was on the scene inspecting the dam and determined the dam was not in danger of failing. The Fire Department noted that the evacuations were ordered out of an abundance of caution.

This incident is a good example of local and state agencies working together and being highly responsive, it also underlines the importance of resilience for dams in an era of increased storm water and floods.

INNOVATION

The State has undergone a number of efforts to contribute to public safety through systems that can provide early warnings as well as situational awareness. These capabilities contribute to public safety by leveraging modern technologies.

- DCR procured remote water level monitoring stations for installation on district owned and operated dams. The monitoring stations provide electronic alert messages based on flow stage triggers designated in the dam's EAP. Monitoring stations are operational for 18 dams and another 60 monitoring stations are in the process of being installed.
- The state is also increasing the number of Integrated Flood Observing and Warning System (IFLOWS)

gauging stations under the direction of Virginia Department of Emergency Management. IFLOWS stations provide real time river stage data.

- A software-based Emergency Dashboard was developed that is integrated with DSIS and reports and ranks hourly precipitation depths alongside critical dam information and potential stage triggers for each dam. The dashboard is powered by a GIS model that samples Quantitative Precipitation Estimate (QPE) data for each dam watershed. QPE data are rainfall accumulation values calculated based on radar and satellite data. NOAA continually processes QPE data and publishes it hourly in the form of a national 1km x 1km gridded dataset.



Dams



RECOMMENDATIONS TO RAISE THE GRADE

The following recommendations are offered to improve dam safety in the Commonwealth of Virginia:

- That the Commonwealth undertake a \$250M five-year capital program of approximately \$50 M per year to bring all high hazard dams that are owned by a government entity up to the required safety standards.
- That a concerted effort be undertaken to bring the database of dams in the Commonwealth up to date and eliminate the large number of key entries that are unknown. This task is manpower intensive; it is suggested that a multi-year program of summer college internships be established to be supervised by the Regional Dam Engineers. Engineering, geology, GIS and similar college majors would be candidates for these internships.
- That dam Emergency Action Plans (EAP) be exercised at an increased pace such that 100% of dams with EAPs are exercised in any three (3) year period.
- Virginia law should be revised to remove exemptions from permitting for special classes of dams.
- Increased emphasis should be placed on understanding and improving the resilience of dams in the Commonwealth.

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Drinking Water





EXECUTIVE SUMMARY

Over the last six years, increased funding and an emphasis on operation and maintenance by the Commonwealth of Virginia's drinking water infrastructure owners have resulted in improved physical conditions. Accelerating improvements, the General Assembly allocated \$100 million from the federal COVID-19 American Rescue Plan to improve drinking water infrastructure in the Commonwealth. State funds are available for lead service line replacement, and since 2017, the City of Richmond, Washington County, Henry County, and the City of Chesapeake have received funding for these projects. The City of Alexandria has reduced lead pipes by 25% over the last four years. As populations grow, particularly in Northern Virginia and along the coast, municipalities are building new treatment plants and up-grading distribution networks. However, legacy systems are aging, and there are anecdotal reports of some pipes being over 100 years old. These systems require robust maintenance and regular funding for modernizations.

CAPACITY AND CONDITION

The Virginia Department of Health (VDH), Office of Drinking Water (ODW) is the primacy agency for implementation of the Safe Drinking Water Act (SDWA) in the Commonwealth of Virginia. SDWA defines a public water system, also known as a waterworks in Virginia law and regulations, as “a system that serves piped water for human consumption to at least 15 service connections or 25 or more individuals for at least 60 days out of the year.” There are currently 2,808 waterworks in the Commonwealth of Virginia collectively serving approximately 7.6 million consumers, or about 89% of the total population.

The SDWA categorizes waterworks into three system types: community, non-transient non-community (NTNC), and transient non-community (TNC). VDH regulates 509 NTNC waterworks, which provide drinking water to schools, day care centers, industrial centers, factories, and other facilities that serve at least 25 of the same persons 6 months out of the year. VDH

also regulates 1,206 TNC waterworks, which serve 25 or more different people for at least 60 days a year at areas such as hotels, restaurants, campgrounds, and marinas. The 2015 United States Geological Survey (USGS) Water Use Report estimated that approximately 1.56 million Virginians depend on private groundwater wells for their domestic water supply estimating around 20% of Virginia's public and private residential water supply.

Across the state, the capacity of drinking water treatment plants and distribution networks is sufficient as Virginia is fortunate to have an abundance of natural source waters including many rivers and viable groundwater systems. While there has been some concern of the water levels of the massive Potomac groundwater aquifer used in the southeastern part of the state, initiatives have been instituted to better manage this source via recharge injection of treated domestic wastewater.

Also of note, many treatment processes are purposefully designed with redundancy (i.e., duplication) to ensure

there is sufficient capacity if part of the treatment plant needs to be shut down, for example, due to extended maintenance. This further ensures sufficient system capacity. Arlington County, Fairfax Water, City of Norfolk, and City of Richmond include treatment plant upgrades and redundant facilities in their capital improvement plans.

In general, the condition of treatment plants and pipes vary around the Commonwealth. For example, more than 65 of the 500 miles of water mains in Arlington County are 50 years or older, which makes breaks in the pipes both unavoidable and unpredictable. There are anecdotal reports of 100-year-old piping still in service in the Commonwealth. However, newer community developments are supported by new infrastructure installed at the time of construction.

Some utilities in Virginia are specifically investing in capacity enhancements. In 2019, Loudoun County linked a six-mile pipeline to their Potomac River Water Pumping Station to the quarry and the Trap Rock Water Treatment Facility to increase capacity of drinking water from 40 to 60 million gallons per day. Fairfax Water announced in 2021 that it would install two new 42-inch pipes underneath the Occoquan River to the Griffith Water Treatment Plant in Lorton, drilling a tunnel beneath the river to pull water from the Occoquan Reservoir and distribute it to Prince William County. New pipes would also handle higher pressure at connections between Fairfax Water and its wholesale customers in Prince William County, the Service Authority and Virginia American Water.

Utilities are also investing in their systems to remove lead service lines, once popular before health implications were fully understood. In 2018 there were 2,641 utility-owned service lines classified as “potentially lead, unknown or presumed lead” in Alexandria, according to Virginia American Water Company (VAWC), the sole water distributor in the city. Since then, the utility has reduced lead pipes by 25% and about 3% of the utilities pipes still have lead remaining.

The location of all lead pipes in the state are currently unknown. However, the Safe Drinking Water Act of 2022 will require all states to submit a full inventory of lead pipes to the EPA by Oct. 2024, which means states and utilities must work on compiling all that data now.

Pumps and mixers need replacement relatively more frequently, and this must occur in order to continue producing potable water. Most locality capital improvement plans include treatment plant equipment and pump replacements and upgrades.

In addition to repairing and replacing water pipes, utilities must regularly invest in their treatment plants. Treatment plant cost estimates in the Commonwealth have ranged between \$44 and \$128 million. The Town of Strasburg constructed new water and wastewater plants in 2013 and 2015, respectively, in order to meet state and federal standards, resulting in debt service payments. The Ni River Water Treatment Plant in Spotsylvania was originally constructed in 1974 as a 1 million gallons per day (MGD) facility. It has since been expanded and updated several times to its current rated capacity of 6 MGD with the last update finishing in 2019.

The location of all lead pipes in the state are currently unknown. However, the Safe Drinking Water Act of 2022 will require all states to submit a full inventory of lead pipes to the EPA by Oct. 2024, which means states and utilities must work on compiling all that data now.

PUBLIC SAFETY

ODW is responsible for oversight of the systems and ensuring owners take corrective action if water quality standards are not met. Although federal data revealing the number of “serious violations” in Virginia have gone down almost fivefold since 2011, data reported to the EPA show problems in some water systems. The town of Amherst, near Lynchburg, Virginia, reported lead levels up to three times higher than EPA’s “action level” in some homes it sampled between Jan. 2015 and June 2019. The town helped bring those levels below the threshold by adding an anti-corrosive chemical to coat pipes, according to its 2019 report. In 2020, 2% of public water systems reported dangerous levels of contamination that could threaten human health, and

the state agency focused on correcting problems at 35 “serious violators.”

Two concerns are the level of lead in drinking water and the presence of total trihalomethanes (TTHM) and Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS). The Virginia Department of Health plans to conduct a study to regulate the presence of chemicals in drinking water. As of 2021 additional funding has been provided to VDH-ODW to continue its study of the occurrence of PFAS in the Commonwealth’s public drinking water and to develop recommendations for specific maximum contaminant levels inclusion in regulations of the Board of Health applicable to waterworks.

FUNDING

Drinking water infrastructure is funded with a combination of water rates, some very limited grant funding, and financing through loan programs. In the rapidly growing communities, such as in Northern Virginia, around Richmond, or along the coast, there are stronger tax or customer bases to support drinking water infrastructure. Similarly, it can be common for developers of new communities to fund the drinking water infrastructure like pipelines and then transfer ownership to the municipality. As a result, funding drinking water infrastructure is easier in high-growth areas of Virginia.

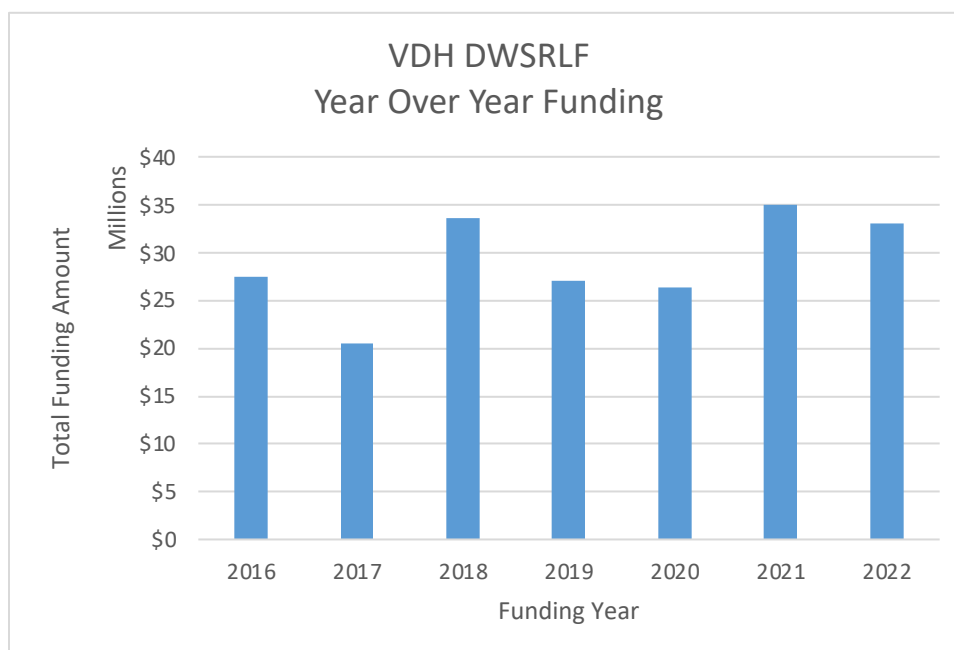
However, Virginia also has many older communities with shrinking populations due to the loss of industries. With a shrinking tax/customer base, economic sustainability

and funding projects can be exceptionally challenging. In recognition and response, VDH has programs available for smaller or economically challenged communities to apply for funding to support water infrastructure projects. This includes \$100 million from the federal American Rescue Plan to help small and disadvantaged communities with drinking water infrastructure improvements.

VDH Drinking Water State Revolving Loan Fund (DWSRLF) provides funding and financing opportunities for drinking water infrastructure. Upon reviewing the VDH DWSRLF Project Priority Lists between 2016 – 2022, 12 to 31 projects have been funded each year for a total funding between \$20.5 - \$35 million per year.

Year	DWSRLF Awarded	Total Projects Awarded
2016	\$27,563,300	24
2017	\$20,484,525	31
2018	\$33,574,633	12
2019	\$27,103,740	24
2020	\$26,409,758	21
2021	\$34,979,253	20
2022	\$33,132,570	13

VDH'S FY2016-2022 PROJECT PRIORITY LIST/ COMPREHENSIVE PROJECT LIST



It is worth noting that state funds are provided for lead service line replacement. The Virginia Financial & Construction Assistance Programs (FCAP) established its Lead Service Line Replacement (LSLR) Program in 2017. Since then, FCAP has worked with the City of

Richmond, Washington County, Henry County, and the City of Chesapeake to replace lead service lines. Two million dollars per year is currently allocated for the LSLR Program.

OPERATIONS AND MAINTENANCE

The number of licensed waterworks operators in Virginia is shrinking. Staff attributes this decrease to an aging workforce and operators retiring. To help increase the number of licensed operators, VDH-ODW is continuing to offer low cost education solutions.

ODW staff does not conduct leak detection, as leak detection requires extensive training and expensive equipment. Instead, ODW fund applications for leak detection equipment. For example, the Virginia Rural Water Association (VRWA) offers leak detection services that can help smaller systems find leaks. Water Circuit Riders, meanwhile, can assist with leak detection across the whole state

Rural communities frequently lack the technical capacity to conduct asset management plans. However, there are increasingly innovative solutions for smaller utilities to take advantage of. During the 2021 reporting period, the collective efforts of VDH contractors and Virginia Rural Water Association (VRWA) produced source water protection plans (SWPPs) for 40 community water systems (CWS). This effort exceeded the goal set in FY2020 and maintained in FY2021 to increase the metrics 1% from the FY2019 goal. Some waterworks began purchasing water from systems who are already implementing protection plans.

RESILIENCE

In general, Virginia has an abundance of source waters, yet even these can be susceptible to stressors like droughts and sea level rise. Many communities (Arlington Co., City of Fredericksburg, Rivanna Water and Sewer Authority, and Western Virginia Water Authority) have improved their resilience by creating conservation programs.

Population growth can stress the resiliency of source waters, treatment plants, and distribution networks. Some communities like Chesterfield County, Fairfax County, and City of Virginia Beach have addressed this by working towards developing more water sources or via purchasing water from other communities. Arlington and Fairfax Counties are constructing an interconnection between their two systems to provide more resiliency.

An important example of a community preparing for the future is the HRSD (Hampton Roads Sanitation District) Sustainable Water Initiative for Tomorrow (SWIFT). This project involves recharging the Potomac

aquifer with drinking-water quality SWIFT Water™, which takes the already highly treated wastewater and puts it through additional Advanced Water Treatment to bring it to drinking water standards. This is an innovative recharging strategy for the important source water for many communities along the eastern side of Virginia. The SWIFT program includes more than 20 projects across the Hampton Roads service area to upgrade existing treatment works and build full-scale SWIFT facilities that will ultimately replenish the overdrawn Potomac Aquifer with up to 100 MGD of SWIFT Water™ daily. By replenishing the Potomac Aquifer, the program will foster climate resilience by restoring water supplies, preventing saltwater intrusion, and mitigating land subsidence for the 1.9 million residents served by the HRSD. The program will also improve the water quality of the Chesapeake Bay by reducing up to 90 percent of HRSD's wastewater discharges to the watershed once SWIFT is fully implemented.

FUTURE NEEDS

Ensuring drinking water infrastructure is well maintained is critical to protecting the public health and safety of our future generations. Priority should be placed on rehabilitating and replacing the aging portions of the water distribution system. Additionally, incomplete system records, leaks, breaks, and harmful leaded

pipes all need to be better addressed. Many of these challenges could be tackled by replacing older pipe sections and installing better metering. According to the EPA's Drinking Water Needs Survey, drinking water infrastructure will require \$8.1 billion in additional funding over the next 20 years.

INNOVATION

Older technologies, such as chemical coagulation with settling and separate filtration, are still readily employed throughout the state with considerable success. Furthermore, there have been attempts to incorporate new membrane technologies within the Commonwealth with mixed success. The City of Chesapeake is constructing a new water treatment plant that will use state-of-the-art filtration technology.

Additionally, ODW has been able to use geographic

information system (GIS) mapping to visualize data in novel ways on the web. Using ESRI®'s story map design, ODW has produced a map to visualize the distribution of water treatment processes employed in Virginia, such as chloramines and membrane filtration, and special source water categories, such as groundwater under the influence of surface water (GUDI). GUDI is any water beneath the surface of the ground with significant occurrence of insects or other macroorganisms, algae or large-diameter pathogens.



Drinking Water



RECOMMENDATIONS TO RAISE THE GRADE

- Older cities and rural communities should pursue every opportunity for Federal Grants, such as the EPA Drinking Water State Revolving Fund (DWSRF) and Water Infrastructure Finance and Innovation Act (WIFIA) Program, the USDA Water and Waste Disposal Loan and Grant Program, and the Infrastructure Investment and Jobs Act 2021.
- Treatment plants need to be resilient against changing source water conditions and significant storm events. Treatment facilities should evaluate their own resilience to determine potential treatment disruptions and build redundancy for protection.
- A more aggressive plan should be developed to address leaded pipes and lead service lines still in service. This should include a full replacement and not just a partial service line replacement, given the potential health effects. Utilities should improve their record keeping of lead pipes as well so that policymakers might better understand the scope of the replacement challenge and budget for it accordingly.
- More utility authorities should develop asset management plans so that they might act proactively to disruptions rather than reactively. While other states have started mandating municipalities evaluate the extent of leakage, Virginia has yet to adopt these better strategies.
- More municipalities should install more flow meters throughout their distributions system. Flow meter technology can provide invaluable information about water demands and leaks.

DEFINITIONS

Source Waters: Source waters are the water bodies that are originally sourced for drinking water applications. This includes rivers, lakes, reservoirs, and groundwater sources in Virginia. Source waters can be natural, like the James River, or engineered sources like the Occoquan Reservoir. Any infrastructure, like pumps or pipelines, needed to transport the source to the treatment plant are considered part of the source water system.

Water Treatment Plant: All source waters will require some form of treatment before it can be supplied to customers in the community. The type and amount of treatment varies depending on the quality of the source water. Water treatment facilities are regulated by state and federal regulations such as the Safe Drinking Water Act (SDWA). Once treated properly, the water is potable and safe for consumption.

Distribution System: The distribution system is infrastructure needed to distribute the potable water to the community. This includes pumps, water storage tanks, and a multitude of pipelines buried and scattered around the community.



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Public Parks





EXECUTIVE SUMMARY

Almost all of Virginia's 95 counties and 38 cities contain park facilities, and visitors to these parks generate significant economic benefits to the Commonwealth's economy. According to the Virginia Department of Conservation and Recreation (DCR), Virginia state parks saw 7.9 million visitors in 2021, a 15% increase over 2019 and a 1.5% increase over 2020. Despite growing numbers of visitors, park maintenance at facilities is underfunded. Deferred maintenance at Virginia state parks is estimated at \$111 million annually. DCR and localities are also challenged to hire sufficient staff to operate equipment and manage resources.

BACKGROUND

Virginia's publicly owned lands provide a wealth of natural goods and services in the form of clean air and water, carbon sequestration and flood reduction. These ancillary services benefit local economies and improve physical health by providing safe outdoor recreation.

A 2019 study by the Virginia Tech Pamplin School of Business reported that in 2019, visitors to Virginia's state parks spent approximately \$286.2 million in the Commonwealth. Nearly 45% of this total, or about \$130 million, was spent by out-of-state visitors. The report

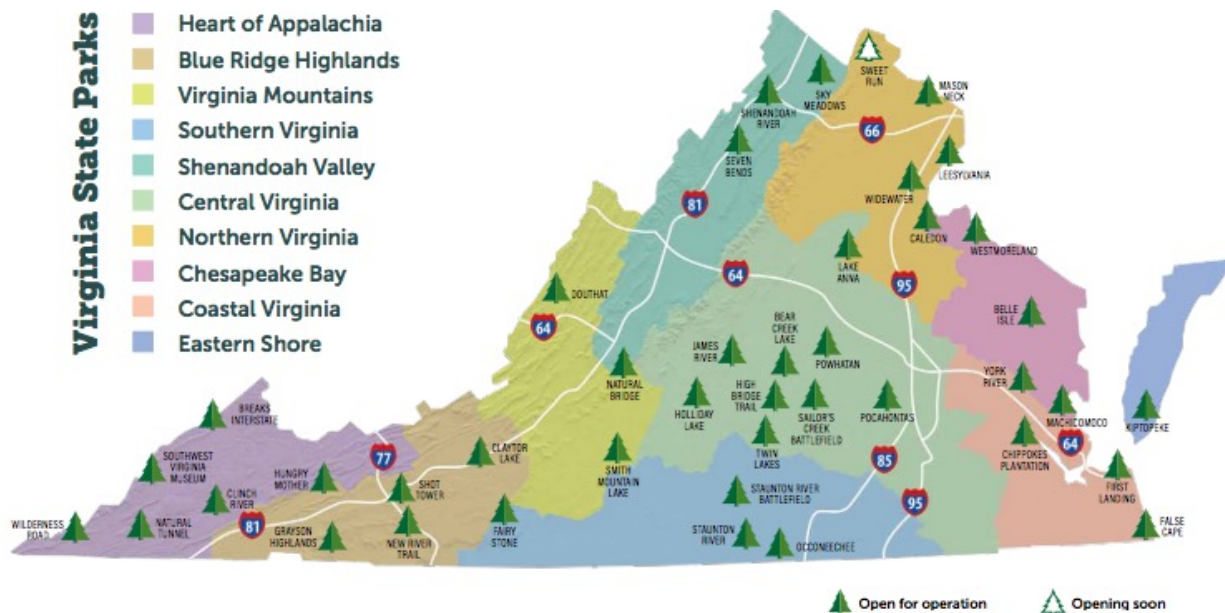
further noted that the total economic activity stimulated by Virginia State Parks during 2019 was approximately \$437.7 million, an estimated \$343 million of which is considered "fresh money," funds that likely would have not been generated at all in the absence of the park system.

The impact and benefits of state and local parks in the Commonwealth have only grown in the wake of the COVID-19 Pandemic.

CONDITION AND CAPACITY

The nation's public parks are owned and operated by a variety of government entities, including federal agencies, such as the National Park Service (NPS) and the U.S. Army Corps of Engineers (USACE), as well as states, regional authorities, counties, and local entities. The areas for public use in Virginia are approximately 3.7 million acres – or 13.5% of the total area of the commonwealth of Virginia – and approximately 1.4 million tourists visit the park each year. Virginia is home to 22 national parks showcasing the natural beauty of the Commonwealth and expansive history.

Virginia state parks are consistently rated among the best in the nation. Virginia has 41 state parks ranging from the Blue Ridge Mountains in the west to Hampton Roads in the east, totaling 75,895 acres with more than 600 miles of trails and convenient access to Virginia's major waterways. These parks allow for a variety of activities, including hiking, biking, camping and fishing. Two new parks, Machicomoco in Gloucester County and Clinch River in southwest Virginia, opened in 2021. Additional land for a new Virginia State Park was acquired in 2022 for the new park known as Sweet Run.



Virginia Department of Forestry (VDOF) manages 26 state forests totaling 71,972 acres –approximately 60% of the state’s total area. The state forests of Virginia are self-supporting and receive no taxpayer funds for operation.

Almost all of Virginia’s 95 counties and 38 cities contain park facilities. For example, Fairfax County has 427 parks with 325 miles of trails, while Albemarle County manages 4 parks and 20 miles of trails. Cities include Virginia Beach with 293 parks, encompassing over 7,000 acres, with over 300 miles of trail, Alexandria with 566 acres of parkland and 20 miles of trails, and Lynchburg with 17 parks with 40 miles of trail. The City of Richmond is home to 169 parks, and 27 miles of trails. The City of Roanoke maintains 60 parks with more than 90 miles of trails.

According to the Virginia Department of Conservation and Recreation (DCR), which oversees Virginia’s state parks, Virginia state parks saw 7.9 million visitors in 2021, a 15% increase over 2019 and a 1.5% increase over 2020.

Active outdoor recreation is an important part of the Virginia economy. Outdoor recreation employs more than 197,000 people and contributes an estimated \$22 billion to the Virginia economy. The industry also generates \$1.2 billion in state and local tax revenues. Further, the U.S. Census reports that each year 3.3 million people hunt, fish, or enjoy wildlife watching in Virginia, contributing \$2.4 billion in wildlife recreation spending to the state economy. With additional

investment in programs for trails, state parks and the state’s Office of Outdoor Recreation, Virginia will be able to promote outdoor recreation, develop partnerships, and create and improve recreation infrastructure.

