# 2014 REPORT CARD FOR VERMONT'S INFRASTRUCTURE

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

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## ABOUT THE REPORT CARD AND GRADING

The Report Card for Vermont's Infrastructure highlights that infrastructure in the State of Vermont simply requires more attention. Throughout history, infrastructure has had a role in the everyday life of people, and this has not changed today. Everyone uses infrastructure daily, whether brushing your teeth in the morning, or picking your child up from school, people use infrastructure. Infrastructure is also a key element to sustaining and growing our economy, public safety, and national security, yet at times we take infrastructure for granted.

The 2014 Report Card for Vermont's Infrastructure assessed six categories of Vermont's critical infrastructure - bridges, roads, dams, drinking water, wastewater, and solid waste - and found that even after the damage of Tropical Storm Irene there has been positive progress in rebuilding and maintaining Vermont's infrastructure. Progress was clear for roads and bridges leading to increases in their grades since 2011 while other categories such as dams, drinking water and wastewater struggle to recover and get the attention they need to continue to serve their communities. The 2014 Report Card found that Vermont's infrastructure earned a cumulative grade-point-average of C showing that a continued attention to rebuilding is needed.

The goal of the 2014 Report Card for Vermont's Infrastructure is to provide an analysis of infrastructure in a simple, school-style "Report Card" using an A to F scale

that can be used as a resource by local, state and federal leaders within our State to help improve infrastructure and raise public awareness. In 2011, the Vermont Section of the American Society of Civil Engineers (ASCE) selected a volunteer team of professional engineers to review the state's infrastructure and develop the first Report Card for Vermont's Infrastructure. The inaugural Vermont Report Card evaluated bridges, roads, dams, drinking water, and wastewater infrastructure within the state of Vermont. As with the national Report Card for America's Infrastructure, produced by the American Society of Civil Engineers, the Vermont Report Card is intended to provide an overview of issues relating to and conditions of common infrastructure. The 2014 Report Card for Vermont's Infrastructure includes a new section for solid waste infrastructure, in addition to the updates provided for the bridges, roads, dams, drinking water, and wastewater infrastructure. Every few years the ASCE Vermont Section intends to update this Report Card to show progress or decline in the state's infrastructure grades.

The Vermont Infrastructure Report Card evaluates key state infrastructure based on the following components and the availability of data:

- Existing Conditions
- Capacity
- Operations & Maintenance
- Public Safety
- Risk & Resilience
- Current & Projected Levels of Funding
- Innovation

Public information was primarily utilized for development of this report. In some instances, the Committee found there was a lack of information available for evaluation and this was taken into account. Grading for each category was also based on the current and projected levels of funding as an indicator of future need.

## REPORT CARD FINDINGS

1. **Building a stronger Vermont starts from the ground up with more resilient and sustainable infrastructure:** Tropical Storm Irene was a wakeup call that highlighted the need for more resilient infrastructure. From roads to water infrastructure to energy, Vermont should take advantage of the opportunity to implement new practices and new building methods to be able to better handle the next natural event and recover quickly. The opportunity to rebuild is an opportunity to build stronger, more sustainable infrastructure that will strategically serve the state in the long-term. Don't just rebuild your grandparents' infrastructure; reconsider the infrastructure that your grandchildren will want to inherit.

2. **Catching up on the state's infrastructure backlog now will go further for the future:** Emergency repair funding and new catch-up investments by state leaders in transportation and water are addressing a long-overdue infrastructure backlog at an accelerated pace. While interest rates are low and the U.S. economy is only starting to rebound, it is a great time to invest in infrastructure and put Vermont workers back to work fixing Vermont's infrastructure backbone. The investments made today can lasts 50 to 100 years with good maintenance and are an investment in the state's future.

3. **Knowing what we don't know is important, too:** A lack of information was taken into account in the grading of Vermont's infrastructure because a lack of information would inhibit Vermont officials from effectively making reasonable decisions about the infrastructure Vermont's citizens use daily. Whether it's a number of dams that cannot be inspected routinely because there is not enough staff or a lack of in-depth, statewide information covering local road needs, it's important that our leaders acknowledge that what we don't know can hurt us.