Virginia State Park system includes structures such as visitor centers, cabins and lodges, meeting facilities, campgrounds, trails, roads, dams, and water systems,



SHENANDOAH NATIONAL PARK

staff residences, restrooms, bathhouses, swimming pools, picnic shelters, docks, boat ramps and contact stations (Table 1). The assets include miles of water, sewer and electric lines, acres of septic systems and the associated buildings to make them function. Also inventoried are

miles of paved roads, gravel roads and various types of hiking trails and boardwalks. Assets currently inventoried include over 2,800 improvements with a replacement value of \$1.2 billion as of November 2021.

TABLE 1. VIRGINIA STATE PARKS NUMBERS

Structures	Total
Yurts	50
Camping Cabins	22
Buildings	1,236
Horse Campgrounds	7
Swimming Beaches	11
Campsites	1,677
Cabins	306
Swimming Pools	6
Miles of Trail	662
Picnic Shelters	99
Agency Owned Vehicles	325
Marinas	3
Commercial Fishing Pier	1
Powerboat launches	17
Rails to Trail Parks	4
Sewage Treatment Plant	2

Source: DCR Virginia State Parks Dedicated Funding Sources and Recommendations Report (Nov 2021)

Maintenance of these facilities is a continuously under met need and Virginia State Parks estimates the deferred

maintenance backlog at \$276 million.

OPERATIONS AND MAINTENANCE

Running a park requires various duties, including natural resource management, visitor services, law enforcement, water and wastewater treatment, facility management

and repairs, occupational safety, human resources, financial management and more. Recruiting sufficient staff is also an ongoing issue.

Staffing of Virginia State Parks consists of approximately 20% full-time equivalent employees (297 positions), and 80% hourly employees (1150 positions), on average. The state agency estimated operation & maintenance activities for park infrastructure and trails to range from \$26.4 million to \$51.3 million in 2021. DCR reports that interviews with park staff indicated they do not currently operate with adequate equipment resources and equipment available is only 80% of that needed. An over dependence upon hourly employees coupled with difficulties in recruiting those employees has resulted in high staff turnover and state parks with critical staffing shortages. With a staffing profile comprised of 80% hourly employees, a critical need for VSP is the conversion of a significant portion of hourly positions to classified employee positions.

The costs of maintenance and repair of park infrastructure, replacement of equipment at the end

of its life cycle, as well as the cost of fully staffing the system, state parks have other operating expenses including fixed costs, administrative costs, and those associated with programming needs. To meet the full funding needs of Virginia State Parks operations, new sources of revenue will need to be found. High potential funding sources DCR has identified include a designated sales tax, a waste disposal-tipping fee, a “Park Fee” to be collected with vehicle registrations, or a substantial increase in general fund appropriations.

The Northern Virginia Regional Park Authority (NOVA Parks), representing jurisdictions in Arlington, Fairfax, Loudoun Counties and the Cities of Alexandria, Falls Church and Fairfax, manages approximately 40 parks and has an operating budget of \$19 million. Revenue is primarily derived from enterprise funds and user fees.

FUNDING

The Virginia Outdoors Plan (VOP) is the state’s comprehensive plan for land conservation, outdoor recreation, and open-space planning. In addition, it provides guidance for the protection of lands through the Virginia Land Conservation Foundation. The VOP helps satisfy National Park Service requirements for Virginia to participate in the Land and Water Conservation Fund (LWCF) program. This program provides 50% matching funds to state agencies and localities for the acquisition and development of outdoor recreation resources. A key feature of the program is that all LWCF assisted areas must be maintained and opened, in perpetuity, as public outdoor recreation areas.

Over the past 40 years, Virginia has received approximately \$368.5 million in LWCF funding to help protect dozens of national parks, wildlife refuges, forests, trails and more. In October 2021, the Department of Conservation and Recreation announced \$7.5 million was awarded in Virginia Land Conservation Foundation (VLCF) grants, which will fund 30 conservation projects and protect 8,000 acres of land across the commonwealth. This was the third round of awards approved by the VLCF board in 2021. A total of \$3.4 million in grants was approved earlier on February 5 and another \$4.8 million was approved on June 10.

Virginians who are passionate about outdoor recreation,

conservation practices and preserving the state’s natural areas may contribute to the Open Space Recreation and Conservation Fund by donating all, or a portion of, their state tax refunds. The fund is used to acquire land and maintain and improve state park sites and facilities, among other purposes. Half the funds are granted to localities through the Virginia Outdoors Fund Grants Program. Most of these small, 50 percent matching grants are used on small, local recreation projects in the state. Grants are awarded based on the availability of funds, hence there is no particular grant calendar cycle for awarding grants. The other half of the funding is used to buy land for conservation and recreation and to develop and maintain public park facilities. This includes supporting the Natural Area Preserve System.

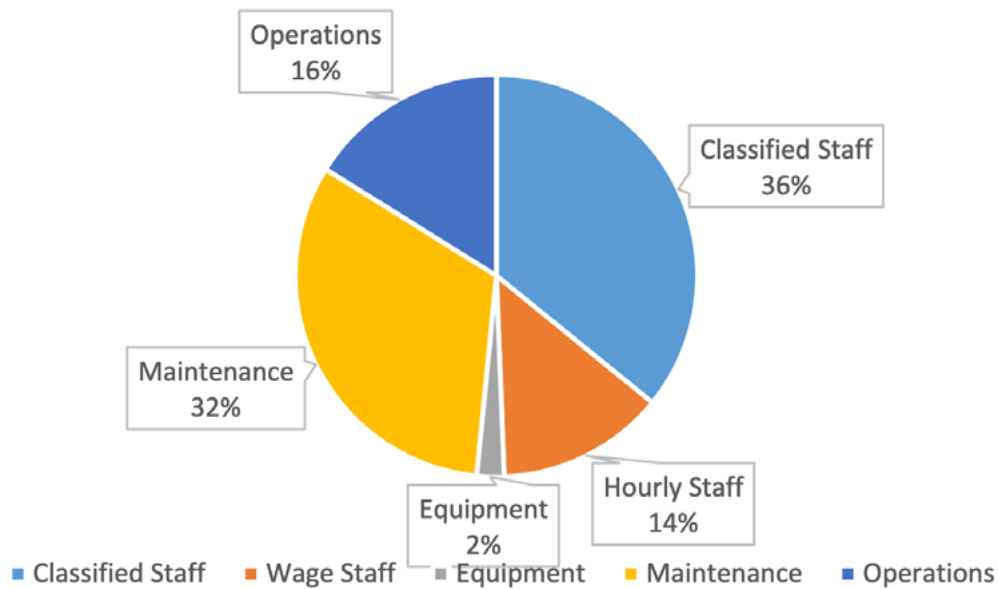
On December 16, 2021 Virginia Governor Ralph Northam proposed a two-year budget that will include nearly \$245 million for outdoor recreation and Virginia’s natural lands. The new funding will help significantly expand Virginia’s network of regional trails, Virginia State Parks, and the Office of Outdoor Recreation. Unfortunately, both the House and Senate budget proposals cut much of Northam’s planned investments and as of April 2022 the State Legislature was still debating the budget.

FUTURE NEEDS

When determining funding needs consideration was given to infrastructure, equipment, staffing, and routine operations and the total identified funding needs for Virginia State Parks is approximately \$159

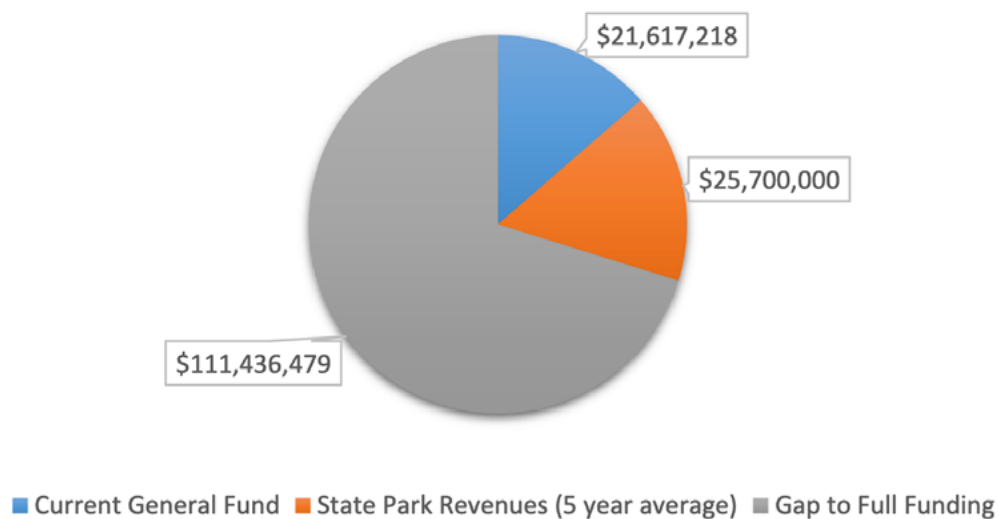
million, according to DCR. With a current general fund appropriation of \$21.6 million and a 5-year average state park revenue stream of \$25.7 million, a gap of just over \$111 million to full funding is recognized.

Full Funding Model for Virginia State Parks



Source: DCR Virginia State Parks Dedicated Funding Sources and Recommendations Report (Nov 2021)

Gap to Full Funding of Virginia State Parks



Source: DCR Virginia State Parks Dedicated Funding Sources and Recommendations Report (Nov 2021)

RESILIENCY AND INNOVATION

The Department of Conservation's ConserveVirginia program was established to prioritize conservation areas across the Commonwealth for natural habitat and floodplains and flooding resilience, protected landscape resilience and water quality improvement. Virginia also requires master plans be developed for Virginia State Parks. These plans cover infrastructure, development,

operations and maintenance. For example, in the "York River State Park Master Plan" summary, building and site design will implement green energy standards using energy efficient and sustainable materials to the greatest extent possible. Green design initiatives are to be considered during the design process for park renovations and new construction.



Geocaching uses technology to get outdoors and explore. Source DCR



Public Parks



RECOMMENDATIONS TO RAISE THE GRADE

- Fully fund the Great American Outdoors Act, which creates a dedicated fund to address the National Park Service's deferred maintenance backlog of nearly \$12 billion and permanently and fully funds the Land and Water Conservation Fund.
- Outdoor facilities need to be rehabilitated, updated and improved, including athletic fields within state parks.
- Mainstream the utility of GIS and other technologies to assist with asset management and to enhance user experience at parks.
- Promote the benefits of multiple-use parks that increase the community's resilience, such as rain gardens, which reduce stormwater pollution and protect drinking water sources.

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Public Parks



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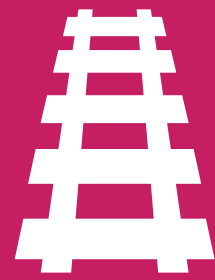
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Rail





EXECUTIVE SUMMARY

Virginia's rail system consists of 3,037 miles of active lines served by two Class I and nine Class III freight railroads, up to 26 national and regional Amtrak passenger routes, and Virginia Railway Express intercity rail. Annually, over 127 million tons of freight and nearly 1.5 million passengers travel through Virginia. Inadequate capacity in the Richmond to Northern Virginia corridor is a constraint to Commonwealth rail infrastructure. This includes the dangerously old two-track Long Bridge; it operates at 98% capacity during peak times on weekdays. Public-private partnerships, such as the Transforming Rail in Virginia program, can increase and expand passenger service while improving freight performance on tracks they share. Meanwhile, the Port of Virginia is expanding rail capacity, and new federal and state funding is available to enhance the condition of passenger rail infrastructure and improve service.

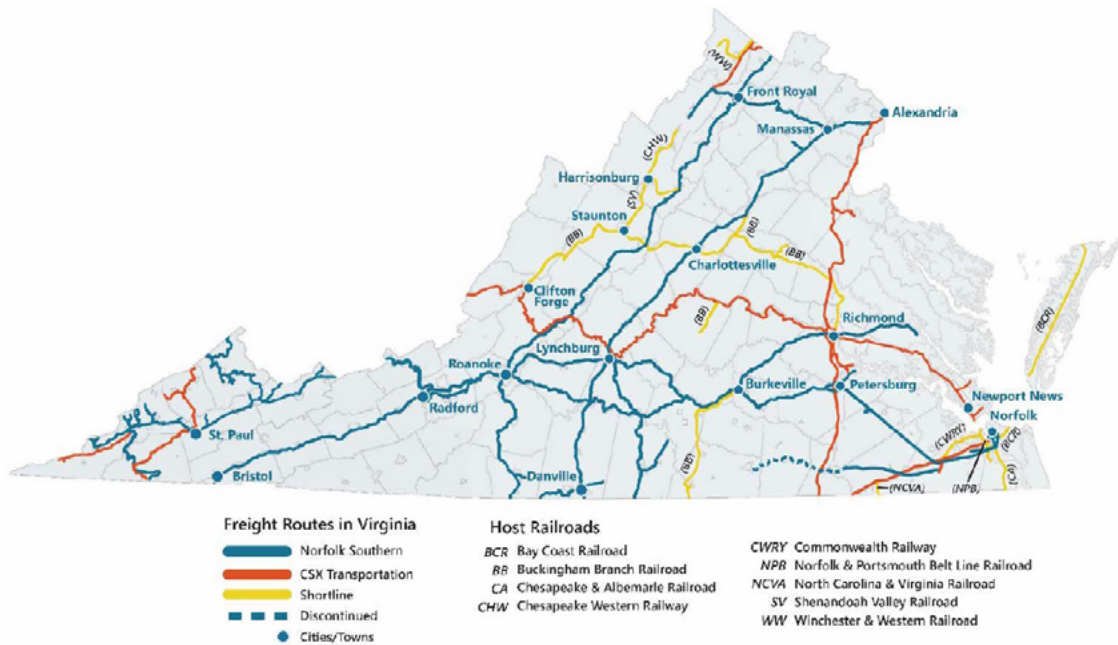
INTRODUCTION

Virginia rail ownership is dominated by the two Class I railroads – carriers earning greater than \$250 million: Norfolk Southern (NS) and CSX. The remainder of the system is owned or leased by nine Class III “shortline” railroads earning less than \$20 million annually (Figure 1). Amtrak operates throughout the state and the Virginia Railway Express (VRE) operates in Northern Virginia. The majority of passenger rail routes in the Commonwealth operate on tracks owned by freight railroads.

CSX operates along three major corridors (I-95, National Gateway, and CSX Coal Network) while NS operates along two major corridors (Crescent and Heartland). In 2017, Virginia ranked 24th and 23rd among all states for tons of freight and carloads traveling through the Commonwealth, respectively [4]. Historically, coal had been a major commodity transported by freight rail but has recently declined and been replaced by passenger service. Approximately one-third of intermodal traffic originating or terminating at the Port of Virginia facilities arrives by rail.



FIGURE 1 – FREIGHT RAIL IN VIRGINIA (DRPT)



In 2020, Amtrak hosted approximately 1.5 million passengers across 25 Commonwealth stations. Virginia-funded regional service, accounting for nearly two-thirds of total ridership in the state, operates six daily trains (Figure 2). In addition, federally funded long-distance trains, and partially state funded routes, operate through

Virginia. For all routes, Amtrak relies heavily on the cooperation of track owners CSX and NS, which prioritize freight traffic. Amtrak's on time performance can be negatively impacted, making passenger rail less attractive than car travel even in busy road corridors.

FIGURE 2 – PASSENGER RAIL SERVICE IN VIRGINIA (DRPT)

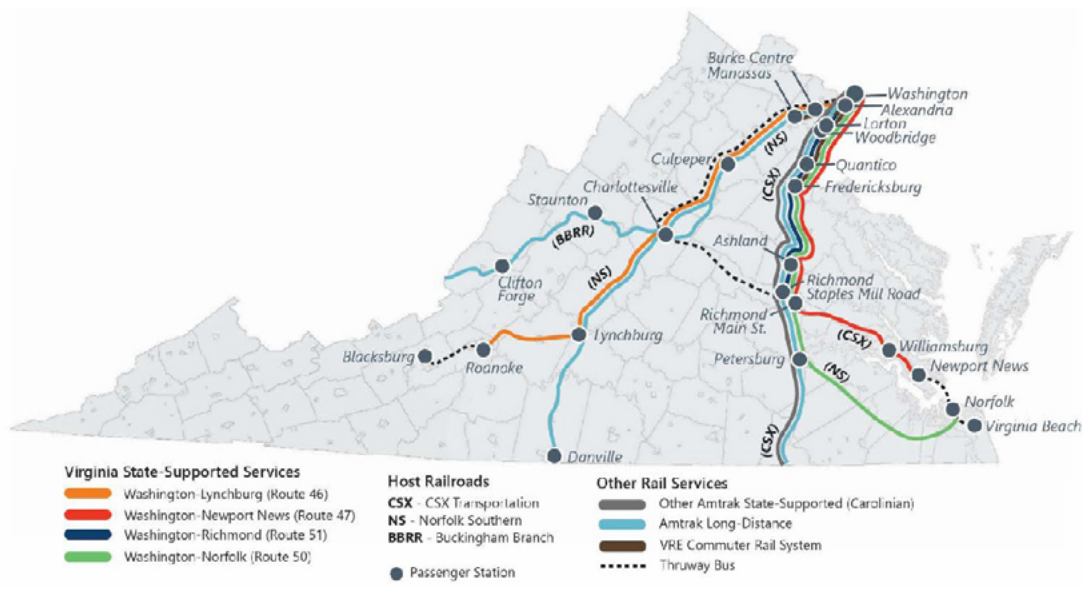


TABLE 1 – AMTRAK STATE-SPONSORED ROUTES (DRPT)

Route Number	Route	Frequency
46	Roanoke-Washington	1 daily round trip
47	Newport News-Washington	2 daily round trips
50	Norfolk-Washington	2 daily round trips
51 ⁴	Richmond-Washington	1 daily round trip

TABLE 2 – AMTRAK LONG DISTANCE ROUTES WITH FEDERAL OR OUTSIDE FUNDING (DRPT)

Name	Route	Frequency
Auto Train	Lorton-Sanford, FL	Daily
Cardinal	Chicago-New York City	3 days a week
Crescent	New Orleans-New York City	Daily
Palmetto	Savannah-New York City	Daily
Silver Meteor	Miami-New York City	Daily
Silver Star	Miami-New York City	Daily
Carolinian ⁵	Charlotte-New York City	Daily

CONDITION AND CAPACITY

Virginia's private rail companies are investing to increase capacity and improve conditions. In November 2021, the Port of Virginia approved a \$61.5 million construction bid aimed at doubling the size of the Central Rail Yard at Norfolk International Terminals to expand rail capacity. This will enable the port to accommodate 610,000 annual container lifts, as well as 1.1 million containers a year via rail. Officials say the work is set to begin in February 2022 and be completed in late 2023.

Virginia is improving passenger rail. Since December 2019, the state announced agreements with CSX and Norfolk Southern to purchase a total of 412 miles of railroad right-of-way and 251 miles of railroad track. The Commonwealth plans to construct 50 miles of new railroad track and double railroad capacity between Washington, D.C. and Virginia by expanding and reconstructing the Long Bridge Potomac River railroad crossing. These agreements, called the Transforming Rail in Virginia program (TRVA), form a \$4 billion rail plan enabling six new roundtrip Amtrak Regional trains, extension of service from Roanoke to Christiansburg, and five more VRE trains on the Fredericksburg line (including weekend service). Additionally, in 2020 the Virginia General

Assembly created the Virginia Passenger Rail Authority (VPRA) to own, maintain, implement, and operate the Commonwealth's passenger rail network. At its May 2021 meeting, the VPRA Board approved numerous projects, including Ettrick Station improvements, a new Newport News Station, Platform, and Train Service Facility, Quantico Station improvements, and a Bedford Amtrak Thruway Intercity Bus Connector. Capacity improvements are planned to total \$3.2 billion.

The TRVA is anticipated to provide a more competitive freight rail network for the Port of Virginia, with \$2 billion estimated in annual economic benefits just in Northern Virginia. To gauge the performance of freight rail, the Virginia Department of Rail and Public Transportation (DRPT) calculates the number of trucks removed from Virginia's highways through the funds' projects. On average, one train carload removes the equivalent of 3.4 truckloads from the highway. Over the past five years, projects funded through the Rail Preservation Fund have removed between approximately 2.0 million and 2.4 million trucks from Virginia highways annually. The Rail Enhancement Fund removed 5,721,367 truckloads in calendar year 2020.

FIGURE 3 – TRUCKLOADS REMOVED FROM VA HIGHWAYS VIA THE SHORTLINE RAILWAY PRESERVATION PROGRAM (DRPT)

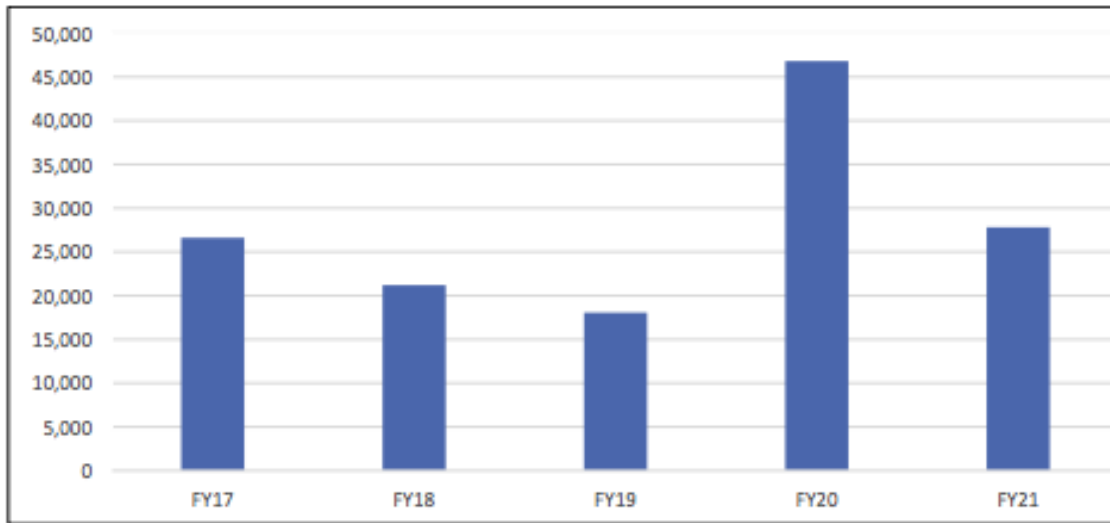
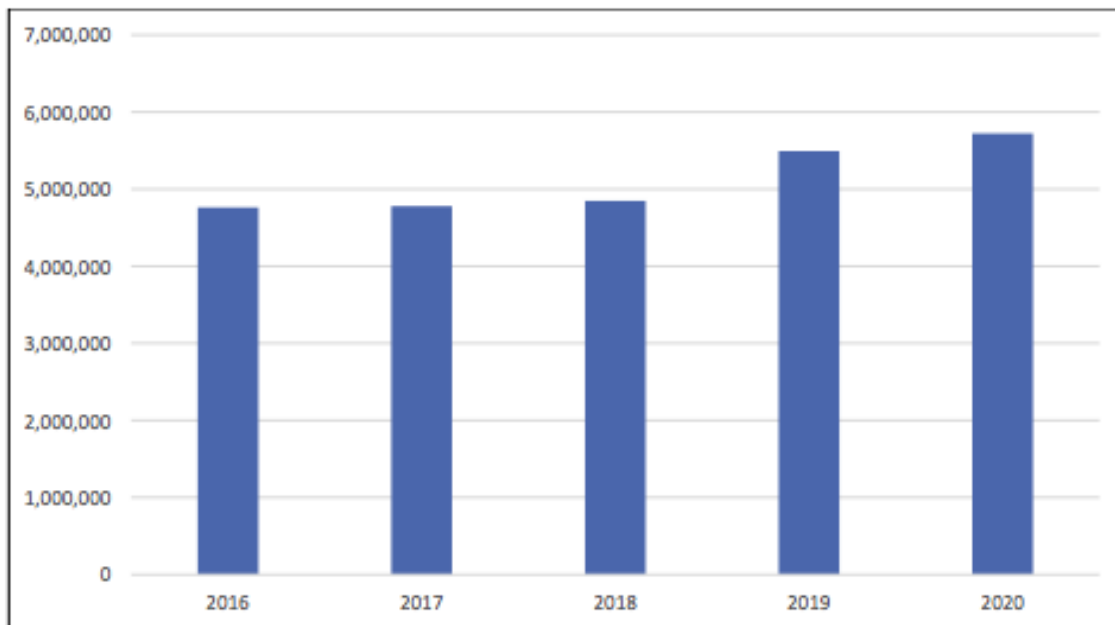


FIGURE 4 – TRUCKLOADS REMOVED FROM VA HIGHWAYS VIA THE RAIL ENHANCEMENT PROGRAM (DRPT)



The COVID-19 pandemic impacted passenger rail service in the Commonwealth. Pre-pandemic, Amtrak state-sponsored ridership had grown to nearly one million riders in FY19. At the pandemic's start, Virginia decided to cease one round trip from Newport News as ridership was falling. By April 2020, Amtrak ridership had dropped by nearly 96 percent compared to the

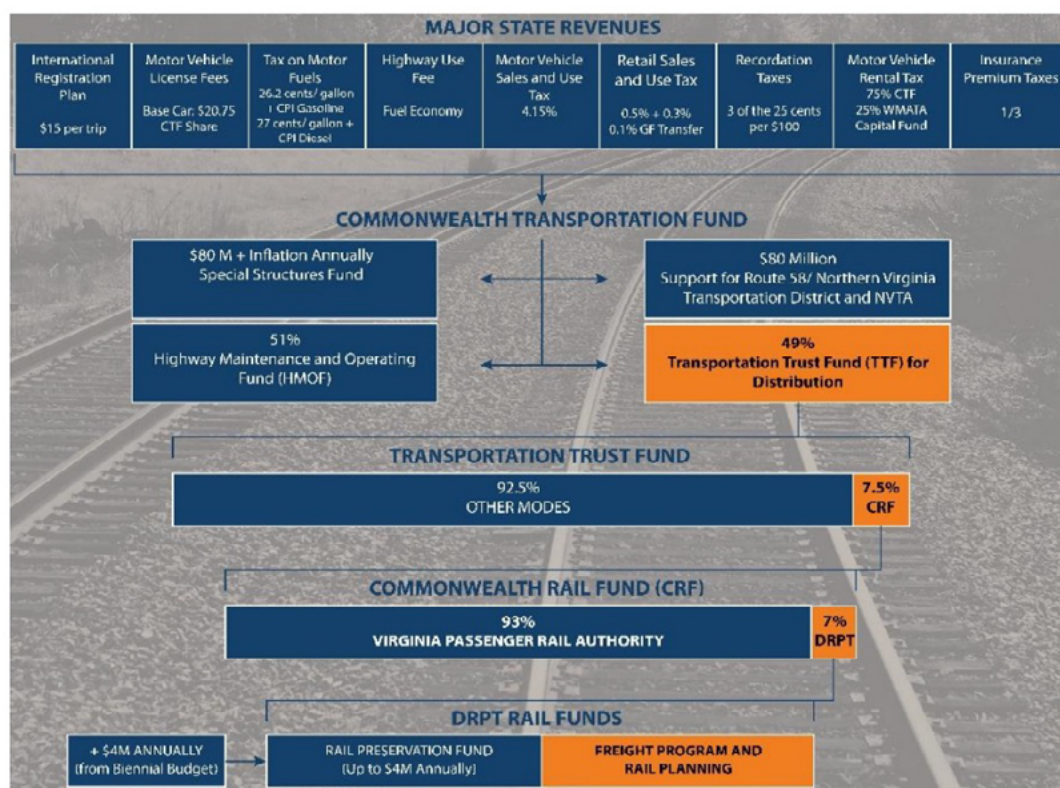
prior April. Starting in May 2020, Amtrak ceased almost all long-distance and Virginia acted on Amtrak's recommendations to reduce service. By this report's publication, the Commonwealth has fully restored service to pre-pandemic levels as well as extending Richmond service from Staples Mill Station to Main Street Station in downtown Richmond.

FUNDING

Virginia's rail network is mostly privately owned, as are the terminals, locomotives, and railcars. Freight railroads sustain their own operational costs and, for the Class I railroads, the costs of small capital improvements. In 2015, the most recent available data, CSX invested more than \$42.6 million in its Virginia network. In addition, the company invested more than \$1 billion in freight cars and other rolling assets throughout its rail system. NS investments in 2020 totaled \$850 million. Class I railroads have partnered with DPRT to fund some larger capital improvements.

In prior years, DPRT oversaw passenger rail projects within the Commonwealth including state-sponsored Amtrak service. However, the 2020 General Assembly established the Commonwealth Rail Fund (CRF) to replace DPRT operations and capital funds. Of the funds allocated to CRF, 93% is dedicated to the new Virginia Passenger Rail Authority (VPRRA) – a budget of \$450.7 million in FY2022 – compared to \$56.2 million for operations and capital spending in the previous fiscal year to its predecessor fund.

FIGURE 5 – COMMONWEALTH RAIL FUND DISTRIBUTIONS (DRPT)



The federal Infrastructure Investment and Jobs Act includes significant new resources for the national passenger rail network. Specifically, there is \$102 billion nationally to eliminate the Amtrak maintenance backlog, modernize the Northeast Corridor, and bring world-class rail service to areas outside the northeast and mid-Atlantic. On top of this, Virginia will be eligible to compete for \$5 billion for rail improvement and safety grants and \$3 billion for grade crossing safety improvements.

In November 2021, The Port of Virginia approved a \$61.5 million construction bid aimed at doubling the size of the Central Rail Yard at Norfolk International Terminals to expand rail capacity. These two projects combined will enable the port to accommodate 610,000 annual container lifts, as well as 1.1 million containers a year via rail. Officials say the work is set to begin in February 2022 and be completed in late 2023.

OPERATION AND MAINTENANCE

Amtrak is struggling to hire and retain workers. Down 1,500 people since the start of COVID-19, the railroad service is unable to resume pre-pandemic service levels, expand dining to some trains, or launch long-planned routes. As of December 2021, Amtrak was operating about 80 percent of its normal schedule after deep reductions in 2020. It's struggling to compete for workers with other railroads that lure experienced train engineers and mechanics. Amtrak service personnel – cooks, cleaners, etc. – are stretched thin in the same hiring market as restaurants and hospitality.

FUTURE NEEDS

Freight Rail

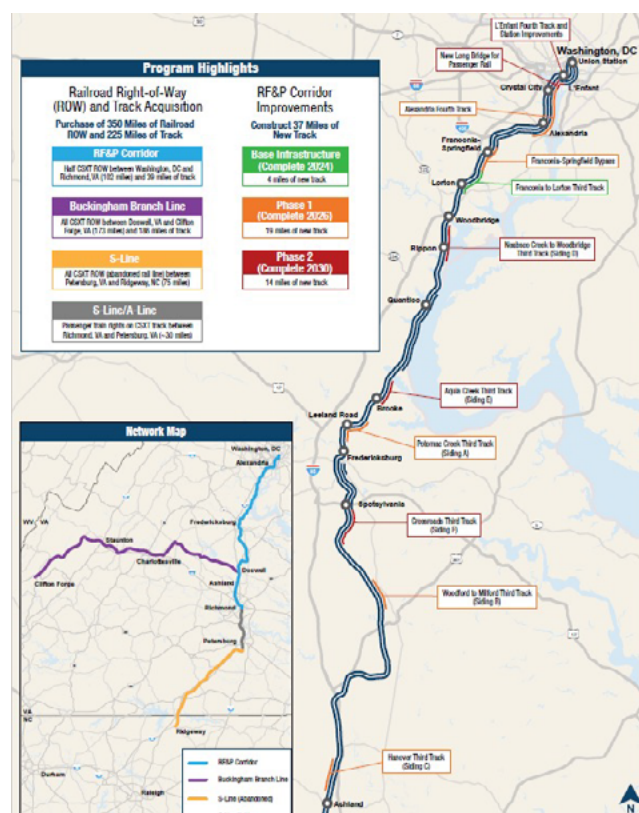
Rail freight tonnage is expected to grow approximately 0.5% annually through 2040.[7]. The Port of Virginia should benefit from freight improvements to keep the port nationally competitive. CSX is increasing rail clearances to operate trains with double-stacked containers. While 100% of the Richmond-D.C. corridor is now capable of handling those trains, the Richmond to Manchester, WV corridor still needs to be upgraded.

Passenger Rail

Virginia's population around existing passenger stations is expected to grow 20%, with station usage expected to increase to 1.86 million passengers through 2040[1]. Additional passenger service in Virginia would come in the form of additional frequency and extensions of existing train routes either beyond Washington, D.C., or further into the state from current endpoints. In spring 2022, Maryland state lawmakers passed a bill, then overrode a gubernatorial veto, starting the process for Maryland Area Regional Commuter Train Service (MARC), Maryland's commuter rail, to offer one-seat rides into Northern Virginia[12]. That service requires federal money and significant infrastructure improvements around the Virginia to address current capacity constraints.

Freight railroads CSX and Norfolk Southern also say labor constraints are affecting service. The industry, which cut positions to reshape operations before the coronavirus struck, endured additional staffing reductions during the pandemic. Railroad companies that employed 160,500 people in January 2020 were down to 142,500 last month. The worker shortage is also threatening the launch of new service that has been in the works for years. In Virginia, officials were expecting two new routes this year — one to Norfolk and one to Roanoke — but said launch dates are postponed until next year.

FIGURE 6 – TRANSFORMING RAIL IN VIRGINIA PROJECT MAP (DRPT)

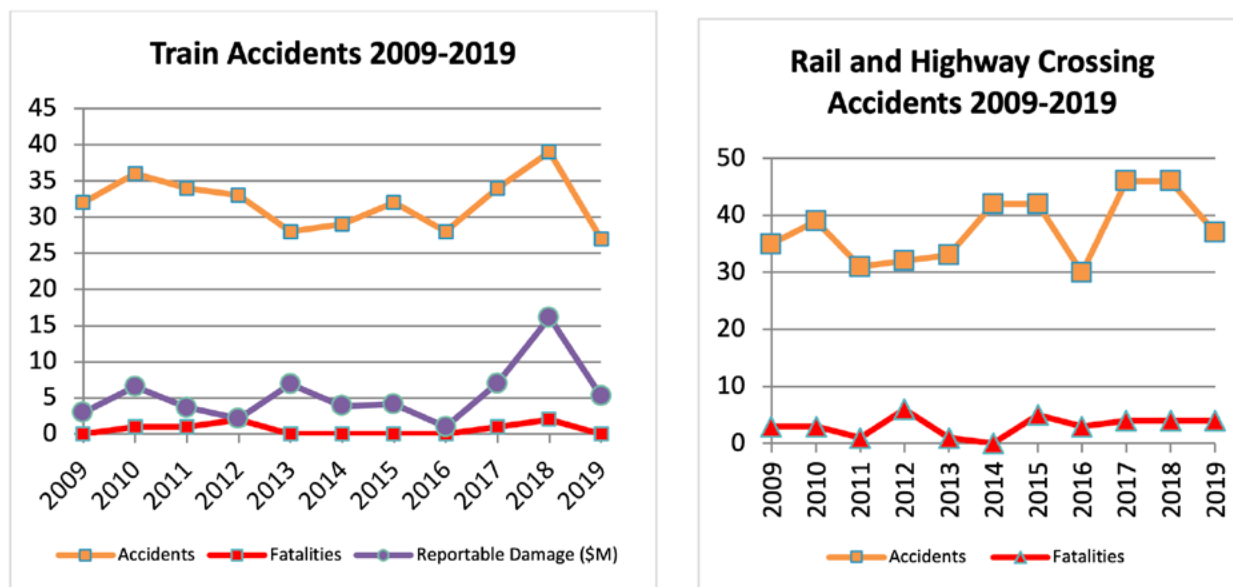


PUBLIC SAFETY

In the last decade, train crashes (derailments, etc.) have remained steady (Figure 8), with an average of 32 incidents per year and 0.6 fatalities per year[9]. Locomotive derailments from 2015-2019 totaled 109 (3.5 per 100 miles of track) ranking the state the 19th fewest out of 49 states. At train and road crossings, crashes have averaged

37.5 per year with 3.4 fatalities per year. Virginia has 1,829 public at-grade crossings with railroads. As of 2015, 1,534 crossings, or 81%, have some form of active warning device such as gates or flashing lights.

FIGURE 7 – TRAIN CRASHES AND RAIL AND HIGHWAY CROSSING ACCIDENTS 2009-2019 (FRA OFFICE OF SAFETY ANALYSIS)



As COVID-19 devastated passenger rail ridership, public transportation providers implemented several strategies to strengthen the perception of safety on transit and

protect staff. Some of these cleaning practices have been phased out, but others – such as plexiglass barriers – have persisted or been accepted as the new normal.

RESILIENCE AND INNOVATION

Virginia's rail plan does not directly address resiliency within the system. Resilient design is imperative, as the Port of Virginia is within a hurricane-susceptible region and is a major driver of freight traffic. Rail connections in the Commonwealth should be designed to withstand

natural hazards. Redundancy, like the Long Bridge's planned second Potomac span with two additional tracks, is fundamental. Isolated track failures can lead to delays and cancellations hundreds of miles away.



Rail



RECOMMENDATIONS TO RAISE THE GRADE

Virginia's current rail network has seen recent improvements and substantial increases in committed funding, but the existing rail network and levels of service are inadequate to meet existing freight demand and encourage higher passenger ridership along heavily-driven corridors. Significant future investment is necessary to improve the state's rail network.

- Continue partnering with Class I and Class III railroads by providing dedicated funding to assist with complex, long-term projects. Use state funding to make capital improvements possible in shortline rail networks to meet modern rail standards for greater capacity, safety, and speed.
- Fund and implement the goals set out in the recent Transforming Rail in Virginia initiative. Provide dedicated funding for reconstruction and second span of the Long Bridge. Make other I-95 corridor improvements and upgrade the Richmond-area rail system.
- Continue joint planning – governments with rail owners and service operators – for multi-modal transportation planning. Make land-use decisions and service improvements so more residents live near high-frequency passenger rail stations. Improve passenger and traffic safety through projects such as rail crossing upgrades.
- Modernize rail stations, connect multimodal transportation services, and co-locate live, work, play centers in transit-oriented developments.
- Authorize a state study of the opportunities to expedite the electrification of our rail corridors.
- Fund a rigorous study of the economic and environmental life-cycle costs and benefits of adding new freight capacity on rail versus roadway expansion in the I-81 Corridor.
- Protect any potentially abandoned rail corridors through public purchase for future service and rails with bike-walk trails.
- Find ways to preserve and improve the performance of its railways, through the appropriate combination of additional capacity and utilization of existing capacity to accommodate passenger and freight movement.
- As Virginia buys its own track segments, establish a dedicated funding source for upkeep.



Rail



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Rail



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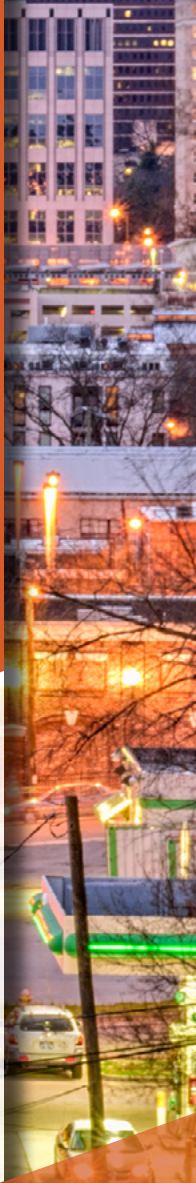
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Roads





EXECUTIVE SUMMARY

The Virginia Department of Transportation (VDOT) is responsible for the third-largest state-maintained highway system in the country. VDOT is a national leader in transportation asset management and has fully integrated the practice into its budgeting process and investment strategies. This has garnered positive results; the percentage of pavement condition that was in good condition rose from 48% to 51% from 2018 to 2022. 968 road users were killed in crashes on Virginia roads in 2021, a large jump from 796 in 2020 and nearing Virginia's previous peak of 1,026 in 2007. Roadway engineering to prioritize safety over speed is the most effective countermeasure. A 2020 Omnibus Transportation Bill mandates new funding for safety projects, including hundreds within the \$672 million Commonwealth Transportation Board investment plan for FY2023-2028.

CONDITION

In Virginia, the Virginia Department of Transportation (VDOT) maintains approximately 128,500 lane miles of roadway, while localities maintain over 30,500 lane miles of roadway. Of the 159,000 lane miles maintained by VDOT and localities, approximately 18,700 lane miles (or 12% of the roadway inventory) are on the National Highway System.

VDOT is responsible for the third-largest state-maintained highway system in the country, behind the Texas and North Carolina DOTs. VDOT has developed a robust asset management program, placing the maintenance of the transportation network at the forefront of agency investment decisions. This commitment to responsible asset management practice is demonstrated through VDOT's annual condition data collection programs and its establishment and

publication of network-level pavement and bridge performance goals. VDOT's current condition measures and performance goals are in the Transportation Asset Management Plan (TAMP). The TAMP must include a summary inventory of NHS pavements and bridges by ownership, whether state-owned or locally owned.

The TAMP is fully integrated into VDOT's budgeting process and investment strategies as indicated in pavement and bridge performances over the years. These longstanding programs, processes, and strategies have made VDOT a national TAM leader with documented practices that exceed federal requirements and expectations. Numerous publications developed by VDOT detail these practices as they apply to the full network of VDOT's roads and bridges.

**TABLE 1: 2018 VIRGINIA PAVEMENT LANE MILES
BY MAINTENANCE RESPONSIBILITY**

NHS Designation	Lane Miles by Maintenance Responsibility		Total Lane Miles
	VDOT	Localities	
Interstate NHS	5,539	NA	5,539
Non Interstate NHS	10,266	2,986	13,252
Total	15,769	2,986	18,755

**TABLE 2: 2018 PAVEMENT CONDITION –
BASED ON FHWA PERFORMANCE MEASURES**

Ownership	Designated	Lane Mile	% Good	%Fair	%Poor
VDOT	NHS-non Interstate	10,266	38.8	61.0	0.2
	NHS Interstate	5,539	57.8	41.7	0.6
Localities	NHS-non Interstate	2,986	10.5	85.8	3.7
	NHS Interstate	5,503	57.8	41.8	0.5
Statewide Total	NHs non- Interstate	13,252	33.5	65.6	0.9

TABLE 3: 5-YEAR INTERSTATE PERFORMANCE

Year	% Good	% Fair	%Poor
2018	48	51	0.8
2019	49	51	0.7
2020	50	50	0.7
2021	50	49	0.8
2022	51	49	1.0

Virginia is anticipated to perform above the federal minimum performance levels (5% Poor) throughout the 5-year analysis period while also achieving the

established 2 year target of 25% Good Non Interstate Performance- and 4 year target of 45% Good Interstate Performance.

TABLE 4: SIX-YEAR IMPROVEMENT PROGRAM ALLOCATION (MILLIONS)
FISCAL YEAR 2019 – 2024

	Fund Source	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
Maintenance and Operations	State	\$1,479.5	\$1,502.4	\$1,460.6	\$1,481.2	\$1,510.7	\$1,565.8
	Federal	\$244.7	\$226.1	\$286.4	\$287.6	\$288.8	\$289.9
	Total	\$1,724.2	\$1,728.5	\$1,747.0	\$1,768.8	\$1,799.5	\$1,855.7
Maintenance and Operations to Localities	State	\$456.8	\$455.5	\$465.9	\$477.1	\$489.0	\$501.2
Total	State	\$1,936.3	\$1,957.9	\$1,926.5	\$1,958.3	\$1,999.7	\$2,067.0
	Federal	\$244.7	\$226.1	\$286.4	\$287.6	\$288.8	\$289.9
	Total	\$2,181.0	\$2,184.0	\$2,184.0	\$2,212.9	\$2,245.9	\$2,356.9

FUNDING & FUTURE NEED

Virginia has several revenue streams that support its roadway network. The state gas tax is set at 26.2 cents per gallon, while the state's diesel tax is 27 cents per gallon. The user fee was last increased in 2020 and indexed to inflation to reflect declining spending power and revenues from fuel-efficient vehicles. Northern Virginia and Hampton Roads also pay a regional gas tax of approximately 2% more. This funding is reserved for projects in those regions.

During the 2019 Virginia General Assembly session, a

similar regional measure was passed into law that funds projects along the Interstate 81 Corridor. House Bill 2718 created a 2% regional gas tax, as well as tractor-trailer registration fees and new registration fees, to be put toward projects along the I-81 Corridor and other areas across the Commonwealth. Of the total \$280 million these funding amendments raises annually, I-81 receives about \$150 million. The funding can be leveraged through bonds to support \$2 billion in critical projects identified by VDOT and approved by the Commonwealth Transportation Board.

TABLE 5: REVENUE ESTIMATES FOR HB 2718/S 1716 (IN MILLIONS)

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	TOTAL
Truck Registration Fees	\$76.0	\$76.0	\$76.0	\$76.0	\$76.0	\$76.0	\$456
Road Tax and Diesel Tax	\$35.8	\$88.3	\$156.2	\$159.4	\$159.4	\$159.4	\$753.9
Regional Fuel Tax	\$55.0	\$60.7	\$61.3	\$61.3	\$61.2	\$61.8	\$361.3
TOTAL	\$166.8	\$225.0	\$293.5	\$296.7	\$293.2	\$296.0	\$1,571.2

While the additional revenue provided by user fees is much needed, it is insufficient to meet future needs of the Virginia roadway system. A 2020 TRIP Study indicates that as a result of increased fuel efficiency and increased use of electric vehicles, gasoline and diesel consumption is expected to decrease 23% between

2020 to 2030 and 51% by 2040. State diesel fuel tax receipts are expected to decrease 24% by 2030 and 50% by 2040.

In order to maintain paving performance, the below table shows the outcomes and annual costs:

TABLE 6: OUTCOMES AND ANNUAL COSTS (IN MILLIONS)

Facility	Performance Measure & Targets Sufficiency	Investment \$2019	Required Investment Years 2019-27	Required Investment Years 2028-30	Annual Shortfall \$2019
Interstate	82%	\$425 M	\$463 M	\$499 M	(\$38M-\$74M)
Primary	82% over 3500 AADT 76% under 3500 AADT				
	82% for over 3500 AADT 60% for under 3500 AADT				

The VDOT budget for FY 2022 totals \$7.2 billion, a 3.4% increase from the FY 2021 budget of \$7 billion. The state's budget does not yet reflect additional funding from the federal government. Congress passed the Infrastructure Investment and Jobs Act in 2021, a

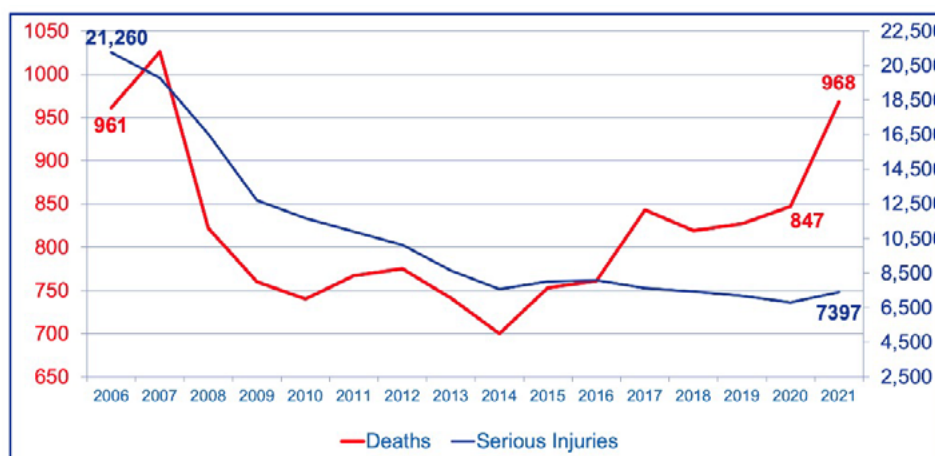
landmark infrastructure bill that will help Virginia close its road funding gap. The bill will provide \$7 billion for federal-aid highway programs over the next five years. This funding can be augmented by federal grants.

PUBLIC SAFETY

In 2020, the most recent year with complete NHTSA analysis, 796 residents were killed in motor vehicle crashes in the Commonwealth. Virginia's Highway Safety Improvement Program (VHSIP) estimated 968 fatalities on Commonwealth roads in 2021. This increase is unacceptable. Engineers have a responsibility to use

the most effective intervention according to national and international data: refresh old roads and design new ones with configurations that calm traffic, slow motorist speeds, and utilize complete streets principles that prioritize the safety and comfort of vulnerable users: cyclists, pedestrians, and the disabled.

FIGURE 1: VIRGINIA TRAFFIC DEATHS AND SERIOUS INJURIES (2006-2021)



In October 2022, the Commonwealth Transportation Board voted to allocate \$674 million to accelerate road safety improvements. The Board – an umbrella body for state transportation agencies – approved use of some state and federal funds to deploy hundreds of upgrades to pedestrian, cyclist, and motorist facilities. This follows from the 2020 Omnibus Transportation Bill, which modified project guidelines such that increases in VDOT construction funding will also trigger increases to a new safety fund for infrastructure and behavioral programs.