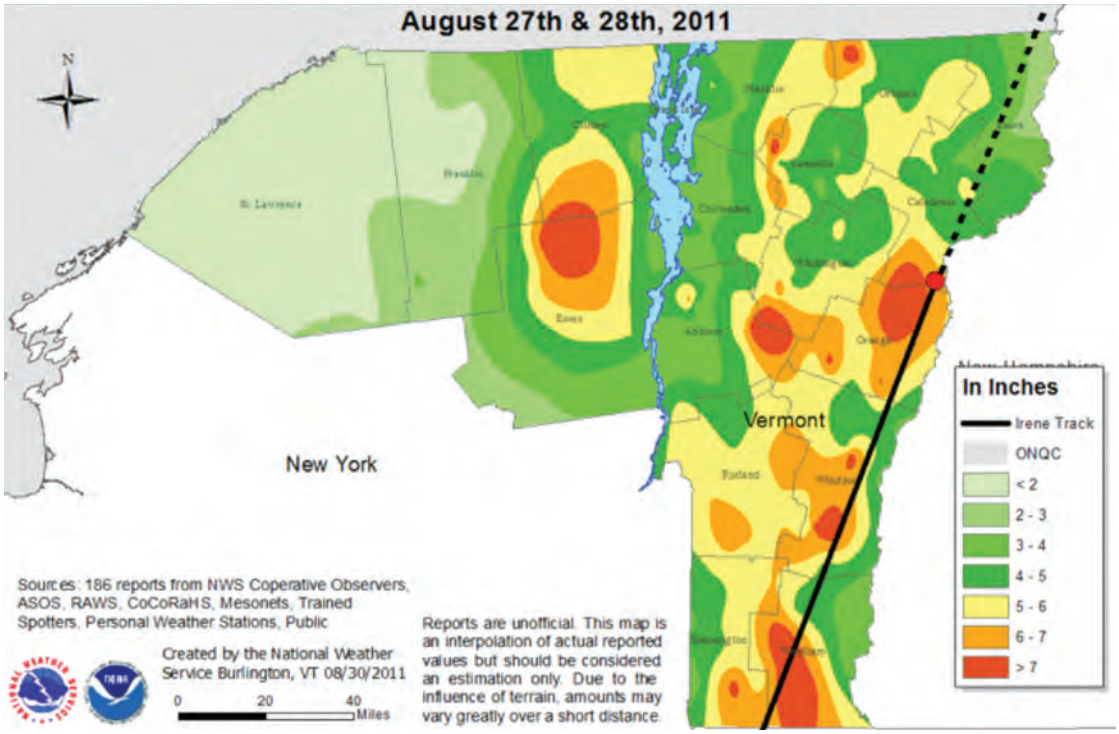
# 2014 REPORT CARD FOR VERMONT'S INFRASTRUCTURE ISSUE BRIEF SUMMARY


| SUBJECT | 2011 GRADE | 2014 GRADE | COMMENTS |
|---|---|---|---|
| Bridges | C- | C | Approximately 30% of Vermont's bridges are deficient, compared to a national average of about 24%. Vermont ranks 23rd in the nation based on the percentage of structurally deficient bridges due in large part to the age of the Vermont bridge network. However, the percentage of structurally deficient bridges declined from 19.7% in 2008 to just over 8% in 2013. The Vermont Agency of Transportation estimated in 2008 that $110 million is needed every year for 20 years to fill the bridges funding gap and address the structural and age issues. In 2014, state legislators and the Governor passed the largest investment ever in the state's transportation infrastructure containing $140.3 million for bridges which will help to improve the overall condition of the state's bridges. |
| Dams | C | C | Vermont has 1,219 dams on its state inventory and 198 (16%) of those structures are classified as high or significant-hazard-potential. Vermont's Dam Safety Program is understaffed and depends on a voluntary action by dam owners or a time-consuming state process for correcting safety deficiencies. Based on inspections completed in 2013, 35% of dams inspected were in poor condition. The Vermont Dam Safety Program relies heavily on educating dam owners of safety risks to motivate repairs. The financial burden of repairing or removing the poor-condition dams is estimated to be $22 million for all removals and $35 million for all repairs. Ten obsolete or unsafe dams have been removed from Vermont waters over the past six years, with five of the removals taking place in 2013-2014. The majority of Vermont dams are the responsibility of private landowners that tend to have limited willingness to invest in maintenance and repairs. Vermont House Bill 590, considered by the Vermont legislature in 2014, would require registration of dams to improve public safety but did not become law. |
| Drinking Water | C- | C- | Vermont has a total of 1,377 active public water systems, and 97% of these are small community systems. Vermont needs $510 million over the next 20 years to meet the demands of the Small Community Water Systems (CWS), and additional resources are needed for the 24 medium and 7 large systems. Vermont is one of 15 states that receives the minimum federal loan program allotment of 1%. Annual funding deficits ranged from $10 million to $40 million over the past four years, providing only about half of the funding needed for Vermont's drinking water systems. While 30 public water systems issued boil water notices as a result of Irene, impacting more than 16,500 people, the damage and repairs required have not been fully reported. |