Enforcement is an essential part of reducing traffic deaths to zero, the explicit goal of many Commonwealth counties and municipalities. The 5-year CTB investment program includes \$30 over the next three years to install automated camera speed enforcement. Current Virginia law restricts camera enforcement effort to work zones. Most traffic deaths and serious injuries – especially to people walking and biking – are on roads near schools, near medical facilities, in denser, mixed-use communities, and on high-crash corridors.

OPERATIONS AND MAINTENANCE

The pavement management program in Virginia began with the establishment of a pavement inventory. In 2019, Virginia DOT announced a plan to bring roadway conditions up to “sustainable performance” levels within 20 years. This requires an annual expenditure of \$463 million a year on pavement.

proposes to manage a sustainable performance of the Interstate System to achieve the current performance target of 82 percent sufficiency. The state agency also proposes maintaining a performance target and condition of the least-trafficked part of the Primary System (routes with less than 3,500 vehicles per day).

To achieve a long-term financially sustainable outcome that ensures acceptable pavement condition, VDOT

FIGURE 2: VDOT PAVEMENT PERFORMANCE HISTORY, % SUFFICIENT – INTERSTATE

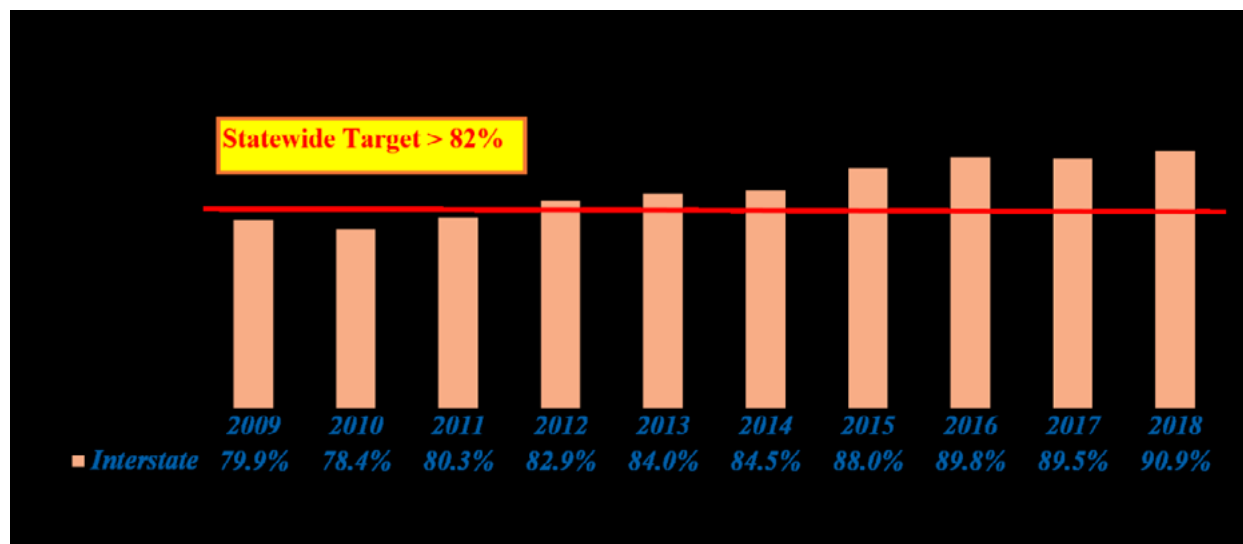
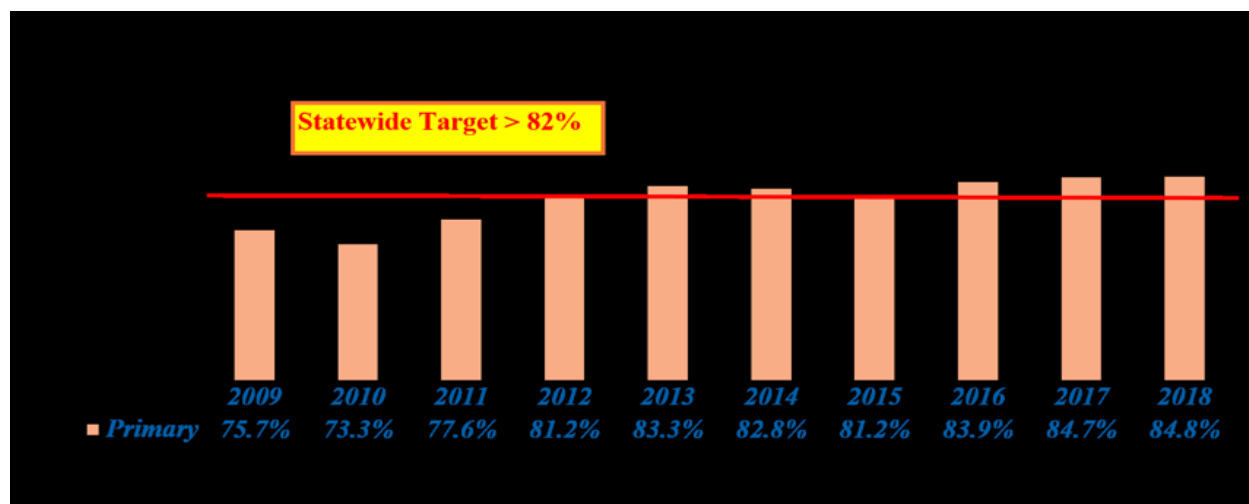


FIGURE 3: VDOT PAVEMENT PERFORMANCE HISTORY,
% SUFFICIENT – SECONDARY



CAPACITY

In Virginia, the steady boost in employment opportunities and limited feasible alternatives to driving led to an exponential demand for road space, exceeding what the state can supply. The only permanent method for the Commonwealth to reduce congestion, especially as the population grows, is to expand and increase public transit, school transportation, and make higher percentages of households comfortable using active transportation like electric cargo bikes.

Some VDOT projects are expanding roadway capacity, but that extra space may not improve congestion in the near term – and will very likely worsen traffic in the long term. The state transport authority plans to widen 46 miles of I-81 between 2025-35, adding 10 miles of truck climbing lanes, and creating 15 miles of auxiliary lanes for freight acceleration and deceleration.

The severity of the growing road demand is clearly reflected in the Urban Mobility Report 2019 issued by the Texas A&M Transportation Institute. According to their report, Virginia Beach had an annual total delay of 40.5 million hours in 2017, which is a 21% increase in

the past decade. Richmond had a 36% increase in the past decade, at 24,461 annual hours of delay in 2017. The worst delay is occurring in the Northern Virginia, a Washington, D.C. metropolitan area. Northern Virginia suffers almost 248 million hours of annual delay, a 31% increase over the past decade.

While these figures reflect pre COVID-19 pandemic travel patterns, IINRIX monthly driving data reports show vehicle miles have already returned to pre-pandemic levels. In many Virginia counties, residents working from home several days a week nonetheless drive more than before the public health crisis.

Freight truck volumes are growing quickly, and struggle to keep supply chains running smoothly stuck in traffic. Roughly 26% of businesses in Virginia rely on freight truck movement. Fortunately, Virginia is home to just 1 of the top 100 freight bottlenecks in the nation, as reported by the American Transportation Research Institute. The Stafford, Virginia I-95 bottleneck is ranked 70th out of 100.

RESILIENCE AND INNOVATION

VDOT's system of 31 residencies and 194 area maintenance headquarters keep the transportation network operational and safe during natural disasters, flooding, and rockslides that hinder traffic. VDOT's Safety Service Patrol Routes on Interstates 66, 81, 95 and state Route 28 now assist motorists 24/7, helping maintain the flow of people and goods. Reducing the duration of incidents can prevent secondary crashes from occurring in the traffic backups caused by the original event. By the end of 2021, VDOT will have installed 150 additional CCTV cameras to interstate and primary routes for traffic operations.

Since 2016, VDOT has been in a data sharing partnership with Waze to exchange information like road closures, incidents, and major traffic events to provide increased real time information to highway users across Virginia. This prepares Virginia drivers from hazardous winter weather conditions and enables VDOT to incorporate more comprehensive information into planning for winter operations.

VDOT promotes resiliency in the Transportation System by the following programs:

- VDOT Mobility Programs and Integrated detour plans in metro areas and interstates

- Integrated Corridor Management with multi-modal responses for planned and unplanned events in Northern Virginia
- Traffic Operation Centers in each District with backup generator power and redundant communications.
- Traffic signals with uninterruptible power supplies on corridors of statewide significance and approaches to critical infrastructure.
- Implementation of new design standards aimed to make bridges and transportation structures more resistant to the effects of climate change.
- Issued in February, 2020 VDOT's "Chapter 33, Consideration of Climate Change and Coastal Storms" directs engineers and designers to account for sea level rise, water salinity, temperature change and rainfall intensity when constructing and maintaining hundreds of bridges.
- New guidelines that will help ensure climate change does not shorten the desired 100-year lifespan of the structures, many of which are in Hampton Roads and Eastern Virginia.





Roads



RECOMMENDATIONS TO RAISE THE GRADE

- In all operating and capital budget projects, Virginia Department of Transportation should prioritize safer design more than vehicle Level of Service (LOS). VDOT should use engineering and cheaper, tactical quick-build project delivery for safer configurations using complete streets principles: transit-only lanes, protected bike lanes, and traffic calming including road diets.
- VDOT should use the large influx of federal money from recent federal legislation to accelerate projects in their investment plan that fix existing roads first, use engineering to induce slower driving, and reduce impervious surface area to curtail stormwater conveyance and flooding.
- Increase the legal authority for state and local law authorities to install and operate automated speed, red light, and stop sign enforcement on state and local roadways. Focus on school zones, medical districts, and officially designated high-crash or high-fatality corridors.
- Urgently pursue traffic safety violation reciprocity with the District of Columbia and Maryland so that moving violations and stationary violations follow a motorist across the tri-state area and allow for enhanced enforcement of dangerous driving.
- Allow at no or minimal cost, counties, municipalities, and regional coalitions to purchase or secure easements in VDOT right of way to pursue projects that improve road condition, increase multimodal capacity, prioritize freight, and lower the “design speed.”
- VDOT policies and efforts focused on improving travel time reliability will need to be implemented to maximize the capacity of the existing road network. This should be done in coordination with the acceleration of the development and deployment of new technologies that promote an integrated, multimodal transportation system.
- Existing transportation funding should be preserved. Conditions are improving but deferred maintenance exists, and progress should not be halted.

DEFINITIONS

Closed Circuit Television Camera (CCTV)

Level of Service (LOS)

National Bridge Inventory (NBI)

National Highway Inventory (NHI)

National Highway System (NHS)

Strategic Highway Safety Plan (SHSP)

Transportation Asset Management Plan (TAMP)

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Roads



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Schools





EXECUTIVE SUMMARY

Beginning the 2021-2022 school year there were a total of 2,381 public schools operating in the Commonwealth of Virginia serving over 1.25 million students. Many of those students spend their days in older, outdated buildings that need replacement. The most recent assessment of schools, performed in 2021, determined that 52% of Virginia's public school buildings are over 50 years old and estimated renovation costs exceed \$24 billion. Virginia is currently faced with aging school infrastructure, shortfalls in funding for repairs/maintenance and operation of existing school facilities, a shrinking tax base in rural areas, and overcrowding in metropolitan areas. The Covid-19 pandemic has exacerbated the situation, making it more difficult for school systems across Virginia to properly maintain, repair, or upgrade school infrastructure.

INTRODUCTION

Virginia's public school system is divided into 8 regions consisting of 133 school divisions. At the start of the 2021-22 school year, Virginia was home to 1,861 locally operated elementary, middle, high, and combined schools. The public school system also includes 520 local and regional

education centers across the Commonwealth that provide alternative, specialized, or technical education. These school facilities served more than over 1.25 million students, a decrease from the 2019 and 2020 fall enrollment numbers primarily caused by the pandemic.

TABLE 1 – SUMMARY OF SCHOOL TYPE (VDOE)

SCHOOL TYPE	NUMBER OF SCHOOLS	PERCENT OF TOTAL
Preschool	34	1.4%
Elementary	1,155	48.5%
Middle	313	13.1%
High	310	13.1%
Combined	49	2.1%
Local Trade Center	422	17.7%
Regional Center	98	4.1%
Total	2,381	100%

Public school (K-12) education in Virginia is governed by the Virginia Department of Education (VDOE) which was founded in 1918. The Board of Education (BoE), a Governor-appointed body that operates within the VDOE, is responsible for setting standards and policies to “provide high-quality educational opportunities for all public-school students in Virginia.” In 1971, the BoE created the Standards of Quality (SOQ) as a means to set policies to ensure each school is in adequate condition and each child in the Commonwealth has access to a school that will offer a quality education.

The BoE approved a comprehensive plan in 2017 that

set priorities and goals for the Commonwealth to meet by 2023. The number one priority in the plan is to “Provide high-quality, effective learning environments for all student[s].” However, educational infrastructure and facilities are not directly mentioned as part of that plan.

The most recent inventory of Virginia school facilities took place in June 2021 as part of a legislative commission studying the conditions of the state’s school buildings. That analysis found that more than half of Virginia’s school buildings are older than 50 years and are experiencing major deficiencies.

CAPACITY

Between 2010 and 2019, student enrollment in Virginia schools increased by 3.6 percent. Student numbers then dropped by that same percentage in 2020 due to the COVID-19 pandemic. In fall 2021, the Virginia Department of Education (VDOE) reported a total enrollment of 1,251,970 students, roughly the same enrollment as the previous school year.

Student enrollment is expected to increase in northern Virginia and decrease in south and southwestern Virginia over the next 5 years based on population growth trends. National enrollment projections estimate an increase of 3.3% enrollment in Virginia public elementary and secondary schools between 2015 and 2027. Today, Virginia school divisions report approximately 41% of schools at or above capacity and 29% nearing capacity.

TABLE 2 – VIRGINIA SCHOOLS CAPACITY LEVEL

Capacity Level	Number of Schools	Percent of Schools
Above Capacity (100% or more of capacity)	239	13.65%
At Capacity (85 to 99% of capacity)	469	26.80%
Nearing Capacity (70 to 84% capacity)	515	29.42%

Capacity is calculated by dividing the serving student enrollment count with the student building capacity count
Data Source: VDOE School/Building Inventory, 2021

School overcrowding is not a widespread problem for public schools across Virginia, however, it is a more frequent problem in major metropolitan areas. Overcrowded school districts commonly choose redistricting to shift school age populations to available education space. Renovation of existing facilities and new construction of a replacement/additional facility appear to be the second

choices to alleviate school overcrowding. Construction is the less frequently chosen path to solve overcrowding, likely due to time and funding constraints. With proper funding and planning, local school systems could choose to expand existing facilities or construct new facilities to best serve the local population.

CONDITION

The Virginia Department of Education collected information on new school facilities, renovations, and alterations in its 2021 School Construction Cost Dataset published by DoE Facility Services. The 2021 assess-

ment surveyed 2,005 school buildings across the state and found that 1,017 school buildings and facilities, or 52%, are at least 50 years old or older.

FIGURE 1 – NUMBER OF VIRGINIA SCHOOL BUILDINGS BY TYPE

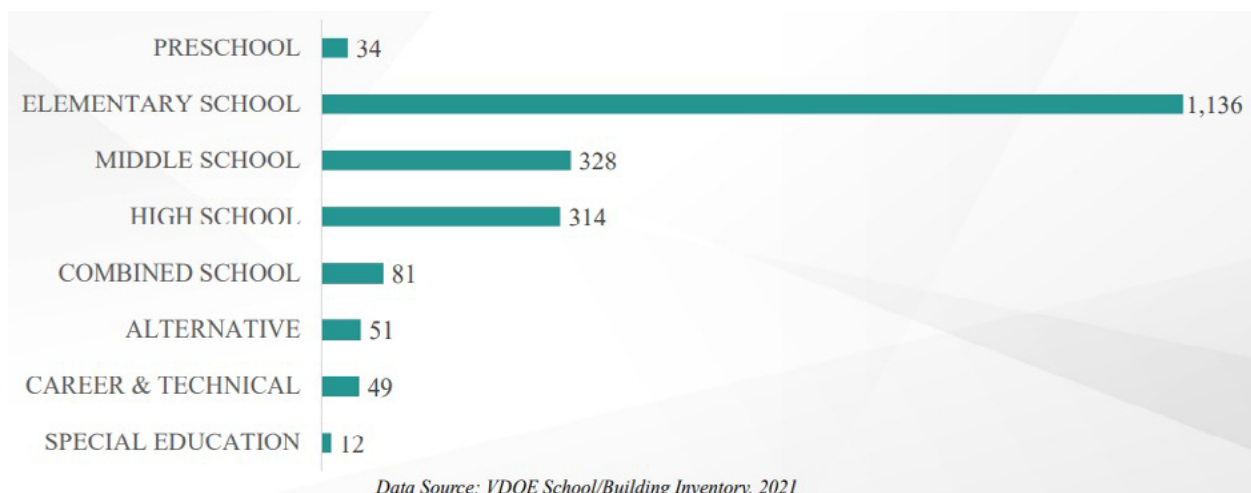


TABLE 3 – VIRGINIA SCHOOLS AGE PERCENTAGE BY REGION

Region	Percentages of Local Schools At Least 50 Years
Chesterfield	38%
Hanover	48%
Henrico	64%
Richmond	72%

National enrollment projections estimate an increase of 3.3% enrollment in Virginia public elementary and secondary schools between 2015 and 2027. Today, Virginia school divisions report approximately 41% of schools at or above capacity and 29% nearing capacity.

While the overall age of a school building doesn't directly indicate a substandard facility, age does indicate the standard the building was constructed to. Many older schools were built without centralized air conditioning systems or asbestos may remain there today as a popular building material of yesteryear. In addition to construction standards, buildings become less energy efficient and more prone to leaks as they age.

Since July 2010, school districts reported constructing 118 new schools at a total cost of \$4.2 billion and completing 544 addition/renovation projects at a total cost of \$3.2 billion. Additionally, VDOE reports that 15% of school buildings have undergone major renovations since 2015.

FIGURE 2 –SCHOOL BUILDINGS AGE BY TYPE

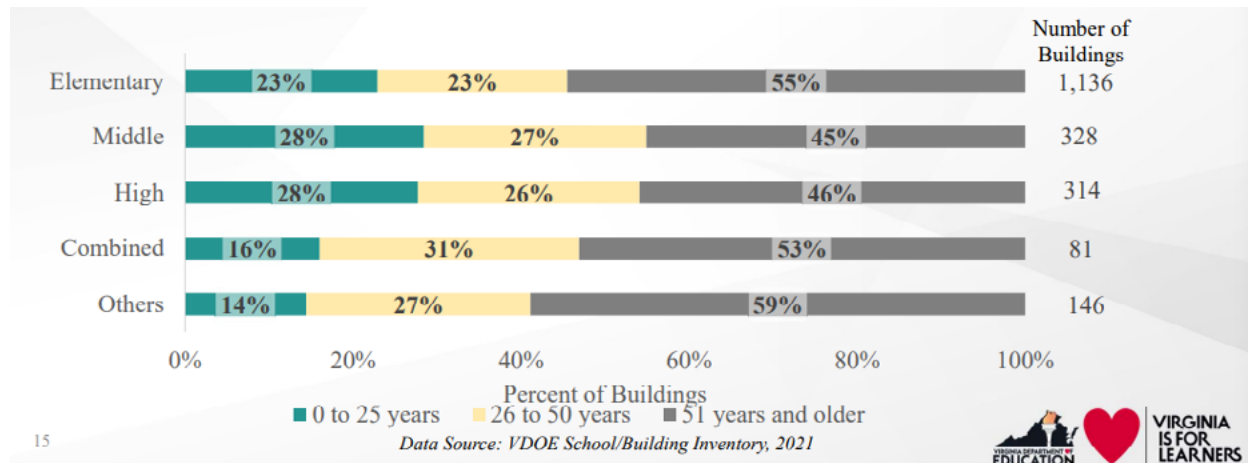


TABLE 4 – VIRGINIA PUBLIC SCHOOL CONSTRUCTION/RENOVATION COSTS, JULY 2010 – MAY 2021

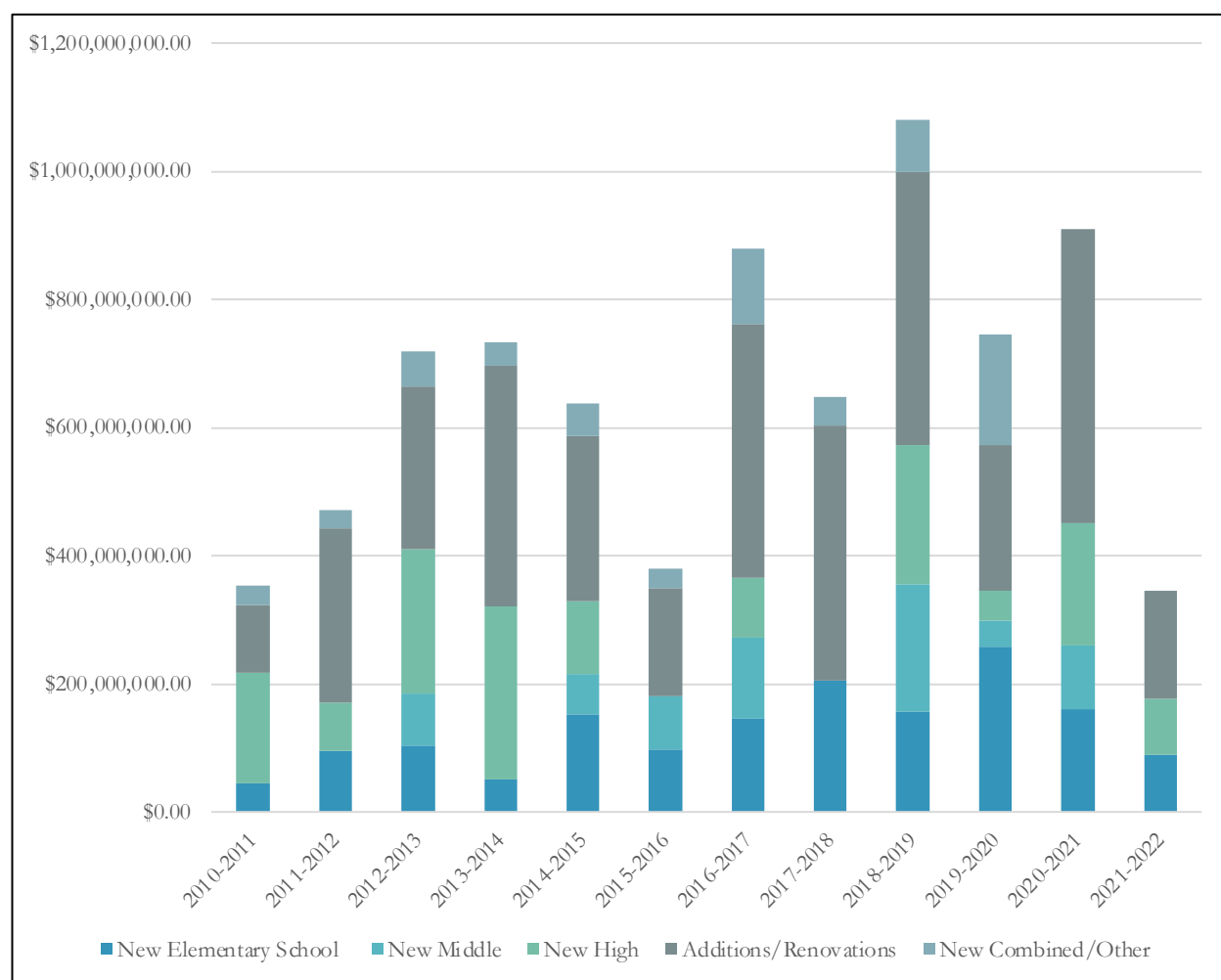
	Total Number of Schools	Total Costs	Total Square Footage	Costs per Square Foot
New Elementary Schools	65	\$1,480,215,361	6,352,068	\$233.03
New Middle Schools	17	\$650,547,138	2,725,476	\$238.69
New High Schools	21	\$1,402,309,778	5,549,672	\$252.68
New Combined Schools	15	\$651,025,693	2,395,561	\$271.76
Total New Schools	118	\$4,184,097,970	17,022,777	\$254.79
Total Additions/Renovations	544	\$3,191,227,290	24,726,994	\$129.06

Data Source: VDOE School Construction Cost Data

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VIRGINIA DEPARTMENT OF EDUCATION VIRGINIA IS FOR LEARNERS

FIGURE 3 – CONSTRUCTION SPENDING TYPE PER YEAR (VDOE)



FUNDING

The majority of public school facility funding in Virginia comes from local funds. For example, bond referendums totaling \$515 million for new schools and renovations in Northern Virginia were approved by voters in November 2015. The reliance on local funds can lead to an imbalance in school facility funding, especially in many rural public school districts that have lower population rates and higher poverty rates. In Virginia, state funding for school construction hasn't been provided since 2009. The Commonwealth is an anomaly; nationally, states

contribute an average of 22% of school capital expense and debt services.