| Waste-water | D+ | D | Vermont has over 7,000 miles of rivers and streams, 300,000 acres of wetlands, and 812 lakes and ponds, totaling over 230,000 acres. There are 91 wastewater treatment facilities that treat approximately 44 million gallons of sewage and discharge the treated effluent to the waters of Vermont each day. To address Vermont's clean water needs, $156 million of additional funds is needed annually to do wastewater and stormwater sewer repairs, retrofits, and facility upgrades. Of this, $18 million is the annual need specifically for municipal wastewater infrastructure. Proposed budget cuts in the state's Clean Water State Revolving Fund – the primary funding mechanism for financing clean water infrastructure upgrades and retrofits – do not support the municipal wastewater systems in the state that are trying to keep the water clean. |
| Roads | D+ | C- | Vermont ranks 28th in the nation in state highway performance and cost effectiveness, moving up 14 spots from 42nd in the previous year. This was due largely to the influx of emergency funding that Vermont received in the aftermath of Tropical Storm Irene which significantly impacted Vermont's roads. To continue making improvements at the same rate since 2011, VTRANS estimates a funding need of $700 million per year, at least through 2018. Positively, state legislators and the Governor passed the largest investment ever made in the state's transportation infrastructure which contains $685.7 million in transportation funding for 2015. The 2015 Transportation package provides $115.7 million for paving, $108.7 million for town highway programs, $50 million for maintaining and improving roadways, and $13.3 million for highway safety and traffic operations. Vermont has also made progress on road safety with its Strategic Highway Safety Plan cutting road fatalities by nearly half since 2006. |
| Solid Waste | NA | C+ | In 2012, Vermonters generated approximately 600,000 tons of municipal solid waste (MSW). Of that, over 200,000 tons were recycled or otherwise diverted from landfills or incinerators. This represents a 35% diversion rate, almost three times the 12% rate in 1987 before implementation of Vermont's first robust solid waste management law (Act 78). Though progress has been made in managing solid waste since passage of Act 78, the diversion rate has remained flat at 30% to 35% over the last two decades. |

A = Exceptional
B = Good
C = Fair
D = Poor
F = Inadequate

*Categories were evaluated on the based on existing conditions, capacity, operations & maintenance, public safety, risk and current and projected levels of funding.*

## *Tropical Storm Irene Total Rainfall*




# IRENE'S IMPACT

Irene hit Vermont on August 28, 2011 with record-breaking rainfall of 3 inches to more than 7 inches in forty-eight hours.[i] It is said that some mountain areas received as much as 11 inches of rainfall during the storm. Extreme flooding occurred in at least ten of Vermont's seventeen major river basins. [ii] The flood of record, defined as the highest known recorded flood elevation for a location, took place at nine USGS stream gauges and the flood had a typical magnitude that equaled or exceeded the 100-year flood.[i] The storm affected 225 municipalities with major devastation to almost all sectors of Vermont's infrastructure.[iii]

Tropical Storm Irene arguably was the most damaging natural disaster to impact Vermont's infrastructure in a lifetime. The powerful storm destroyed approximately 500 bridges and 1000 culverts, washed away 500 miles of roads, damaged over 200 miles of rail, ruined numerous drinking and wastewater systems, and outflanked several dams[ii]. Vermont had not seen such widespread damages since the great flood of 1927. The effects of Irene are still felt around Vermont. Infrastructure repairs continue in some areas, large debts exist from completed essential repair work, and legal battles with the Federal Emergency Management Agency (FEMA) are ongoing for reimbursement of emergency repairs. Recovering from Irene is expected to cost between $700 million and $1 billion for the state.[iii]

Irene was an extreme event that warranted a U.S. disaster declaration across most of the state.[i] Irene was one of many flood-related disaster declarations for Vermont this decade, impacting every aspect of Vermont's infrastructure. For example, just months prior to Irene, a disaster was declared due to record high water levels in Lake Champlain that impacted all of the surrounding communities. Flooding has taken a major toll on Vermont's infrastructure. A review of seventy-five years of long-term stream gauge records on unregulated rivers in the northeast US shows a trend of increasing flood magnitude and frequency.[iv] Floods have had a devastating effect on Vermont's infrastructure and are likely to be larger threats moving forward.

The people of Vermont came together to rebuild their homes, businesses, and public infrastructure following Irene. Careful planning and improved designs are necessary to create infrastructure that is more flood resilient. The state has also demonstrated its continued support by increasing investment in post-Irene recovery efforts. For example, in June Governor Peter Shumlin signed a $685.7 million Transportation Bill for FY2015, which represents the largest investment ever made in the state's transportation infrastructure.[v] The Vermont Section of ASCE believes this is a positive step towards repairing and improving Vermont's infrastructure.

## SOURCES

Information for this report was obtained from the following sources


i. Medalie, Laura and S.A. Olson, 2013. High-water marks from flooding in Lake Champlain from April through June 2011 and Tropical Storm Irene in August 2011 in Vermont: U.S. Geological Survey Data Series 763, 11p. Available at http://pubs.usgs.gov/ds/763/

ii. Pealer, Sacha, 2012. Lessons from Irene: Building resiliency as we rebuild. Vermont Agency of Natural Resources, Climate Change Team.

iii. Minter, Sue, 2012. Update on Vermont's Recovery from Tropical Storm Irene. Irene Recovery Officer, State of Vermont. www.vtstrong.vermont.gov.

iv. Collins, Mathius J., 2009. Evidence for Changing Flood Risk in New England Since the Late 20th Century. Journal of the American Water Resources Association (JAWRA) 45(2):279-290.

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# BRIDGES


*Photo by: Lars Gange & Mansfield Heliflight*

VERMONT SECTION ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

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# BRIDGES

## GRADE: C

Approximately 30% of Vermont's bridges are deficient, compared to a national average of about 24%. Vermont ranks 23rd in the nation based on the percentage of structurally deficient bridges due in large part to the age of the Vermont bridge network. However, the percentage of structurally deficient bridges declined from 19.7% in 2008 to just over 8% in 2013. The Vermont Agency of Transportation estimated in 2008 that $110 million is needed every year for 20 years to fill the bridges funding gap and address the structural and age issues.[v] In 2014, state legislators and the Governor passed the largest investment ever in the state's transportation infrastructure containing $140.3 million for bridges which will help to improve the overall condition of the state's bridges.

## BACKGROUND

Vermont has 2,712 long structures greater than 20 feet on interstate, state, and town routes and an additional 1,265 short structures between 6 and 20 feet on the state system that the VTRANS inspects.[i] All Vermont bridges are inspected in accordance with the FHWA's National Bridge Inspection Standards (NBIS), and inspections are conducted every 24 months on long structures and every 60 months on short structures, unless conditions warrant more frequent inspections.[i] Inspection data for bridges with spans of at least 20 feet in length and located on public roads are submitted to FHWA for inclusion in the National Bridge Inventory (NBI). NBIS inspection data, supplemented with data from VTRANS, was used as the basis for this evaluation. There are two key condition terms for bridges that indicate their needs:

Structurally Deficient (SD): A bridge is structurally deficient if there is significant deterioration to the bridge deck, bridge supports, or other major components. Although bridges classified as structurally deficient are safe for continued use, they may be posted for lower weight limits or closed if their conditions warrant such action.