One limited tool that is available to school divisions in Virginia to address school infrastructure concerns is the Literary Fund. In the last 5 years, only six school divisions have accessed this option of low interest loans. The Literary Fund should be prioritized for school infrastructure, specifically school construction grants.

OPERATION AND MAINTENANCE

Proper operation and maintenance of the infrastructure associated with the Commonwealth's public schools requires adequate funding. School infrastructure systems include athletic facilities, playgrounds, buses and transportation, buildings, and parking lots. Maintenance may include routine replacement of lighting, filters, or building system parts, as well as emergency repairs or upgrades to building systems. Vehicles and fleet operations are also an O&M cost.

Yearly operation and maintenance services spending has been approximately 8% of the total yearly expenses for the past 10 years. Virginia disbursed approximately \$1.62 billion for O&M during the 2021-2022 school year. That amount has steadily increased but it is not keeping up with the increasing needs of the school systems. VDOE further identifies Commonwealth schools lack

\$527 million every year for maintenance and operations. This maintenance gap is most pronounced in lower-income communities.

Virginia legislators have recently passed House and Senate bills that may help schools in the near future. One recently passed bill, titled the Public School Assistance Fund and Program, aims to providing grants to school divisions for repairing or replacing the roof, heating and air systems, plumbing, and electrical systems of public elementary and secondary school buildings. As of early 2021, legislators had yet to allocate state funds to the program. As the school facilities in the Commonwealth grow older, school districts must spend more funds on maintenance and repairs. Modernization of school facilities has a direct impact on operation and maintenance costs.

FUTURE NEED

Aging school facilities and increasing enrollment drive future needs of Virginia public schools. VDOE's latest school conditions report estimated that total replacement

costs for all schools more than 50 years old would be greater than \$24 billion.

TABLE 5 – REPLACEMENT COSTS FOR SCHOOL BUILDINGS OVER 50 YEARS OLD

Usage Type	Number of Schools over 50 Years Old	Total Square Footage	Total Replacement Cost
Elementary	619	40,286,230	\$10,071,557,500
Middle	148	18,467,374	\$4,616,843,500
High	144	25,225,870	\$7,567,761,000
Combined	43	3,883,406	\$1,165,021,800
Others	86	4,751,318	\$1,369,651,700
Total	1,040	92,614,198	\$24,790,835,500

Note: Replacement costs were estimated at \$250 per sq ft for schools serving PK-8 students, and \$300 per sq ft for schools serving 9-12 students, for an average costs of \$267 per sq ft for the state. At \$185 per sq ft, total replacement costs would be reduced to \$879M.

Data Source: VDOE School/Building Inventory, 2021



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Future school needs differ regionally. Capital Improvement Plan (CIP) projects for Virginia schools should focus on student clustering within growing metro areas, rather than one-size-fits-all statewide. Identified needs

in CIPs today total over \$9.8 billion, with the most common projects identified as renovations, HVAC repair/replacement, and grounds & parking lot maintenance.

TABLE 6 – SCHOOL DIVISION CIP PROJECTS BY TOTAL COSTS

Project Type	Number of Schools with Project Type	Total Costs
New Schools	81	\$3,834,076,026
Renovations	566	\$3,318,205,135
HVAC Repair/Replacement	463	\$623,451,926
School Additions	48	\$514,763,904
Roof Repair/Replacement	344	\$467,944,657
Other Items*	171	\$376,585,276
Technology Upgrades	132	\$172,340,570
Electrical & Plumbing	226	\$169,013,619
Sports & Playgrounds	287	\$161,815,993
Grounds & Parking Lots	353	\$127,645,348
Safety Upgrades & Lighting	191	\$50,664,811

*Other most often included transportation related costs

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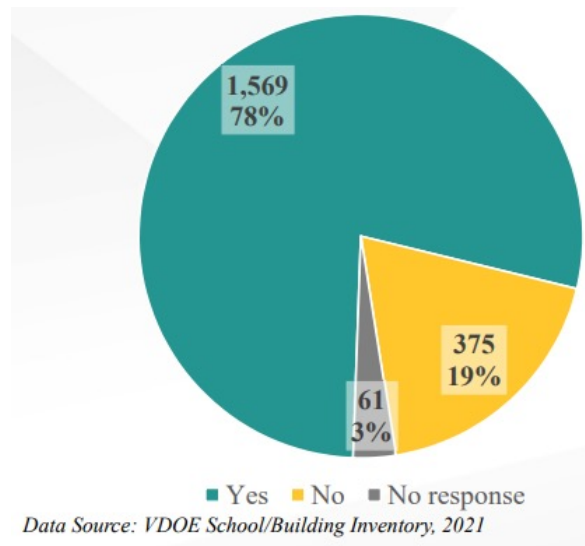
In recognition of the condition of the public school system facilities, the Virginia Senate created a School Facility Modernization Subcommittee in 2018 that made possible a \$3 billion bond issue for school construction and repairs. Unfortunately, this effort was voted down.

As detailed in Figure 3 above, the Commonwealth is spending money on new school construction and renovations, but that expense isn't proving adequate due to the current condition of many facilities.

PUBLIC SAFETY AND RESILIENCE

Nearly every public elementary and secondary school in the Commonwealth has had security-related features constructed within the past 10 years. Most of these security upgrades have been aimed at preventing unwanted entry into school buildings and classrooms. During the 2019 legislative session, Virginia passed HB1738 which requires that the plans and specifications of all new or remodeled public school buildings be reviewed by an individual or entity with professional expertise in crime prevention through environmental design. Many localities around the Commonwealth have selected their public-school facilities to serve as community shelters in the event of a disaster or emergency situation.

FIGURE 6 – % OF SCHOOL BUILDINGS MEETING AMERICANS WITH DISABILITIES ACT (ADA) REQUIREMENTS



Multiple news outlets report of the many problems schools in Virginia are dealing with that include heating and cooling control, rodent problems, Americans with Disabilities Act (ADA) compliance, mold, leaks/flooding, and asbestos. VDOE reports that majority of school

buildings or 78% currently meet ADA requirements and estimated renovation costs for ADA Compliance total \$205 million. Since COVID-19, VDOE reports that 62% of its 133 divisions completed HVAC renovations to address deficiencies highlighted by the pandemic.

TABLE 7 – STATE-LEVEL SUMMARY: HVAC PROJECTS AND COVID-19

HVAC System Projects in Response to COVID-19	Average Number of Projects per Division	Total Number of Projects, All Divisions
Number completed since March 2020	8	975
Number begun but not completed since March 2020	8	942
Number planned but not begun since March 2020	12	1,527
Total	26	3,444

*Note: Total counts include multiple HVAC projects per school if school has no central HVAC or multiple HVAC systems.
Data Source: School Construction Survey, 2021*

INNOVATION

Many new laws have recently been passed to improve schools, however, these have not had a noticeable impact yet. Some examples of recent infrastructure innovation within public schools include:

HB 2192 / SB 1331

Passed in 2019, this law requires that new public school buildings and facilities, as well as improvements and renovations to existing facilities, be designed, constructed, maintained, and operated to generate more electricity than consumed. The measure requires school construction meets industry design standards from the American Society of Heating, Refrigeration and Air-Conditioning Engineers. The law made provisions for local school boards to enter into leases with private entities to achieve the electricity generation goal. This law provided a big step towards funding the use of renewable energy at public school facilities. These bills recently passed in 2019 and became part of the Code of Virginia (see Sections 22.1-141.1, 22.1-141.2, and 56-589.1).

Electric School Buses/HB 2118

Virginia state lawmakers committed to move the Commonwealth's 17,000 school buses to a battery electric when Governor Northam signed HB 2118 into law in 2021. However, that expensive promise did not come with new, dedicated government funding. Dominion Energy, the state's largest power company, is funding the purchase of some school buses and discounting electricity for charging them. Virginia's Department of Environmental Quality also has funding for this purpose from the Volkswagen Environmental Mitigation Trust.

Solar Power

More Virginia schools are addressing climate change while also looking to save on operating costs by installing solar panels thanks to the Virginia Clean Economy Act. Middlesex County Schools recently installed solar panels at the county's elementary schools, middle schools, and high school. The installations are anticipated to save the County \$50,000+ per year.



Schools



RECOMMENDATIONS TO RAISE THE GRADE

- Allocate dedicated school infrastructure funds to facilitate renovation, construction, and proper operation and maintenance of public school facilities.
- Focus on repairing, upgrading, and renovating older school facilities with highest maintenance cost
- Address undersized school facilities with funding to expand in lieu of redistricting
- Continue and increase support and funding for school modernization.
- Create and execute a plan to level the funding gap for rural school districts where local funding is not as abundant.
- Continue creating an easier path for school districts to utilize renewable resources such as solar power. Prioritize solar implementation in high poverty school districts.
- Perform condition assessments of school facilities every 1-3 years. Maintain a database of records.
- Include school infrastructure and facilities data in yearly reports to monitor upkeep and condition.



Schools



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Schools



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**Solid
Waste**





EXECUTIVE SUMMARY

There are 202 permitted waste facilities in Virginia that manage municipal solid waste and several other waste streams. Existing capacity is generally sufficient and due to open real estate for landfill operations, Virginia can maintain competitive disposal fees. Per capita solid waste generation rates in Virginia exceeded the national average by some 44 percent which was an increase of 11% from the amount reported in the 2015 Report Card. However, Virginians recycling rates are very high; in 2018, communities with populations over 100,000 achieved a recycling rate of 46%, approximately 11% higher than the national average of 34.7%. The grade for Solid Waste infrastructure in Virginia is a grade of B-, which was the grade assigned in the 2015 ASCE Virginia Infrastructure Report Card. This reflects the balance between concerns for an 11% increase in per capita waste generation rate with the continued improvement in the per capita recycling rate which exceeded the national average by nearly 11 percent.

CONDITION & CAPACITY

Although the public generally thinks of solid waste as the trash they generate and leave at the curb for pickup, in fact, the processing and disposal of Municipal Solid Waste (MSW) from residents constitutes only about half of the solid waste managed in Virginia. In addition to Virginia residents generated waste, in 2018, the 202 permitted solid waste facilities in Virginia also managed construction and demolition waste, waste from outside Virginia, industrial waste, incinerator ash, yard waste, contaminated soil, sludge, and several other waste streams.

As a result, these Virginia Department of Environmental Quality (VDEQ) permitted facilities processed 21.8 million tons of solid waste representing a 7.9% increase from the figures reported in the 2015 Report Card report. Of this amount, approximately 16.7 million tons originated within the Commonwealth, while 5.1 million tons were imported from out of state (25.39%). The out of state imported waste percentages were 47% from

Maryland, 19% from New York, and 18% from the District of Columbia.

2018 data is used for this report since that is the most recent data available at the time of this report preparation. Therefore, based on the 2018 population estimate of 8.52 million persons in Virginia, the annual in-state solid waste generation rate was approximately 2.0 tons per person or a per capita generation rate of 10.96 pounds per day per person. Although this seems high, this includes numerous non-residential sources, for example solid waste from packaging containers from stores, wastepaper from schools, by-products from manufacturing, landscaping waste, demolition waste, and sludges from sanitary and industrial waste plants.

In breaking this down to the 10 million tons directly attributable to MSW generated in Virginia, this equates to an annual average of 1.17 tons per person, or 6.43 pounds per

day per person which exceeds the national average of 4.48 pounds per day per person by 1.95 pounds per day (44% higher). This MSW would not only include home recycling and waste going to curbside pickup but also include non-residential waste collected from restaurants, schools, shops, and numerous other facilities supporting the public.

In 2015, Americans generated about 262 million tons of trash and recycled and composted almost 91 million tons of this material, equivalent to a 34.7% recycling rate ... On average, Americans recycled and composted 1.55 pounds out of our individual waste generation rate of 4.48 pounds per person per day.” – USEPA, 2018 Report. Note: Although available National data requires comparing 2015 to 2018 data, the National per capita generation rate has only varied 0.2 of a pound over the last 25 years.

Based on the 2019 DEQ Recycling in Virginia: An Evaluation of Recycling Rates and Recommendations, solid waste planning units (SWPU) that have a population over 100,000 Virginia in 2018 achieved a recycling rate of 46.1%. This exceeded the 2015 national average of 34.7% by nearly 11%. As stated in the 2015 Report Card, these remain positive trends for the state, which continues with many local initiatives across the state to promote recycling programs.

Overall, this data shows Virginia continues to effectively meet waste recovery and recycling standards by exceeding the national rate by 11% while still needing to be more effective in reducing the amount of MSW generated which is 44% higher than the national per capita amount.

Meanwhile, importing 25.39% of the total solid waste tonnage from out-of-state remains a concern since this indicates a dependence on non-Virginia funding to defray a portion of the costs of operating solid waste facilities. However, although this can make Virginia vulnerable to a loss of this additional funding for solid waste infrastructure and long-term maintenance, the amount of solid waste coming into Virginia has remained stable since the 2015 Report Card.

**TABLE 1 – SUMMARY OF SOLID WASTE VOLUME
(2014 -2019 VDEQ ANNUAL REPORTS)**

Year	2013	2018
Number of Facilities (Includes Transfer Facilities & Material Recovery Facilities)	208	202
Solid Waste Generated in Virginia (in million tons)	15.0	16.7
Solid Waste Imported to Virginia (in million ton)	5.2	5.1
Total Solid Waste (in million ton)	20.2	21.8

This report card analysis relies primarily on annual solid waste statistics in the 2019 Annual Solid Waste Report for calendar year 2018 issued by VDEQ. This same VDEQ Annual Report was used for the 2015 Report Card which was for calendar year 2013, allowing a 5-year comparison to be made. In 2018 the expected longevity of the existing MSW capacity was approximately 23.4 years, which is a 6% increase over the 22 years expectation in 2013, which in

turn was a slight improvement over the 2009 report card, which indicated an expected capacity of approximately 20 years. Since this is reasonable simplistic figure for comparative analysis, a more detailed analysis of the 2018 VDEQ Report showed that 18 of the 51 landfills had less than 20 years of remaining permitted life that included 5 landfills receiving over 100,000 tons of annual MSW. As an example, over the last five years one of these landfills

receiving over 145,000 tons went from over 7 remaining years to just 4 years of expected remaining permitted life. In this instance, voters have not supported a referendum to fund expansion of the county landfill. However, the county has stated that without the referendum the expansion will still be funded with taxpayer money.

In addition to compost sites, municipal disposal and construction/demolition/debris facilities, medical transfer and disposal facilities, and incinerators, Virginia also requires information from 53 waste transfer facilities and 56 material recovery facilities which comprises about half the facilities in the Number of Facilities in Table 1.

TABLE 2: CAPACITY AND REMAINING LIFE OF DISPOSAL FACILITIES

Facility Type	Number of Facilities	Capacity (Tons)	Landfilled (Tons)	Remaining Life (Years)
Municipal Solid Waste	51	252,161,609	10,717,291	23.4
Construction/Demolition/ Debris	13	30,704,906	1,981,594	15.5
Industrial Landfills	3	4,502,529	319,984	14.1
Totals	67	287,369,044	13,018,869	22.1

Although the amount of solid waste being locally generated increased by 1.7 tons, which was offset slightly by a 0.1 ton decrease in imported solid waste, the existing

capacity is estimated to have increased slightly from 22 years to 22.1 years, since the publishing of a 2015 ASCE-VA report card, as shown in Table 2.

FUNDING AND FUTURE NEED

Virginia has set requirements for ensuring, through a comprehensive annual financial report, that permitted facilities have sufficient financial resources for both operations and for closure costs. These requirements are defined in Virginia's Administrative Code for Financial Assurance Regulations for Solid Waste Disposal, Transfer and Treatment Facilities.

The funding of solid waste infrastructure is primarily a local government obligation. The majority of the 51 MSW (landfills) in Virginia are county- or city-owned. These facilities are either owned and operated by a local government agency or are operated with a contract or as part of a regional agreement (or compact) or as individual not-for-profit entities. About 15% of the facilities are non-government disposal facilities.

Generally, across Virginia there is ample, open real estate for landfill operations. The exceptions are in the urban areas in Northern Virginia and in the tidewater regions. However, even in these places, the reasonable distance to more rural areas allows for the construction of landfills to serve transfer stations receiving waste in the urban areas.

As a result of these conditions, Virginia can maintain competitive disposal fees. At \$53/ton, they are \$10/ton lower than Pennsylvania and Maryland, and \$13/ton lower than New York. These lower tipping fees and the availability of disposal facilities has kept the amount of waste coming into Virginia stable over the last five years. Across the Commonwealth, the tipping fees ranged from \$68/ton in northern urban areas to \$41 in rural areas, which is in line with \$55/ton in Tennessee and \$42/ton in North Carolina.

PUBLIC SAFETY

To ensure effective management of facilities, Solid Waste Planning Regulations, 9 VAC 20-130-10 et seq., set requirements for Virginia regions or each city, county and town not part of such a region to develop

comprehensive and integrated solid waste management plans. These regulations thus establish minimum solid waste management standards and planning requirements for protection of the public health, public safety, the

environment, and natural resources locally and regionally throughout Virginia. The effectiveness of implementing these planning regulations can be shown by another landfill that received over 135,000 ton of MSW. The annual reporting to VDEQ in 2014 showed the expected remaining life was only 4 years which dropped to 2 years in the 2017 VDEQ Report. However, the landfill's management plan which had been updated in 2015 had identified the need for additional capacity. As a result, the 2018 annual reporting to VDEQ indicates the new capacity has been added since the MSW Expected Remaining Permitted Life was 35 years.

OPERATION & MAINTENANCE

Per capita solid waste generation rates in Virginia exceeded the national average by some 44% which was an increase of 11% from the amount reported in the 2015 Report Card. Closing this gap could return significant revenue to other positive infrastructure needs, which becomes even more viable as the per capita MSW rates has gone from 31% to 44% higher than the national average since the 2015 Report Card. As a result, based on the national generation rate and

The importance in achieving minimum management standards and planning requirements ensures public health and safety, and the environment and natural resources are protected. These requirements go well beyond collection and transport of waste to a landfill or other disposal facility. For example, leachate (contaminated water) from a poorly managed landfill can pollute groundwater or streams. Therefore, effective management during and following closure of these facilities protects the public and the environment.

the 2018 population, Virginia should only generate 7 million tons of MSW. Therefore, Virginia spends an additional \$ 165 million per year for MSW disposal for the 3 million tons generated above the national average. Although meeting the national average could be very challenging, achieving a reduction back to the 1.05 tons per person rate identified in the 2015 Report Card would result in a saving of \$56 million per year to Virginia's economy.

RESILIENCE & INNOVATION

The Virginia General Assembly set a 25% recycling rate for SWPU that have a population over 100,000. As a result, in CY 2018 there were 17 SWPU that were required to report their rates which showed the overall rate was 46.1%. There was only one small (total recycle + MSW below 80,000 tons) SWPU that fell below the required 25% recycling rate. This was more than offset by two of the larger SWPUs with recycling rate over 55%. In addition, the two previous reporting years (2016 & 2017) had recycling rates below 43%.

Although the increase in the recycling rate for 2018 indicates a positive trend, the 2019 VDEQ Recycling in Virginia: An Evaluation of Recycling Rates and Recommendations Report to the Virginia General Assembly also discussed external factors that could have an impact on the recycling rate. The ability to ship recyclable materials to foreign markets has been a key factor in the amount of recycling conducted nationally. In 2017, China launched a campaign, which became known as the "National Sword 2017," targeting "foreign

waste, including plastics, industrial waste, electronics, and other household waste material." This continued into 2018 with bans on 24 materials and further stricter limits on contamination levels on imported mixed paper and plastics. As a result, nationally roughly 1 in 4 items placed in recycling containers would not be recyclable.

In Virginia, National Sword 2017 has contributed to a decrease in plastic recycling, however the materials with the highest recycle rates are metal, paper, yard waste, and commingled (single stream collected recyclables), and waste wood. These rates have generally increased, for example paper has increased 6% over the last year. These increases have offset the 3% decrease in plastics and the 5% decrease in commingled waste. The total percentage breakdown for 2018 recycled material/waste by tonnage was metal at 28%, yard waste at 20%, commingled at 13%, paper at 23%, waste wood at 8%, plastic 2 1%, and other materials at 6%. Based on these tonnages, commingled and plastics would be only 14% of the total for recycled material/waste.



Solid Waste



RECOMMENDATIONS TO RAISE THE GRADE

- The continued increase in the per capita waste generation rate impacts the expected remaining life of the landfills and increases the cost for waste management in Virginia. Therefore, as stated in the 2015 Report Card, statewide support of successful locality waste reduction strategies should be communicated and shared as models for improved performance across the Commonwealth, especially in the less populated and affluent areas, so that waste generation rates are further reduced statewide. Achieving just a modest reduction to the 1.05 tons/person rate identified in the 2015 Report Card could result in saving \$56 million per year in Virginia's solid waste management program.
- The example of the successful use of a comprehensive and integrated solid waste management plan needs to be emphasized at a number of MSW sanitary landfills where the expected remaining permitted life has dropped below 20 years. Ensure the requirements for updating the plans every five years or when the expected life drops below 20 years are enforced.
- Although all the 17 SWPU with a population above 100,000 achieved a recycling rate above the required 25%, two SWPU were just above this required rate. For the 20 SWPU below 100,000 which voluntarily reported their rates (which have a mandated recycling rate of 15%), there were 3 SWPU that were just above this mandated rate. In order to increase the recycling rates for those SWPU nearing the required mandated rates, VDEQ needs to continue to engage in outreach initiatives and activities which include recycling equipment tax credit, litter grants for localities, and the increased use of recycling material in Virginia Department of Transportation projects.
- National actions and new programs to address the impact on the market for recycling material imposed by China's "National Sword 2017" needs to be monitored. Although in 2018 the impact in Virginia has been for plastics and commingled waste, the continued restrictions beyond 2017 that add to the list of recyclable material that would no longer be accepted could impact additional materials. A major recycling item in Virginia is used paper which the stricter limits on contamination levels could adversely impact. Therefore, guidance and assistance to support private and publicly owned facilities to adapt will be necessary to allow Virginia to continue to meet the mandated recycling rates.

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Virginia Department of Environmental Quality



Stormwater





EXECUTIVE SUMMARY

Increased development, aging infrastructure, more intense rainstorm events, and rising sea levels are all placing demands on the Commonwealth's stormwater infrastructure systems. Fortunately, there is some limited funding available for infrastructure capacity and condition improvements. Richmond, Portsmouth, Norfolk, Virginia Beach, Hampton, Chesapeake, Newport News, Lynchburg, Roanoke and Alexandria have stormwater user fees paid by residents. These fees serve as dedicated funding source for existing stormwater management services and new capital projects. In FY 2021, Virginia financed approximately \$205 million in project loans targeted at 14 projects through the Virginia Clean Water Revolving Loan Fund, however, future needs are significant. More than 70% of the commonwealth's population lives in coastal areas. Meanwhile, it is estimated that 1 inch of water in a home can cause upwards of \$25,000 in damages.

BACKGROUND

Stormwater occurs when precipitation and snow melt creates runoff from streets, lawns, parking lots, construction sites, industrial facilities, and other impervious surfaces. If not properly managed, stormwater can cause threats to building, transportation and utility service infrastructure, and can lead to urban flooding. Unmanaged stormwater is also a major source of excess nutrients, sediment, toxins and other pollutants into waterways. Properly managed stormwater can recharge groundwater and protect land and streams from erosion, flooding and pollutants.

Stormwater infrastructure consists of drainage systems with pipes, ditches, canals, channels, pump stations, stormwater ponds, culverts, and runoff treatment devices to capture stormwater before releasing it to nearby waterbodies. In recent years, green stormwater infrastructure has been introduced in new developments to maximize the benefits from natural hydrologic cycles using vegetation, soils, site grading, and natural filtration

processes. It provides benefits by reducing runoff, minimizing erosion, and contributing to water quality improvements.

Virginia Department of Environmental Quality (DEQ) is the lead agency for developing and implementing the Commonwealth's statewide program to protect water quality and quantity from stormwater runoff. Under the Virginia Stormwater Management Program (VSMP), the agency issues municipal separate storm sewer systems (MS4s) permits, certifies land disturbers and offers compliance assistance. Local governments are key partners in the VSMP program, administering erosion and sediment control programs as well as some stormwater discharges to control water quality impacts, localized flooding, and stream channel erosion from new and redevelopment projects. These stormwater requirements serve to further protect the Commonwealth's receiving waters, including the Chesapeake Bay.