Functionally Obsolete (FO): A bridge that is functionally obsolete is safe to carry traffic, but has less than desirable geometric conditions required by current design standards. Bridges that are functionally obsolete often have narrow lanes, inadequate clearances, or poor alignments. Bridges that qualify as both structurally deficient and functionally obsolete are categorized only as structurally deficient.

## CONDITION

In 2011, Tropical Storm Irene devastated Vermont's transportation infrastructure, including damage to over 300 bridges. An infusion of emergency transportation funding in 2012 of more than $650 million from the FEMA, FHWA, and Vermont resulted in a major effort to repair, rehabilitate, and replace the necessary bridge infrastructure in Vermont. In 2012, 30% of Vermont bridges 20 feet or longer in length were classified as deficient, including 20% classified as FO and 10% classified as SD. For the same period, NBI data indicates that about 24% of bridges nationally were deficient, including 14% classified as FO and 10% classified as SD. The breakdown of Vermont bridges listed as either structurally deficient or functionally obsolete is shown in Table 1. Spans less than 20 feet are not included in the NBI data.

When Vermont's National Highway System (NHS) bridges 20 feet or longer in length are considered separately, the percentage of deficient bridges is about 35%—with 30% classified as FO and 4% classified as SD. The smaller number of SD bridges on Vermont's NHS roadways indicate that these structures are generally in better condition. However, the larger number of FO bridges indicates that many of the bridges in the NHS system are older and do not meet current standards.

To preserve bridge safety and public safety, VTRANS has placed restrictions, limitations or even closed bridges if necessary on 182 bridges. These restrictions range from postings for speed, number of vehicles, or vertical clearance to posted weight limits, to complete closure.

Moving forward, VTRANS has set a goal for percentage of bridges that are SD as 6% for the interstate, 10% for state bridges, and 12% for town bridges. For the period 2001 to 2012, the deficiency status of interstate and town bridges has remained consistently

*Table 1- Vermont Highway Bridges*[i]
(Source: FHWA, 2012)

| STRUCTURE TYPE | #BRIDGES | #SD | %SD | #FO | %FO | #DEFICIENT (SD+FO) | %DEFICIENT (SD+FO) |
|---|---|---|---|---|---|---|---|
| Interstate | 313 | 13 | 4.15% | 97 | 30.99% | 110 | 35.14% |
| State Hwy | 773 | 72 | 9.31% | 97 | 12.55% | 169 | 21.86% |
| Town Hwy | 1620 | 182 | 11.23% | 352 | 21.73% | 534 | 32.96% |
| Other | 6 | | | | | | |
| **Total** | **2712** | **267** | **9.84%** | **546** | **20.13%** | **813** | **30%** |
| **SHORT STRUCTURES** | | | | | | | |
| Interstate | 211 | | | | | | |
| State Hwy | 1054 | | | | | | |
| Town Hwy | ---- | | | | | | |
| Other | ---- | | | | | | |
| **Total** | **1265** | **115** | **9.09%** | | | | |

in the 30% range, while state bridges have improved to approximately 20%, as shown in Figures 1-3.

**Figure 1**
*State Highway Trends*

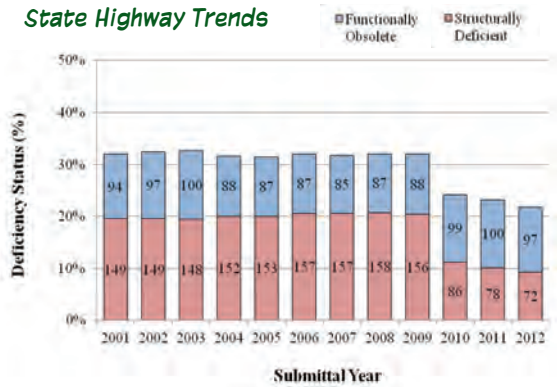



**Figure 2**
*Interstate Trends*

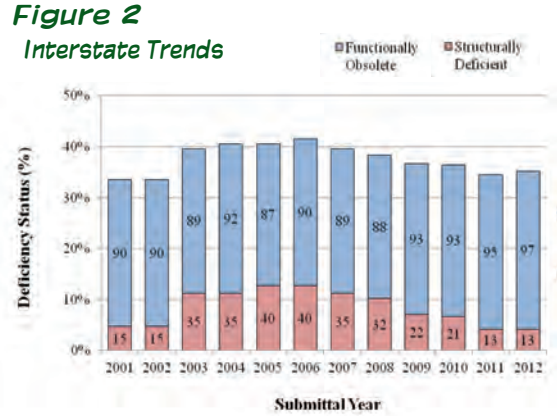
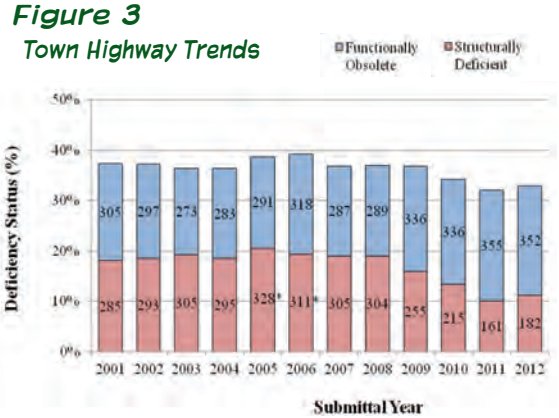



**Figure 3**
*Town Highway Trends*




## INVESTMENT NEEDS

In a November 2008 report to the Governor and legislature,[v] VTRANS estimated a $110 million dollar shortfall per year in funding over the next 20 years based on trends in funding. This funding level would replace all bridges over 70 years old and all structurally deficient bridges regardless of age. This funding level also includes $7 million annually for preventative maintenance.

Recently funding levels have more than doubled from $48.7 million in 2005 to $123.6 million in 2013, due to congressional earmarks, ARRA funding, bridge maintenance funding, Tropical Storm Irene funding, and support from the administration and legislature.[i] Future federal funding sources in the state transportation budget are uncertain. Congress is still working on a new federal transportation bill and ARRA and Irene funding were short term infusions. As such, state transportation dollars will likely need to be stretched even further in the future.

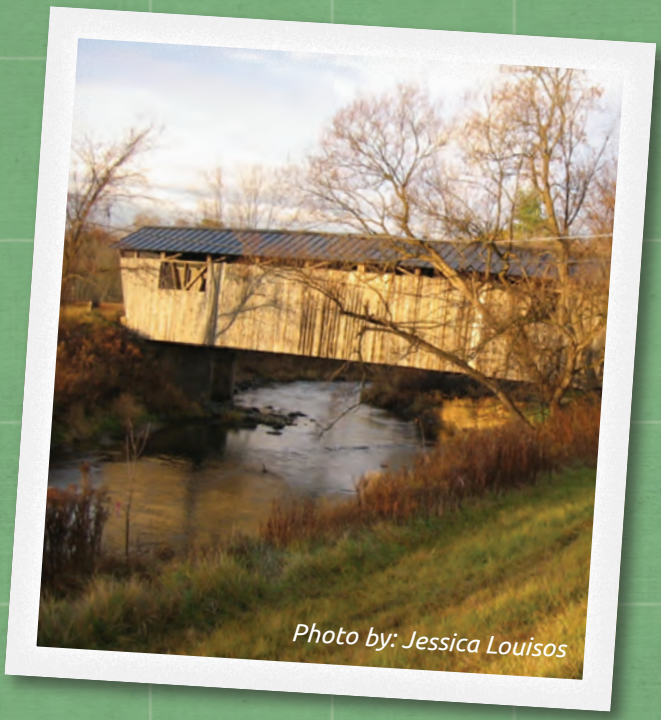


Photo by: Jessica Louisos

## RECOMMENDATIONS

Recent historic increases will begin to address both the damage from Hurricane Irene and the significant long-term needs that have been growing with time and age. Successfully and efficiently addressing Vermont's bridge infrastructure will require a long-term, comprehensive strategy, including identifying potential financing methods and investment requirements. Increasing investment levels now will improve the condition and functionality of Vermont's bridges and reduce the required future investment.