CAPACITY AND CONDITION

There is increased demands on the Commonwealth's major stormwater system's capacity due to development and an aging system, resulting in flooding in areas with intense rainstorm events. Many localities with traditional stormwater systems (culverts, drain pipes, & detention basins) are already experiencing street flooding due to backflow of tidal waters into low-lying pipes and drainage ditches. Most localities were built before the negative impacts caused by runoff were fully understood. Since then, most urban waterways have been converted from wildlife-filled buffers that naturally processed pollution, into drainage canals which generate large loads of pollution with every heavy rain. Municipal and state agencies within Virginia are confronted with maintaining aging stormwater systems with limited funding available. For example, the Cities of Richmond, Lynchburg and Alexandria all have over 200-year-old combined sanitary and stormwater systems and the cities are challenged to fund system separation.

Local towns and municipalities in Virginia work to reduce the amount of pollution reaching waterways by implementing MS4 program plans and local VSMP authority, and administering the VSMP Construction General Permit on behalf of DEQ. There are 13 major

urban municipalities with MS4 programs within the Commonwealth of Virginia. Encompassing more than 50,000 miles of roadways, over 1,000 stormwater management facilities, and over 30,000 regulated outfalls, Virginia Department of Transportation's (VDOT) MS4 is the largest in the Commonwealth. VDOT's MS4 program is authorized to collect and safely discharge excess stormwater into bodies of water within urbanized areas of the Commonwealth in adherence with Virginia Pollution and Discharge Elimination System (VPDES) permit limits.

DEQ is also charged with characterizing, protecting and improving all waters, including protection of groundwater, coastal waters and wetlands in Virginia. A total of 100,953 miles of rivers, 2,842 square miles of estuarine waters, and 117,752 acres of reservoir/lakes was identified in DEQ's FY 2019 assessment report. Statewide summaries of the river miles, estuarine square miles, and lake/reservoir acres within and bordering Virginia are presented in Table A. The percentage of impaired bodies of water can be a proxy for assessing the condition of stormwater infrastructure; if water is impaired, it suggests stormwater infrastructure is not functioning as intended.

TABLE A: SUMMARY OF OVERALL ASSESSMENT RESULTS FOR VIRGINIA'S RIVERS, LAKES AND ESTUARIES AS REPORTED IN THE 2020 IR. THE PERCENT OF TOTAL IS REPORTED IN PARENTHESES

	Rivers (mi)	Lakes (acres)	Estuaries (sq mi)
Non-Impaired (% total)	5,963 (6%)	18,976 (16%)	312 (11%)
Impaired (% total)	15,871 (16%)	94,789 (80%)	2,137 (75%)
Not Assessed (% total)	79,119 (78%)	3,988 (3%)	393 (14%)
TOTAL	100,953	117,752	2,842

FUNDING

Cities within Virginia such as the City of Richmond, Portsmouth, Norfolk, Virginia Beach, Hampton, Chesapeake, Newport News, Lynchburg, Roanoke, and Alexandria have stormwater user fees paid by residents that serves as a dedicated funding source for existing stormwater management services and new capital projects. DEQ's Clean Water Financing and Assistance Program (CWFAP) further provides flexible funding solutions through three programs: Virginia Clean Water Revolving Loan Fund (VCWRLF), Stormwater Local Assistance Fund (SLAF) and Water Quality Improvement Fund (WQIF).

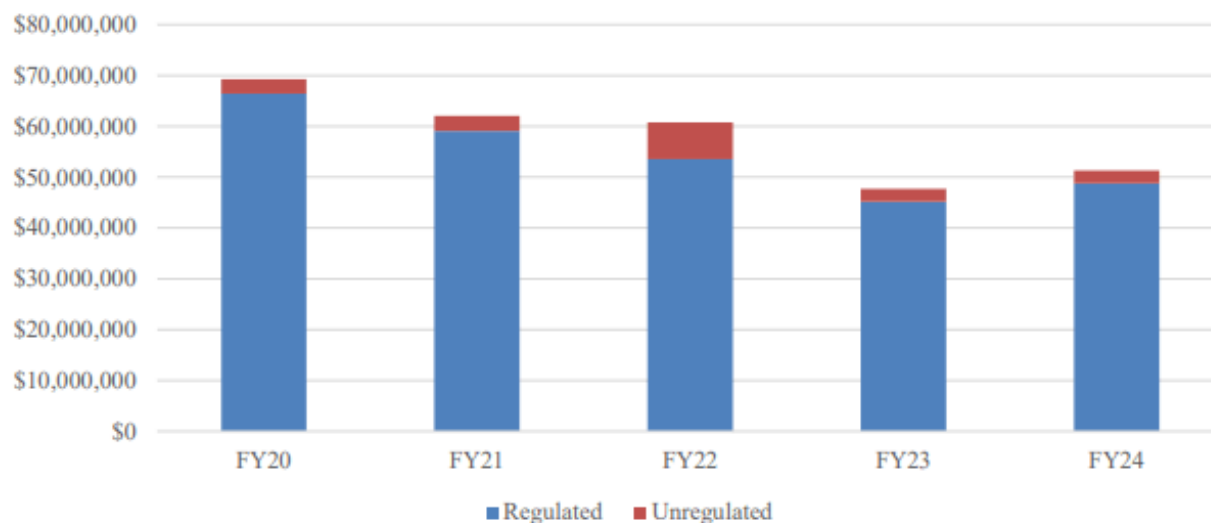
The VCWRLF was created to provide a long-term, renewing source of financial assistance for water quality improvements by reducing interest rates for local governments for projects. In FY 2021, Virginia planned to finance approximately \$205 million in project loans targeted at 14 projects. Virginia is also slated to get \$126.4 million for FY 2022 through the VCWRLF and Drinking Water State Revolving Fund from the federal Infrastructure Investment and Jobs Act (also known as the Bipartisan Infrastructure Law).

The SLAF provides matching grants to local governments for planning, design and implementation specifically

for stormwater best management practices. Since the program began in 2014, DEQ has awarded \$71 million in grants to more than 190 projects in 50 localities to being a critical part of Chesapeake Bay restoration and providing local water quality benefits, flood mitigation, improved air quality, reduced wastewater infrastructure costs, increased work for small businesses in construction and engineering and improved aesthetics related to native landscaping. The Virginia General Assembly has invested \$80 million in SLAF in recent years but has not consistently provided funding for all years.

In November 2019, the Secretariat of Natural Resources estimated that SLAF will need \$291 million in funding between fiscal years 2020 and 2024. In the 2019 Virginia Legislative Report from the Chesapeake Bay Foundation, the General Assembly voted for an increase in Virginia commonwealth funding to invest \$10 million in SLAF and \$25 million to offset the cost of upgrading the city of Alexandria's combined sewer and stormwater system, dramatically reducing sewage overflows into the Potomac River and Chesapeake Bay. Virginia legislators also voted for additional \$89.7 million in the agricultural cost share program to reduce runoff and \$4 million for oyster shell replenishment and restoration for sanctuary reefs.

2019 SLAF Needs Survey Results
FY 2020 - FY 2024
Total Estimate = \$291,024,943



To further help fund watershed-scale projects and local capacity improvements and expansions to mitigate high risk flood areas, some municipalities have approved the use of bonds. In 2020, as part of a path toward a Flood Resilient Arlington, the county's stormwater management plan, Arlington County approved a stormwater bond referendum for capacity improvement projects including stormwater detention vaults, stormwater pumping stations, land acquisition and small drainage improvements.

Smaller communities also benefit from SLAF support. In January 2022, the town of Warrenton won \$1 million and the city of Fredericksburg received \$3.25 million in grants from SLAF to reduce stream flows into Cedar Creek, leading to significantly less sediment and other pollution downstream and to reduce and treat stormwater runoff leading to the Rappahannock River.

In 2020 Virginia created the Virginia Community Flood Preparedness Fund (CFPF) to help localities reduce their

disaster risk by investing in strategic planning and projects that harness the power of nature to combat flooding at the community scale. The fund prioritizes projects that are in concert with local, state and federal floodplain management standards, local resilience plans and the Virginia Coastal Resilience Master Plan. By December 2021, Virginia had been awarded \$24.5 million in grants from the CFPF funded from the Regional Greenhouse Gas Initiative. The fund is expected to provide an estimated \$75 million a year to improve the resilience of the Commonwealth, including targeted funding for Virginia's most vulnerable and underserved communities.

To further help fund watershed-scale projects and local capacity improvements and expansions to mitigate high risk flood areas, some municipalities have approved the use of bonds. In 2020, as part of a path toward a Flood Resilient Arlington, the county's stormwater management plan, Arlington County approved a stormwater bond referendum for capacity improvement projects including stormwater detention vaults, stormwater pumping stations, land acquisition and small drainage improvements. By the end of same year, Hampton became the first municipality in Virginia – and just the third in the country – to use a \$12 million environmental impact bond to help reduce flooding and pollution having experienced increased flooding frequency and severity in recent years. With the bond, the city aimed to predict, measure, and report on the stormwater volume storage capacity and use the gathered data to inform future public investments in resilience projects. Following Hampton, Virginia Beach has recently approved a \$567 million bond referendum to also deal with flooding from stormwater and sea level.

FUTURE NEEDS

More than 70% of the commonwealth's population lives in coastal areas. Virginia is experiencing the highest rate of relative sea level rise on the Atlantic coast, putting residents at increased risk of flooding. Increased precipitation is also increasing flood risk statewide. In 2018 and 2019, flooding was listed as the most common and costly natural hazard in the Commonwealth with over nine major flooding events and infrastructure damages totaling at least \$1.6 billion. As of July 1, 2014, any locality that operates a regulated MS4 is required

to implement the Virginia Stormwater Management Program (VSMP) for private and local public projects. In 2018, the Virginia Municipal Stormwater Association surveyed 14 local governments about their needs for managing polluted runoff, which only represented a small portion of local governments that managed stormwater program. Nonetheless, the survey found a total need of \$150 million for the next two years alone, which was stated could be met by a \$75 million investment in SLAF.

Cities such as Richmond, Lynchburg, and Alexandria are currently seeking \$1.4 billion in funding aid for ending combined sewer overflows. The City of Richmond is implementing its Long-Term Control Plan and \$315 million has been invested by the City and the Commonwealth of Virginia to date. More funding, possibly hundreds of millions of dollars, is needed to fully address combined sewer overflows.

Recent state and federal funding is helping Virginia to fill the difficult funding gaps to address stormwater and food risk across the state. By August 2021, Virginia General

Assembly approved \$4.3 billion in federal pandemic relief funds through the \$1.9 trillion American Rescue Plan, including \$411 million for clean-water projects to fund work on wastewater, sewer and stormwater systems. Furthermore, as of December 2021, Virginia is set to receive more than \$8 billion in total funding from the bipartisan Infrastructure Investment and Jobs Act over next five years. While elected leaders and officials in Virginia are eagerly looking at which projects, they'll put on the priority list, it has been recognized that funds need to go to flooding concerns.

Between rising sea levels and changing precipitation patterns, Virginia has already recorded changes to the frequency and intensity of floods that pose increasingly greater risks to communities. While some communities are well-resourced and focused on the challenges ahead, others lack capacity or allocated funds to address growing and changing flood risks.

OPERATIONS AND MAINTENANCE

Research into climate change modeling indicates how extreme events pose a challenge to operators of stormwater infrastructure. It is expected that the magnitude and frequency of extreme precipitation are projected to increase up to three times during the period 2016 to 2099. The larger municipalities within Virginia maintain their systems within the limits of their areas. The towns, counties and VDOT maintains the drainage systems on roadway system in the remaining parts of the Commonwealth. Maintaining a scattered stormwater system in the rural areas remains a challenge to the agencies.

VDOT works to maintain the flow of stormwater off the pavement and through the right-of-way of state-maintained roads. VDOT and the departments of public

works in Virginia remove soil buildup and debris from open channels and ditches, clean out inlets, catch basins, storm sewer pipes and culverts, replace structurally deficient or damages storm sewer pipes and culverts and perform annual inspections on storm water facilities and necessary corrective actions in accordance to DEQ permit regulations.

Property owners are responsible for the maintenance of drainage facilities on their private property when the facilities are not part of a VDOT-owned drainage easement or a county or city easement and must take responsibility to keep stormwater free-flowing through their drainage facilities. Furthermore, property owners may not obstruct the flow of stormwater to the detriment of another property owner.

PUBLIC SAFETY

Between rising sea levels and changing precipitation patterns, Virginia has already recorded changes to the frequency and intensity of floods that pose increasingly greater risks to communities. While some communities are well-resourced and focused on the challenges ahead, others lack capacity or allocated funds to address growing and changing flood risks. Cities such as Lynchburg and Roanoke have reported concerns of potential dam failures in addition to flooding over recent years.

RESILIENCY

MS4 localities are retrofitting and upgrading their traditional stormwater management systems with green streets & other green infrastructure practices (e.g., cisterns, rain gardens, bios wales, permeable pavement, green roofs, bios wales) to meet water quality goals and reduce storm water runoff, flooding and combined sewer overflows (CSOs).

Buchanan County, which borders West Virginia and Kentucky, has suffered from riverine flooding for many years. As a lower-income area, the county has lacked the resources to comprehensively plan for and address its flood-related challenges. With the help of First Earth 2030, an environmental management firm based in Richmond, Virginia, working with the county at no cost, county officials secured a \$387,500 grant to develop a resilience plan that will engage community members to assess flood risk and identify ways to reduce it, including

Additionally, while flooding is the most common and costly natural disaster, only 3% of Virginians have flood insurance. It is estimated that 1 inch of water in a home can cause upwards of \$25,000 in damages. Virginia Department of Conservation and Recreation (DCR) hosted Flood Awareness Week from March 13-19, 2022, to encourage Virginians to learn about their flood risk and protect the life they've built with flood insurance.

nature-based projects. The county will also train a local official to become a certified floodplain manager. Once the state approves the resilience plan, the county will be able to apply for funding for shovel-ready mitigation projects.

On October 22, 2020, Virginia announced the release of the Virginia Coastal Resilience Master Planning Framework (VCRMP) as a call to action for the Commonwealth to mitigate impacts of sea level rise and climate change. To achieve functional resilience, the VCRMP aims to create equitable opportunities to build capacity. The framework divides coastal Virginia into four master planning regions to identify priority projects within each of the four regions. The Framework lays out the threats from climate change, what's at stake in Virginia, and key actions and processes that will take the Commonwealth to a full Master Plan.

INNOVATION

Innovative practices are currently underway in Virginia to minimize and manage the effects of stormwater in the state. For example, the city of Hampton is currently working to convert a public space into an innovative park that will collect, slow, and treat stormwater runoff while providing residents with a revitalized recreational area.

Showcasing a range of nature-based resilience practices, the park will include constructed wetlands that absorb and treat stormwater, a dual-purpose amphitheater that can store excess runoff, and pervious pavers that can detain and slowly release water.



Stormwater



RECOMMENDATIONS TO RAISE THE GRADE

- A State level data collection and records management system should be established
- All storm water industry leaders should encourage a dedicated funding mechanism at the local level, such as a Storm water Utility, by local governments for Operation and Maintenance and Capital Improvements of the Storm water Infrastructure to improve sustainability and performance of our storm water infrastructure.
- Increased federal investment in storm water infrastructure, with no off-sets to other programs. Federal grants, loans and new programs, similar to the Municipal Construction Grant Program, are needed to fund critical storm water infrastructure in communities of all sizes across the country and support local funding sources.
- Develop a new and enhanced construction grant program specifically for storm water projects, similar to the federal Municipal Construction Grants Program that funded the construction of wastewater treatment plants.
- Encourage First floor elevations to help stakeholders identify precise locations of risk, target outreach before and after flood events, direct first responders during events, stagger evacuation orders, differentiate between rain and surge flood risk, apply for assistance to implement mitigation projects, and much more.
- Identify right of ways when proposing redesigns to accommodate stormwater and tidal flooding.
- Conduct consistent regional or state sea level rise, rainfall, and flooding scenarios to help with cost benefit analysis & ensure consistency
- An official standardized set of scenarios for rainfall is needed.
- Information about a structure's age or current condition is important knowledge when considering mitigation actions for structures.
- Encourage stakeholders to report cross-locality real estate information to build resilience
- Better coordination with VDOT to identify VDOT right of locations in rural communities
- Data to determine the percentage of impervious cover in a community or regional area.
- A comprehensive inventory of stormwater systems that includes culverts, ditches, and more.
- Create a dataset that identifies tidal wetlands projected to drown due to sea level rise to prioritize locations for restoration
- Encourage technology such as GIS and LiDAR that includes a frequently updated shoreline inventory and resilience projects.
- Identify remediation sites located in the floodplain can help communities receive Brownfield grants
- Identify hot spots & pocket flooding areas need to be identified, as FEMA Flood Insurance Rate Maps (FIRMs) do not identify all at-risk areas.
- Determine whether current design storm standards are still accurate in the state or region would be helpful
- Increased information about which green infrastructure techniques work in communities with very localized risks



Stormwater



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Stormwater



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Stormwater



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Transit

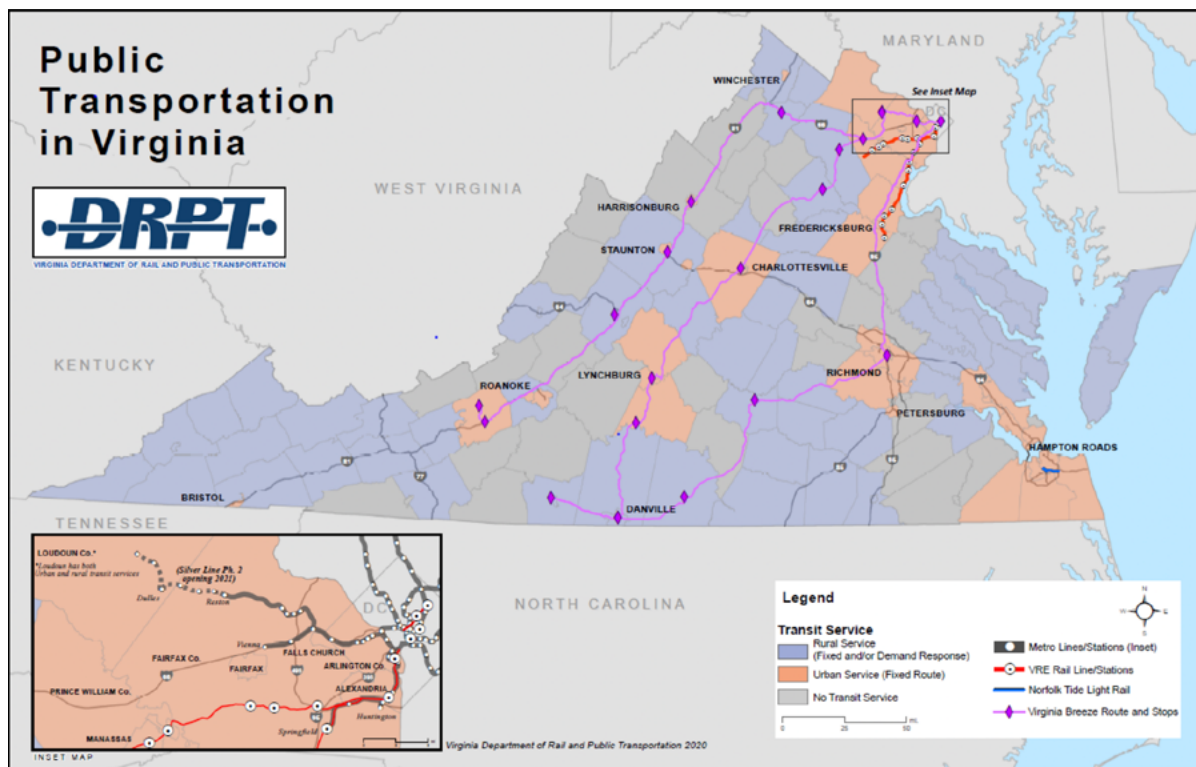




EXECUTIVE SUMMARY

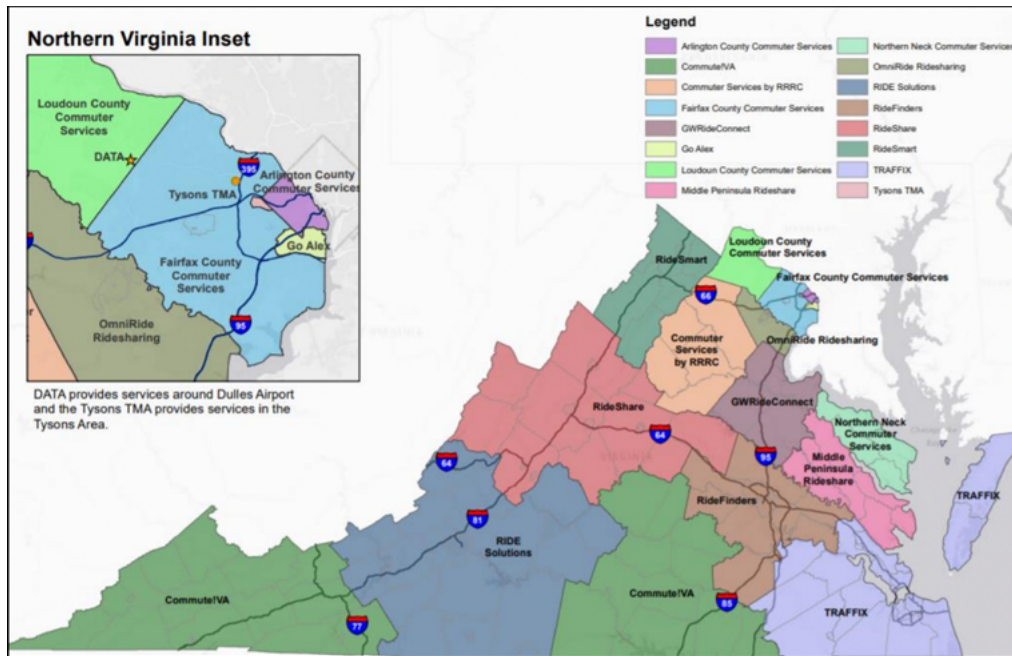
The Commonwealth's 41 transit agencies provided almost 172 million trips in FY 2019, the last year before the COVID-19 pandemic. That year, the Commonwealth's 16 commuter assistance programs removed almost 3.3 million automobile trips and 937 vanpools provided almost 2 million trips. Nineteen transit agencies reported ridership increases. Since the onset of the pandemic, transit agencies are fighting to win back riders with investments in capacity and condition. In FY21, the Commonwealth Transportation Board provided funding for 137 replacement revenue vehicles, 17 expansion vehicles, and the rehabilitation of 42 buses. The second phase of the Silver Line extension from Falls Church to Dulles Airport is nearly complete, which adds high-quality transit options to locations where concentrations of residents work, live, access essential services, and recreate. While this is encouraging, the 2022 Virginia Department of Rail and Public Transportation (VDRPT) needs assessment shows a 5-year, \$208 million gap between projected available funds and what is needed to deliver transit services and modernize the existing system.

FIGURE 1 – PUBLIC TRANSPORTATION IN VIRGINIA



Source: DRPT FY 2021 Report

FIGURE 2 – TRANSIT DEMAND MANAGEMENT IN VIRGINIA



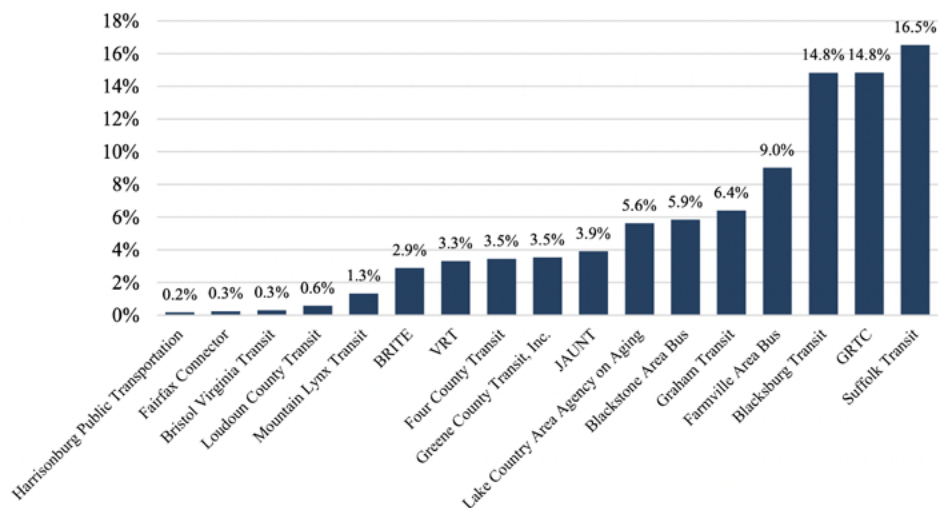
Source: VDRPT FY 2021 Report

CONDITION AND CAPACITY

Virginia statewide transit agencies are increasing fleet sizes and facility capabilities, adding bus/train lines, enhancing services with Intelligent Transportation Systems, and restructuring system design to improve transit operations in Virginia. These efforts spurred an increase in transit ridership before COVID-19, as shown in Figure 3. Virginia's 41 transit agencies provided almost

172 million trips in FY 2019. The Commonwealth's 16 commuter assistance programs removed almost 3.3 million automobile trips and 937 vanpools provided almost 2 million trips. Nineteen transit agencies reported ridership increases in the last fiscal year before the pandemic.

FIGURE 3 - TRANSIT ANNUAL RIDERSHIP CHANGE FY18-19



Source: VDRPT FY 2019 Report

Ridership changes from the pandemic and system financial health varied by agency. In general, systems focused on paratransit and higher-frequency, all-day bus systems experienced the least ridership decline. These are transit systems serving Virginians who have no other means for essential trips and travel during midday and weekends. In FY2021, April 2020 through June 2021, Virginia transit systems were slowly winning riders back, attracting approximately 51 million trips.

A 2021 report from DRPT shows the condition of statewide transit infrastructure has improved in terms of new buses (40 transit providers) and added bus routes. In FY21, the Commonwealth Transportation Board furnished funding for 137 replacement revenue vehicles, 17 expansion vehicles, and the rehabilitation of 42 buses. Additionally, efforts are underway to increase the number of trains, train lines, buses, bus routes, and train stations. Supporting improvements include expanding existing lots, increasing the number of elevators, improving escalators, and adding new park and ride lots. For FY 2021, the total value of SMART SCALE funds awarded was \$72.8 million, which includes projects for improvements such as new bus stop amenities as part of larger roadway projects.

Virginia has been a regional leader by providing dedicated funding and increased oversight reforms to the Washington Metropolitan Area Transit Authority (WMATA), the largest transit agency with operations in the Commonwealth. Starting May 2019, the General Assembly agreed to provide dedicated operating funding for WMATA – \$310 million for the year beginning July 1, 2021, and Virginia’s proportional regional share of an additional \$500 million in annual capital funding for critical state of good repair needs. WMATA includes

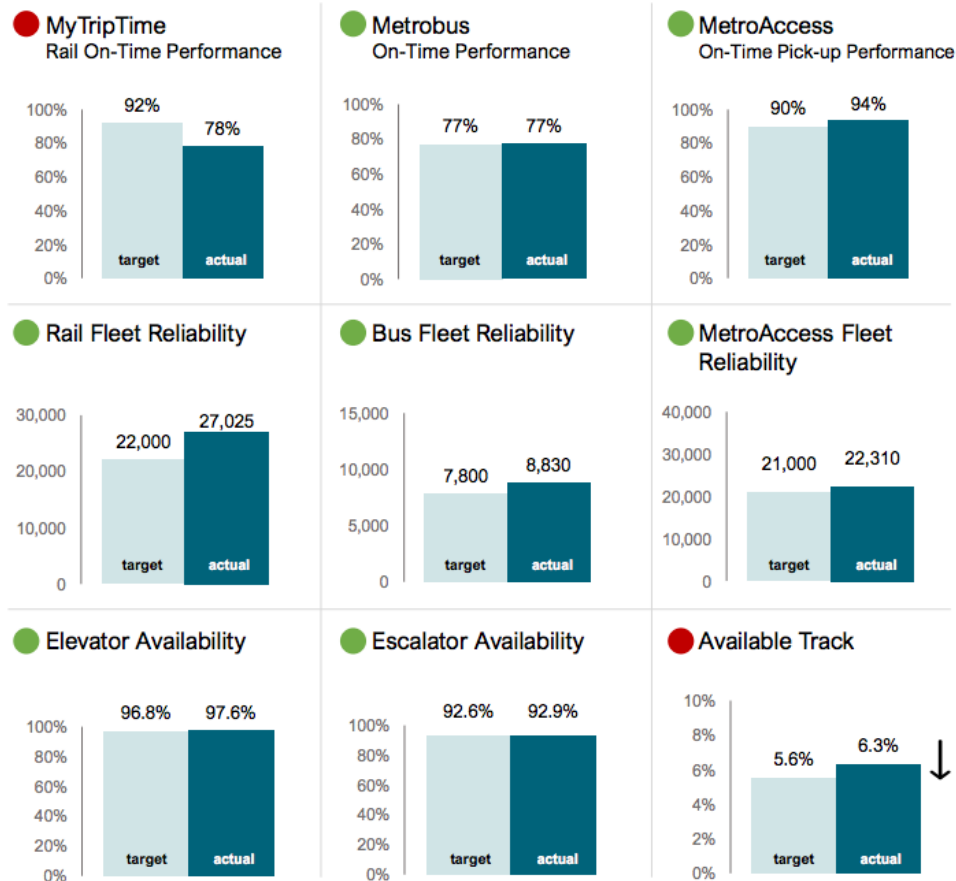
services such as Metrorail, Metrobus, and MetroAccess in Northern Virginia. The total ridership of 99.7 million in FY22 was 39% above the forecast of 72 million and a 78% increase from the same period in FY21.

Rail on-time performance within WMATA’s Virginia, D.C., and Maryland stations saw a deep decrease following the derailment on October 12, 2021, when a majority of its rolling fleet were removed from service and train frequencies were cut in half, doubling wait times. Significant improvement has been seen in February (72%) and March (75%) of 2022. However, the pandemic destroyed demand for transit trips, and it also caused serious workforce constraints on WMATA’s performance. In January of 2022, 30% of Metrobus operators were out sick, an unprecedented occurrence.

At any given time in the first three quarters of FY22, an average of only seven of WMATA’s 276 elevators in Metrorail stations system-wide were out of service. Slightly over half of the hours out of service were due to capital work, with the remaining hours out of service attributed to other work such as unit failures, related fixes, or preventive maintenance.

At any given time in the first three quarters of FY22, an average of 44 of the 616 escalators in tri-state Metrorail stations were out of service. With two active multi-year contracts to replace or repair more than 200 escalators across the system, outage hours caused by capital work have increased by 85% since the beginning of FY22, and now affect roughly 24 units at a time. Newer units, lower ridership, and stronger work practices have helped drive the longer times between repairs. WMATA’s reliability summary of performance is shared in Figure 4.

FIGURE 4 – RELIABILITY SUMMARY OF FYTD PERFORMANCE



Source: WMATA Metro Performance Report FY22/Q3

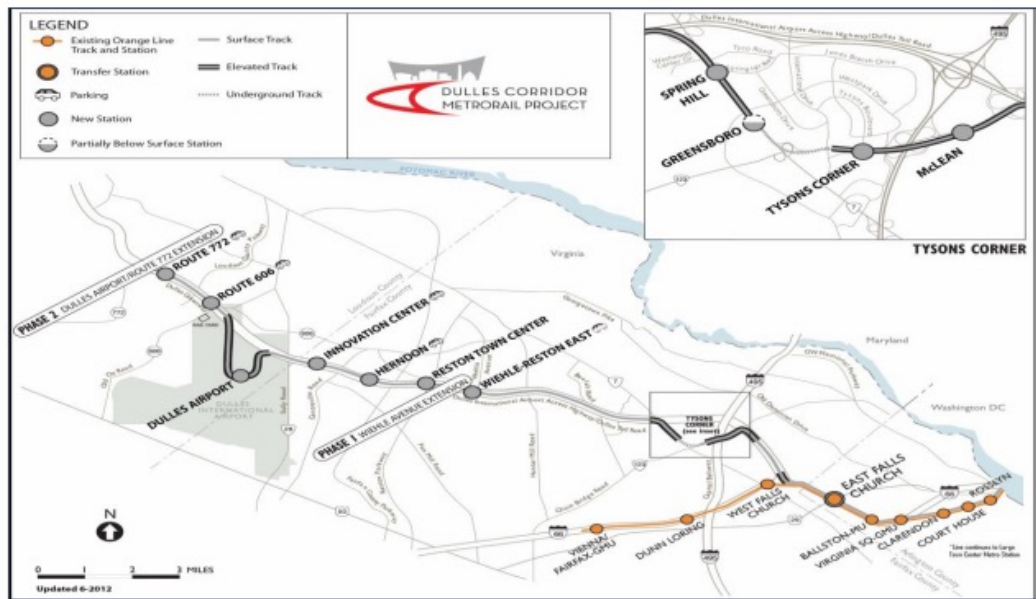
The laws, funding, and future transit plans for multimodal transportation and TDM complementing public transit have advanced in Virginia. TDM programs provide the following services for the public and employers: personalized ride-matching/commute options; information/trip planning; carpool and vanpool formation assistance; guaranteed/emergency ride home programs; employer services/commuter benefits and telework program development; marketing and promotions; bike sharing; and promotion of carsharing services. TDM provides many benefits to Virginians by relieving congestion and lowering the number of single-occupant vehicles on highways. To encourage the use of TDM and these benefits, DRPT promotes Try Transit Week, Bike to Work Week, and Vanpool!VA, which was developed to increase the number of vanpools and riders.

Dulles Corridor Metrorail provides a stellar example of transit expansion with TDM. An almost \$3 billion effort, it expands WMATA's rail transit northwest from Falls Church, VA. The Metropolitan Washington Airports

Authority led this project to add stations at major jobs centers near planned or already completed mixed-used developments in Fairfax and Loudoun Counties. This new 23.1-mile the Silver Line route, partially opened in 2014, connects downtown Washington with Tysons Corner and Reston. The second phase is almost complete, extending the Silver Line into Reston Town Center, Herndon, Dulles International Airport, and Ashburn.

The Silver Line project achieves several TDM objectives. It adds high-quality transit options to locations (Figure 5) where concentrations of residents work, live, access essential services, and recreate. The project was funded in part by past and future toll revenue collected on the parallel Dulles Toll Road, creating financial incentives for motorists to switch travel modes. The Silver Line adds non-car alternatives to a combustion chamber of Virginia's economic growth, where tomorrow's new residents and businesses would flood the engine if too many of them traveled only by personal vehicle.

FIGURE 5 – WMATA SILVER LINE EXPANSION



Source: DRPT FY 2021 Report

In recent years, Virginia’s transit providers have made progress on first-mile last-mile challenges. WMATA and other agencies have installed bike share docks,

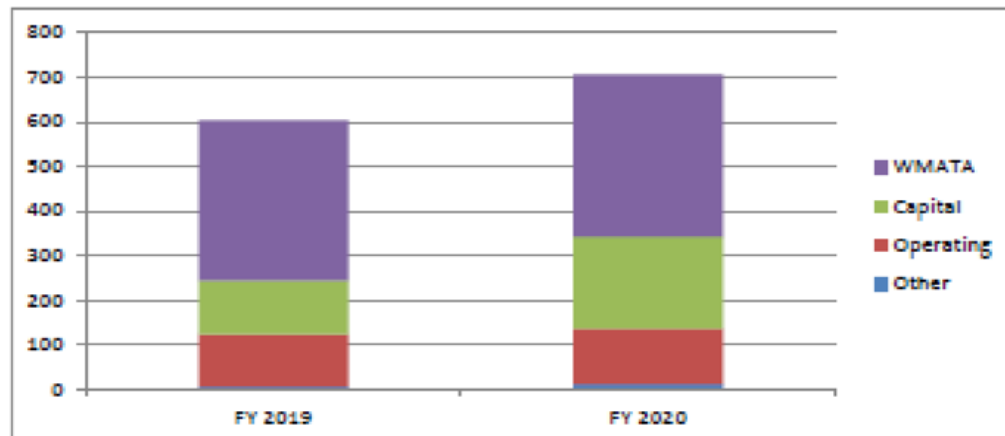
legalized the use of scooters, and created other types of connections for people of all ages and abilities.

OPERATION, MAINTENANCE, AND FUNDING

For FY2019, VDRPT allocated approximately \$603.7 million in federal and state dollars to transit and TDM initiatives throughout the Commonwealth. In Fiscal Year 2020, funding grew to approximately \$706.6 million in allocations. Figure 6 below breaks down the use of

this funding into four categories: WMATA, statewide capital, statewide operating, and other (including TDM). Overall, 32 of 40 Virginia transit agencies saw an increase in funding from FY2019 to FY2020.

FIGURE 6 - FEDERAL AND STATE TRANSIT CATEGORY ALLOCATIONS



Source: DRPT FY 2021 Report

The 2018 General Assembly created several new transit funding reforms, which include prioritization of statewide transit capital funding, a 100% performance-based method of allocating statewide transit operating assistance, and the requirement of strategic plans for urban transit agencies impacting VDRPT's statewide public transportation grant programs. These reforms (became effective in Fiscal Year 2020) apply to all statewide operating assistance programs and statewide capital assistance grants.

Transit funding has increased and budgets for several transit support programs are growing. In FY21 DRPT created the MERIT (Making Efficient and Responsible Investments in Transit) program, later expanded its scope, and then added the SMART SCALE program. SMART SCALE provides transportation funding through a prioritization process. It evaluates projects based on

improvements to safety, congestion, accessibility, land use, economic development, and the environment. For example, toll revenues from Northern Virginia projects, including I-66 inside the Capital Beltway HOT Lanes, are being used to help commuters on those highways with funding for highway and multimodal improvements.

The Transit Ridership Incentive Program (TRIP) is a new statewide grant program dedicated to improving transit's regional connectivity in urban areas with a population greater than 100,000 people and reducing barriers to transit use by supporting low-income and zero fare programming. VDRPT received 13 applications. Three applications were for regional connectivity projects totaling \$2.2 million in FY22. The remaining 10 applications were for zero fare programs totaling \$11.2 million in FY22.

FIGURE 7 – SIX-YEAR TRIP FUNDING OVERVIEW

	FY22	FY23	FY24	FY25	FY26	FY27	Total
Regional Routes	\$7.5	\$11.3	\$16.9	\$16.5	\$18.0	\$18.2	\$88.4
Zero Fare/Low Income	\$12.5	\$3.7	\$5.6	\$5.8	\$6.0	\$6.0	\$39.6
Total	\$20.0	\$15.0	\$22.5	\$23.3	\$24.0	\$24.2	\$129M

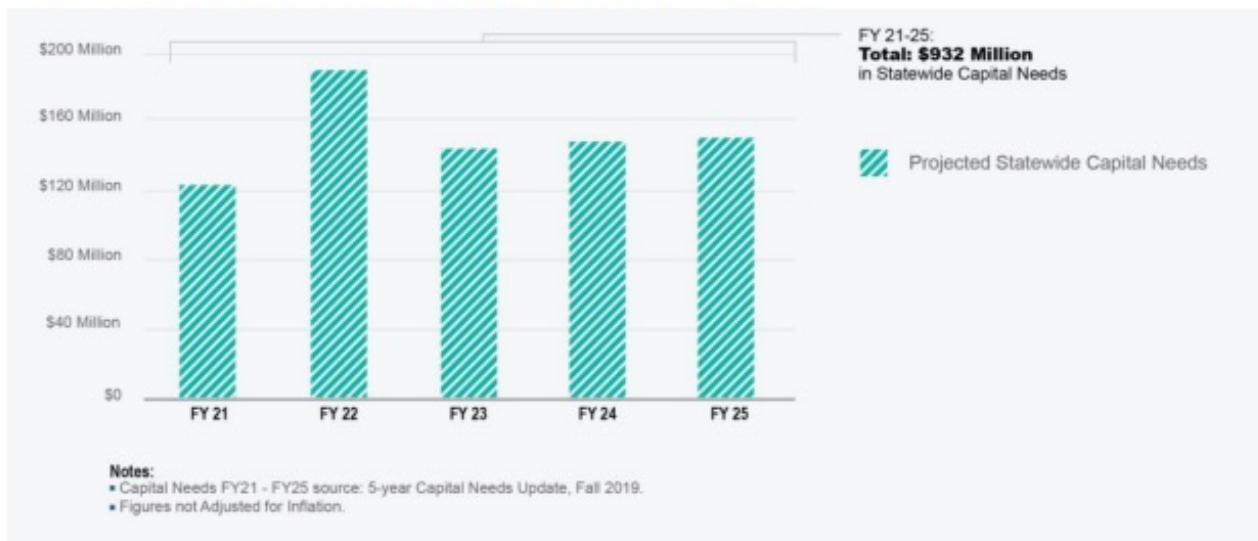
Source: DRPT FY 2021 Report

FUTURE NEED

The 2021 General Assembly directed VDRPT to complete a needs assessment focusing on the equitable delivery of transit services and modernization of transit in the Commonwealth. According to the DRPT reports (December 2019 and January 2020), transit agencies throughout the state identified \$932 million in statewide transit capital needs over the next 5 fiscal years as part

of this process. Considering projected funding between FY2021 and FY2025, this analysis projects a shortfall of \$208 million in state-controlled capital funds that would be required to implement all projects included in a 5-year capital budget. Virginia's population is expected to add 400,000 new residents in that period, mostly in cities and heavily populated suburbs.

FIGURE 8 – PROJECTED STATEWIDE TRANSIT CAPITAL NEEDS, FY 2021-2025



Source: DRPT Transit Capital Needs Assessment FY2021-FY2025 (December 2019)

PUBLIC SAFETY, INNOVATION, AND RESILIENCE

Transit agencies have increased programs to aid public safety. For example, VDRPT announced the statewide cooperative procurement of Mobileye Shield+ Driver Assistance System technology for a \$450,000 pilot program. DRPT announced funding to 10 public transit agencies to retrofit up to 50 buses with innovative pedestrian collision avoidance systems that can alert transit operators of pedestrians and bicyclists that enter the path of the vehicle.

VDRPT, in cooperation with the COVID-19 Unified

Command Joint Information Center, provided resilience to public health emergencies with guidance to assist transit agencies with their COVID-19 responses. In May 2020, the USDOT announced that it would distribute approximately 15.5 million cloth face coverings to transportation personnel across the United States, 4.8 million of which had been reserved for mass transit and passenger rail workers. VDRPT and VDOT distributed 10,000 face coverings statewide to transit agencies with fewer than 40 employees, and larger transit agencies received shipments directly from USDOT.



Transit



RECOMMENDATIONS TO RAISE THE GRADE

The recommendations of the Virginia Section are to:

- Identify ways to maximize funding secured from the Bipartisan Infrastructure law and other federal legislation for operations, maintenance, and capital improvement projects.
- Increase dedicated state funding for transit systems in both operations and capital budgets, including WMATA. For example, support more of the significant, up-front costs to vehicle purchase and operations overhaul for the zero-emission fleet transition.
- Provide financial and regulatory support for transit workforce recruitment, training, and retention, such as apprenticeship subsidies, expedited licensure, and enhanced government support for paid benefits such as family and medical leave.
- Increase funding available for transit as a percentage of revenue generated in roadway pricing schemes, such as express lanes.
- Refocus government funds and project guidelines to incentivize transit service that delivers frequent, all-day, all-week service rather than traditional rush hour peaking on weekdays.
- Install dedicated transit equipment and facilities into roadway projects as part of complete streets road repaving, roadway reconstruction, and capacity expansion. Prioritize high-ridership corridors with the worst on-time performance. These improvements include dedicated bus lanes with physical separation, transit signal priority, curb reconstruction for level boarding, and more.
- Improve coordination and cross-subsidization between transit systems and TDM programs, so that employers, employees, students, retired residents, and visitors benefit from riding transit and reducing personal vehicle use.
- Improve the feasibility and safety of multi-modal trips on last/first mile with transit. For example, install covered, secure bike storage at transit centers, place bike racks on all buses, and place bike racks at bus shelters. Coordinate transit station and route improvements with enhanced pedestrian facilities and protected bike lanes or shared-use paths.
- Provide additional funding mechanisms to support safety and Americans with Disabilities Act compliance mandates for bus shelters and other rider amenities.



Transit



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Transit



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Wastewater





EXECUTIVE SUMMARY

There are an estimated 584 municipal wastewater treatment facilities in Virginia serving a population of over 8.5 million. Virginia's three cities with combined sewer systems – Richmond, Lynchburg, and Alexandria – have made considerable progress in reducing combined sewer overflows, but remaining remediation will cost an estimated \$700 million to \$900 million. A 2012 survey estimated Virginia's wastewater infrastructure needs exceeded \$6.4 billion, probably much higher today due to inflation, aging physical infrastructure, and worsened threats from climate change such as infiltration and inflow. Utilities are raising their rates to meet this challenge: \$44.70 was the Commonwealth average in 2018, compared to \$42 nationally. Virginia water systems continue to innovate, including SWIFT, which takes highly treated water that is normally discharged into local waterways and puts it through additional advanced water treatment to achieve drinking water quality which is then used to replenish the Potomac Aquifer.

BACKGROUND

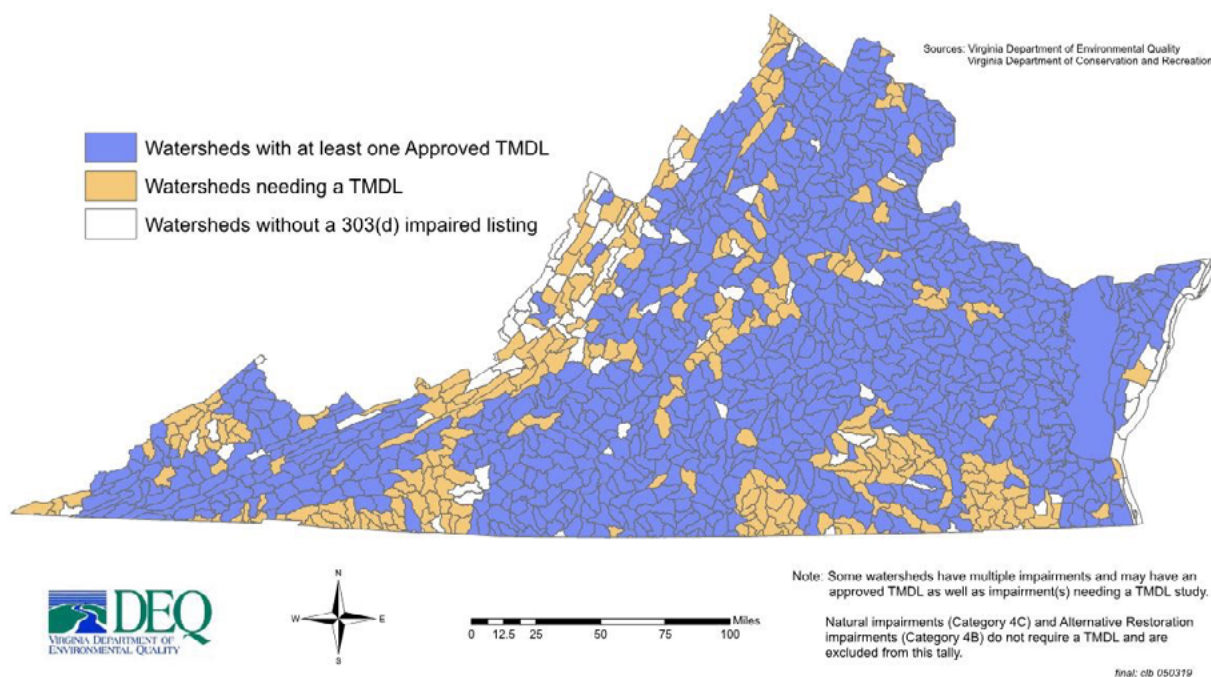
Virginia's wastewater infrastructure collects and treats effluents from households and businesses. If the effluent from Virginia's more than 580 municipal wastewater

treatment facilities contains high nutrient levels it can contribute to statewide water quality issues (TABLE 1).

TABLE 1. IMPAIRED AREA BY WATERBODY TYPE (2018)

	Rivers (mi)	Lakes/Reservoirs (acres)	Estuaries (sq mi)
Non-Impaired (% total)	6,395 (6%)	18,120 (15%)	316 (11%)
Impaired (% total)	15,553 (15%)	95,366 (81%)	2,133 (75%)
Not Assessed (% total)	79,011 (78%)	3,729 (3%)	398 (14%)
TOTAL	100,959	117,215	2,848

FIGURE 1. TMDL COMPLETION STATUS IN VIRGINIA



Maintaining high water quality in Virginia’s creeks, streams, rivers, estuaries, and coastal waters is necessary for both human and environmental health, as well as sustained economic development. A substantial portion of Virginia’s economy including fishing, agriculture, military installations, water-based tourism, ecotourism and shipbuilding, is dependent on availability to the Commonwealth’s 3,285 square miles of surface water. For example, restoring the Chesapeake Bay Watershed (CBW), which is the largest estuary in the country and runs along much of Virginia’s eastern coast, is worth an estimated \$8.3 billion to the local economy.

Since 1985, excess nitrogen and phosphorus (“nutrients”) have threatened the Chesapeake Bay’s water quality with the predominant source attributed to agricultural surface runoff followed by wastewater treatment plants/ Combined Sewer Overflows (CSOs) (FIGURE 2). Due to reductions in nutrient outputs, wastewater and combined sewer overflows (CSO) are, as of 2016, only the fourth and third most significant contributors of nitrogen and phosphorus, respectively, in the Chesapeake Bay (FIGURE 2).

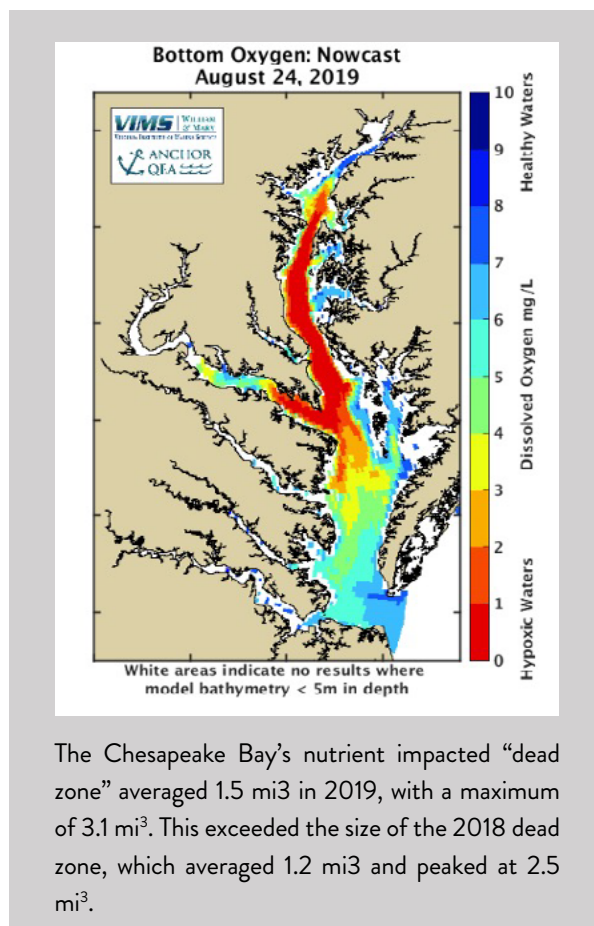
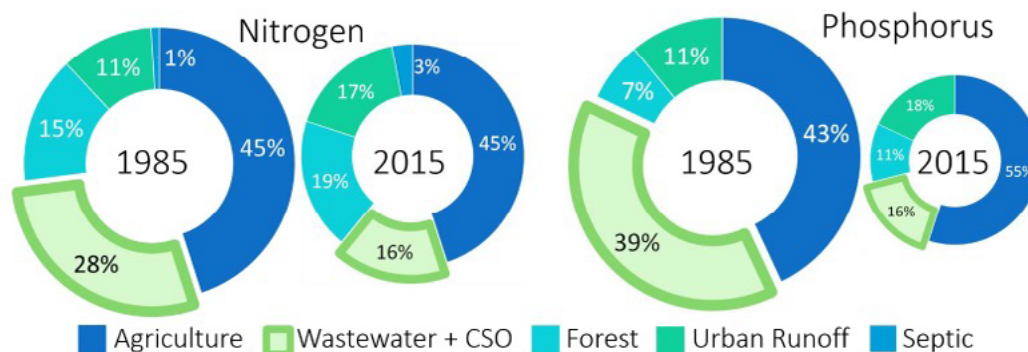


FIGURE 2. RELATIVE CONTRIBUTION OF THE SOURCES OF NITROGEN AND PHOSPHORUS LOADING IN THE CBW IN 1985 AND 2015

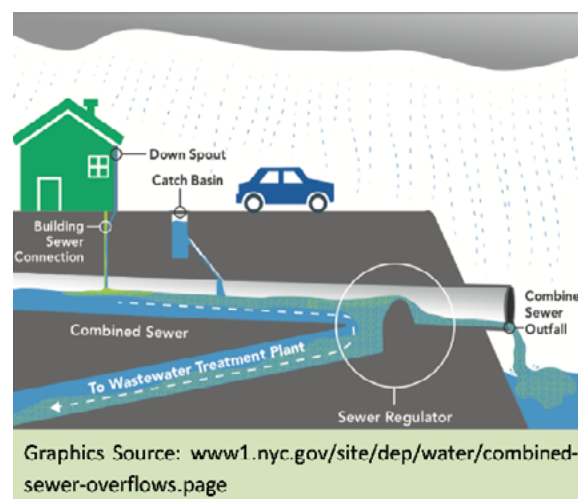


CONDITION AND CAPACITY

Virginia's wastewater is collected and treated either at the household or municipal level. Oftentimes rural areas use septic tanks for wastewater needs. However, in 2018, the U.S. Census Bureau indicated that more than 10,000 occupied houses in Virginia did not have complete plumbing facilities. Organizations like the Southeast Rural Community Assistance Project, Inc. provide financial and technical assistance to communities prone to poor and absent wastewater infrastructure. At the centralized level, Virginia's 584 municipal wastewater treatment facilities are comprised of 474 "minor" municipal facilities [with design capacities $\geq 1,000$ gallons per day, but < 1 million gallons per day (MGD)], and 110 "major" municipal facilities (with design capacities ≥ 1 MGD). Sewer flows to these facilities have increased an average of 12.5% over the past 5 years as the population has grown to over 8.5 million. With an estimated 8% increase in population expected to occur over the next ten years, growing sewer flows will likely straining the Commonwealth's wastewater capacity and potentially overload some treatment facilities.

The U.S. Environmental Protection Agency (EPA) indicates that the design life for sewage collection systems is 80 to 100 years, 25 years for force mains, and 50 years for concrete structures in pump stations and treatment facilities. Based on these timelines, much of Virginia's aging wastewater infrastructure is approaching or past due for replacement.

As distribution systems age, sewer pipes and joints may fail allowing elevated groundwater levels to infiltrate into the collection system, exceeding pipe capacities and leading to sanitary sewer overflows (SSO). The Virginia Department of Environmental Quality (VDEQ) maintains a pollution response and preparedness web platform that shows approximately 1,000 SSO events were reported in 2019. In 2017, there were between 23,000 and 75,000 SSOs nationally.



The cities of Richmond, Lynchburg, and Alexandria convey their stormwater and sanitary sewage through combined sewer systems, which are designed to overflow to rivers and streams whenever there is significant rainfall. This

CSO contaminates Virginia's rivers and waterways with raw, untreated sewage. The City of Richmond is currently in the third phase of its CSO Control Program to reduce overflows at its 29 CSO outlets to the James River. Prior initiatives to address CSO include the Shockoe retention basin and expansion of the conveyance and treatment systems. Lynchburg has previously closed 112 of its 132 CSO outlets and is working to further control CSO by adding a 4 million-gallon storage tank at the wastewater

treatment plant. The city expects to reduce the original overflow rate in 1979 by 93% by the completion of its CSO control program. Alexandria Renew Enterprises, the water resource recovery utility for the City of Alexandria, plans to construct a tunnel system to direct CSO to the treatment plant. The project, RiverRenew, is scheduled to be completed by 2025 and will reduce the average number of SSO per year from 60 to four.

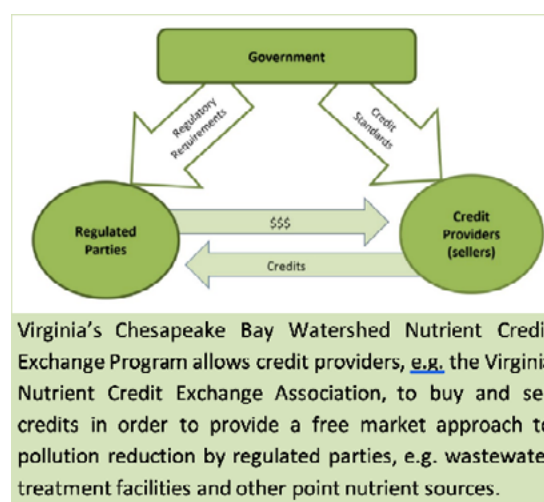
“We’re fast approaching an operator shortage... [Water] reuse is a driver for advanced operator levels. But operators moving up into the higher classification — that’s not happening.”

– Wesley Basore, wastewater operations manager, Louisa County Water Authority

OPERATIONS AND MAINTENANCE

The wastewater sector depends on a well-trained workforce to conduct routine operation and maintenance (O&M) which ensures permit requirements are met and the lifespan of a wastewater system is maximized. However, as Virginia's existing workforce ages and nears retirement, a shortage in trained personnel is ranked among the top ten concerns reported in the American Water Works Association's (AWWA) 2019 State of the Water Industry Report. To address this critical O&M need, VDEQ, Virginia Rural Water Association (VRWA), and the EPA all offer various training opportunities on topics such as wastewater sampling, compliance with the Clean Water Act, process control, and permit reporting.

Because of the strict nutrient regulations within the Chesapeake Bay Watershed, utilities have adapted their operations using two important techniques – nutrient credit trading and water reuse. Taking a large-scale approach to nutrient management, treatment facilities that discharge less than their allocations allow may sell credits to the Nutrient Credit Exchange or trade credits within a shared river basin. Other facilities that cannot cost effectively reduce their nutrient loading may purchase credits. Taking a more “micro” or technological approach, wastewater facilities operating under the paradigm of “wastewater as a resource” are implementing technologies that enable the reuse of



treated effluent for irrigation or cooling processes. For example, the Noman M. Cole Jr. Pollution Control Plant in Fairfax County reuses 500 million gallons per year, while Loudon Water's Broad Run Water Reclamation Facility reuses 1 MGD.

While septic systems are a minor contributor to the Bay's nitrogen loading, only about 3% in 2015 (FIGURE 2)], the systems significantly exceeded their annual discharge in 2017. Therefore, the Virginia Department of Health (VDH) has passed stricter nutrient regulations to limit the loading from the 550,000 septic systems within the area.

FUNDING AND FUTURE NEED

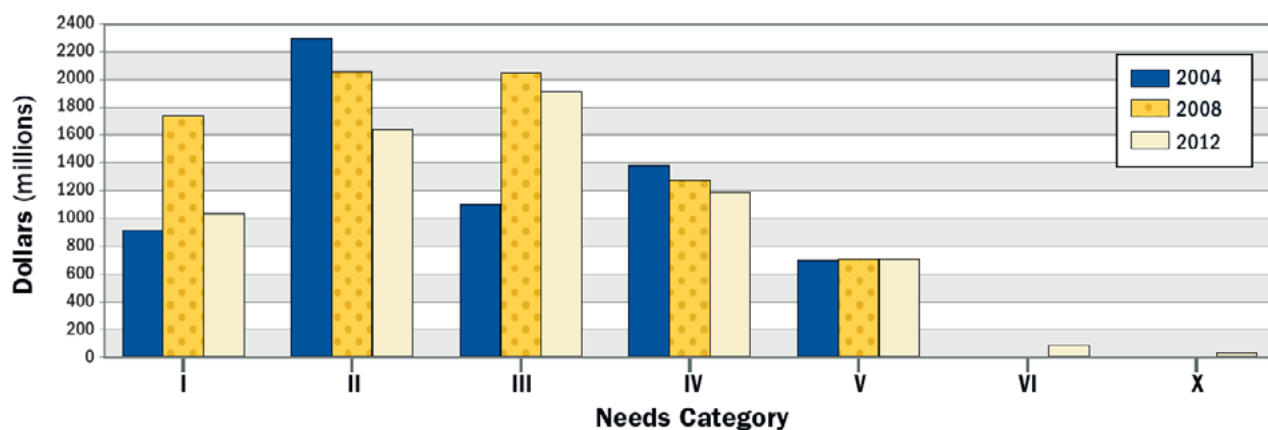
The EPA's most recent Clean Watershed Needs Survey (CWNS) from 2012 reported Virginia's funding need at \$6.528 billion. Compared to the funding needs in 2008, Virginia's 2012 wastewater needs declined or remained the same across all categories. In recent years, Congressional funding for an update to the CWNS report has been cut, so Virginia's current infrastructure needs are difficult to

precisely determine. For example, the cities of Richmond and Alexandria are expecting to spend roughly \$700 million to \$900 million, respectively, to correct CSOs. TABLE 2 shows Virginia's CWNS needs by category and reports the total CSO corrections at \$695 million, significantly lower than the actual anticipated costs.

TABLE 2. VIRGINIA'S DOCUMENTED NEEDS BY CATEGORY (2012 CWNS)

Categories	Funding Needs (\$, million)
I Secondary wastewater treatment	1,024
II Advanced wastewater treatment	1,628
III Conveyance System Repair	1,898
IV New Conveyance Systems	1,176
V Combined Sewer Overflow Correction	695
VI Stormwater Management Program	80
X Recycled Water Distribution	26
TOTAL	6,528

FIGURE 3. VIRGINIA'S DOCUMENTED NEEDS BY CATEGORY (SEE TABLE 3 FOR CATEGORY DESCRIPTION)



Regardless of the old data and rising costs for construction, maintenance, and upgrades, Virginia has made use of state and federal funding programs to cost effectively alleviate the growing financial burden being put on local communities while still complying with federal clean water regulations. For instance, the Virginia Clean Water Revolving Loan Fund (VCWRLF) Program that has provided over \$3 billion since 1987 to support wastewater projects throughout the Commonwealth. Although over \$35 million was delegated to this program in 2019, applicant needs totaled nearly \$78 million, underscoring the extent to which the program is oversubscribed. Furthermore in 2020, municipalities applied for \$651 million to support wastewater projects, an eight-fold increase from the previous year.

Another funding source is the Water Quality Improvement Fund (WQIF) which has provided \$660 million since 2007 but is limited to supporting the design and installation of nutrient reduction technologies at publicly owned wastewater treatment plants within the CBW.

A relatively new funding source is the EPA's Water

Infrastructure Finance and Innovation Act (WIFIA) program. WIFIA has provided loans to fund 89 projects in U.S. since 2017. Virginia projects receiving funding in 2019 are the City of Alexandria's tunnel system to control CSO (\$189 million), Hampton Roads Sanitation District's (HRSD) SWIFT initiative (\$930 million), and the City of Newport News' advance metering infrastructure project (\$24 million). TABLE 3 provides a list of selected funding sources and dollar amounts being utilized by Virginia's wastewater industry for 2019 and 2020.

Some funding programs, such as the U.S. Department of Agriculture Rural Development's (USDA RD) Water & Environmental Programs and the Southeast Rural Community Assistance Project (SERCAP), Inc., specifically target rural communities and small treatment systems. The USDA RD's Water & Environmental Program, for example, provided over \$35 million and \$50 million in grants and loans to support water and waste disposal projects in Virginia in 2015 and 2016, respectively. Communities can also apply for loans of up to \$250,000 from SERCAP, Inc.'s Community Development Financial Institution (CDFI) Loan Fund.

TABLE 3. SELECTED FUNDING AGENCIES, FUNDING TYPES AND DOLLAR AMOUNT OF FUNDS ALLOCATED TO THE COMMONWEALTH OF VIRGINIA FOR 2019 and 2020

Funding Agency/Manager	Funding Type	2019 Funding (\$, million) ^I	2020 Funding (\$, million) ^I
Virginia State Revolving Loan Fund	State Loans	35	651 ^{II}
Water Quality Improvement Fund	Grant	N/A	4 ^{III}
Water Infrastructure Finance and Innovation Act	Loan	1,143	N/A ^{IV}

^I Dollar amounts rounded to nearest million

^{II} This is the sum of applicant projects; the approved amount will likely be less

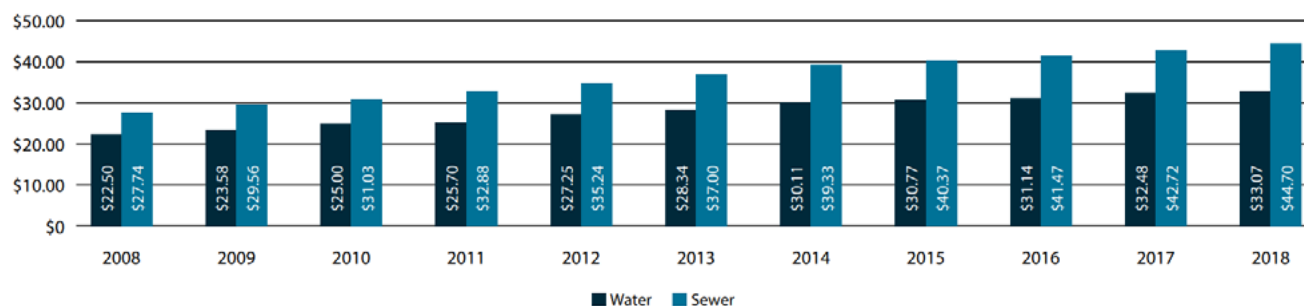
^{III} This is a proposed amount currently receiving public comment

^{IV} Data not yet available

Because the wastewater infrastructure funding needs exceed \$6 billion while the federal and state grants and loans fall short of that target, the funding gap adds pressure for localities to find alternative financial resources. The funding gap has also led to an increase in public wastewater rates, with communities bearing 95% of clean water costs.

The Commonwealth's average monthly wastewater rate in 2018 was \$44.70 (FIGURE 4), which equates to a 7.8% increase since 2016. Virginia's wastewater rate exceeds that of the national average of approximately \$42 per month.

FIGURE 4. AVERAGE MONTHLY WATER AND SEWER RATES
(PER 5,000 GALLONS) IN VIRGINIA



PUBLIC SAFETY

It is important that the public be notified about health issues such as SSOs at nearby wastewater treatment plants. For example, in 2019, monitoring of enterococci bacteria for possible fecal contamination at 46 of Virginia's beaches resulted in 77 days of posted swimming advisories. Further, Virginia still has a significant number of waterways with posted fish consumption advisories. The VDEQ maintains a publicly accessible database where reported pollution incidents are listed.

In recent years, studies have revealed a new class of pollutants being called "contaminants of emerging concern" (CEC) which include pharmaceuticals and personal care products (PPCPs), perfluorinated compounds (PFAS), antibiotics, and nano-plastics. Many of these CECs make their way to a wastewater treatment facility, where they either pass through into the effluent or are accumulated in biosolids. In 2019, VDEQ commissioned a literature review to inform their future efforts at monitoring CECs.

"There are often stories about how people don't want to pay more for water and sewer, and my reaction is – of course they don't! ...I don't want to pay more for anything – unless I know why. That value proposition must be made to the customer."

– George Hawkins, former general manager of DC Water.

Source: <https://www.waterworld.com/wastewater/article/16190177/educating-the-public-about-the-value-of-water>

INNOVATION

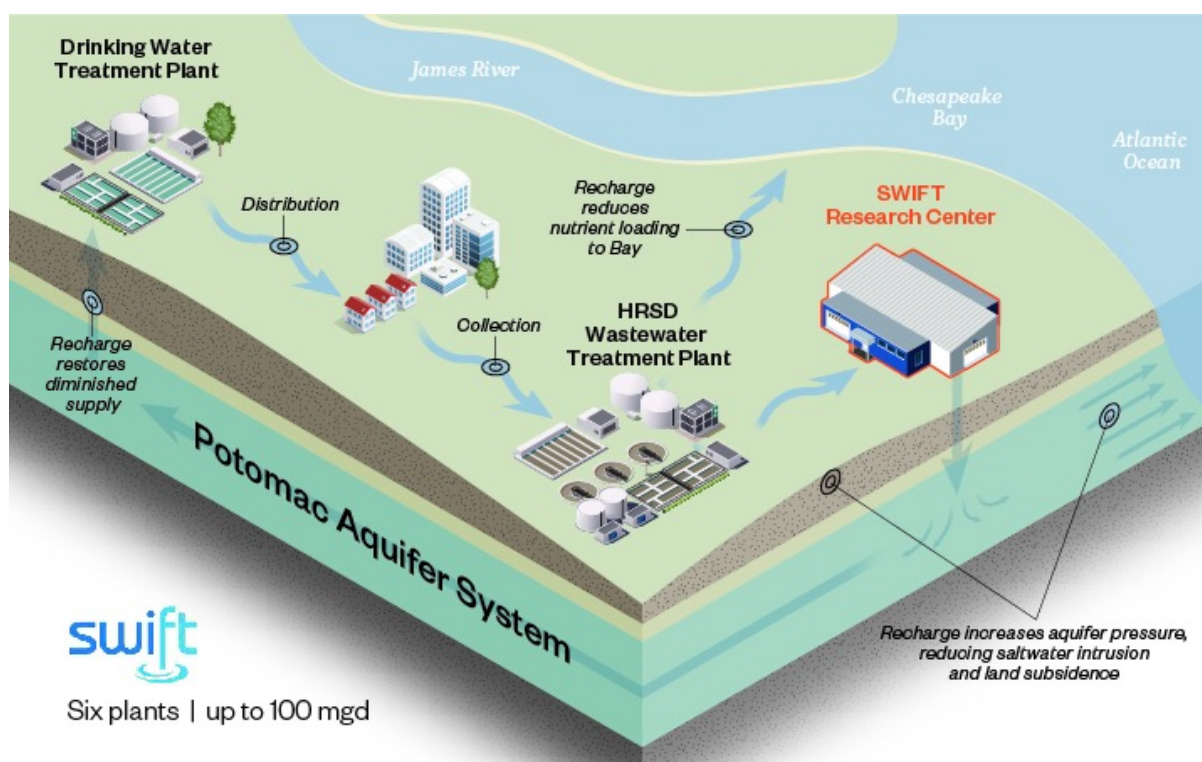
Virginia wastewater utilities are leading the way in research and implementation of new technologies that save money and energy through innovative treatment processes and promote watershed resilience.

Alexandria Renew Enterprises (Alex Renew) is the first facility in North America to **incorporate full-scale mainstream deammonification**. This process removes nitrogen from the wastewater with approximately 60% savings in aeration and 40% in supplemental carbon. Mainstream deammonification is expected to reduce the nitrogen discharged by Alex Renew by up to 20%.

HRSD is scheduled to begin construction of its first full-scale SWIFT facility in 2022, with completion of all

SWIFT full-scale facilities by 2032. SWIFT (**Sustainable Water Initiative for Tomorrow**) is HRSD's response to the depletion of the Potomac Aquifer, eastern Virginia's primary source of drinking water. The new SWIFT facility will recharge the Potomac aquifer with drinking-water quality SWIFT Water™, which is effluent from local wastewater treatment plants which is put through additional Advanced Water Treatment to bring it to drinking water standards (FIGURE 5), replenishing the overdrawn aquifer as a water source, addressing the subsidence of the land over the aquifer, and lowering the amount of nutrients being discharged to the Chesapeake Bay. SWIFT also addresses salt water intrusion.

FIGURE 5. WATER FLOW DIAGRAM FOR HRSD'S SWIFT INITIATIVE





Wastewater



RECOMMENDATIONS TO RAISE THE GRADE

- The Commonwealth should devote more of its attention and financial resources to rehabilitating the aging infrastructure using asset management principals to lower life cycle costs,, which will only become more of an issue if left unresolved.
- Consideration should be given to upgrading more treatment facilities in the CBW so that they will be able to meet the pending 4 mg L-1 total nitrogen and 0.3 mg L-1 total phosphorus limits. This will become especially important if facilities must expand or new facilities must be built to serve the growing population, increasing demand for credits in the point source trading program.
- DEQ should continue to assess the impairment of Virginia's waterways and establish necessary TMDL's, especially in watersheds where no TMDL's yet exist.
- Treatment facilities should continue to seek innovative ways to reduce pollution and costs. While most facilities may not have the resources to pursue cutting-edge research projects, they may consider water reuse agreements with local non-potable water users.
- Utilities should ensure that sewer user fees (rates) reflect the full cost of service including operation, maintenance, and capital needs.
- Wastewater utilities should continue to apply for grants from federal and state agencies, e.g., VCWRLF, WQIF, and WIFIA, to alleviate the economic burden on the local communities. New sources of funding should be pursued as they become available.

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