For the continued safety of bridges, Vermont ASCE makes the following recommendations:

- Ensure funding to VTRANS bridge program continues to catch up to fill the projected gap;
- Increase funding for municipal bridges and encourage municipalities to establish capital reserve funds for the repair of municipally-owned bridges;
- Support VTRANS existing performance goals and prioritization system.

*Photo by: Jessica Louisos*

## SOURCES

Information for this report was obtained from the following sources


i. "2013 Annual Report- Interstate Bridge Program, State Highway Bridge Program, Town Highway Bridge Program", Vermont Agency of Transportation- Program Development- Structures Section, 2013.

ii. "VTRANS 2014 Fact Book", Vermont Agency of Transportation, 2014.

iii. "Election 2012- Transportation, Issue Paper #1", Vermont League of Cities and Towns, September 2012.

iv. "20th Annual Report on the Performance of State Highway Systems (1984-2009/10)", The Reason Foundation, Policy Study 406, July 2013.

v. "Bridges and Culverts Long-term Assessment and Funding Options- Report to the Governor and the General Assembly", The Office of the State Treasurer, November 15, 2008.

vi. Federal Highway Administration, Bridges and Structures, Deficient Bridges and Structures by State, December 2013.

vii. Federal Highway Administration, Bridges and Structures, Estimated 2012 Costs to Replace or Rehabilitate Structurally Deficient Bridges.

# DAMS

*Photo by: Jessica Louisos*

# DAMS

## GRADE: C

Vermont has 1,219 dams on its state inventory and 198 (16%) of those structures are classified as high or significant-hazard-potential. Vermont's Dam Safety Program is understaffed and depends on a voluntary action by dam owners or a time-consuming state process for correcting safety deficiencies. Based on inspections completed in 2013, 35% of dams inspected were in poor condition.[i] The Vermont Dam Safety Program relies heavily on educating dam owners of safety risks to motivate repairs. The financial burden of repairing or removing the poor-condition dams is estimated to be $22 million for all removals and $35 million for all repairs. Ten obsolete or unsafe dams have been removed from Vermont waters over the past six years, with five of the removals taking place in 2013-2014. The majority of Vermont dams are the responsibility of private landowners that tend to have limited willingness to invest in maintenance and repairs. Vermont House Bill 590, considered by the Vermont legislature in 2014, would require registration of dams to improve public safety but did not become law.

## BACKGROUND

Vermont has approximately 1,150 dams inventoried by the Vermont Department of Environmental Conservation (VTDEC). The dams inventoried range from large power generation dams to small simple structures. The majority of dams are privately owned, but many are also owned by the federal, state and local governments (Figure 1). Through 10 V.S.A., Chapter 43: DAMS VTDEC regulates 454 dams that are inspected by two full time Dam Safety Engineers[i] with the assistance of one or two summer interns. The Federal Energy Regulatory Commission (FERC) regulates 82 dams in Vermont[ii]. The Vermont Public Service board regulates 96 dams, many of which are also regulated by FERC[iii]. Of the regulated dams, 59 are classified as high-hazard-potential (9%) and 135 are significant-hazard-dams (21%) (Figure 2). A total of 461 dams in the state inventory are not regulated under the aforementioned programs, including 5 significant-hazard-potential dams, and for many of these the hazard-potential has not been classified[iv]. The majority of dams with known ages are more than 50 years old. Only one jurisdictional dam was built in the last five years[i].

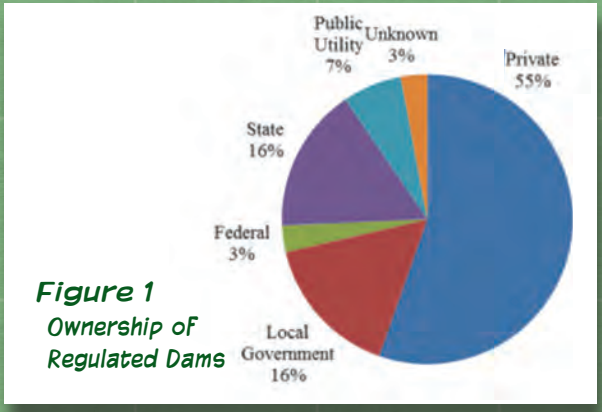



*Figure 1*
*Ownership of Regulated Dams*

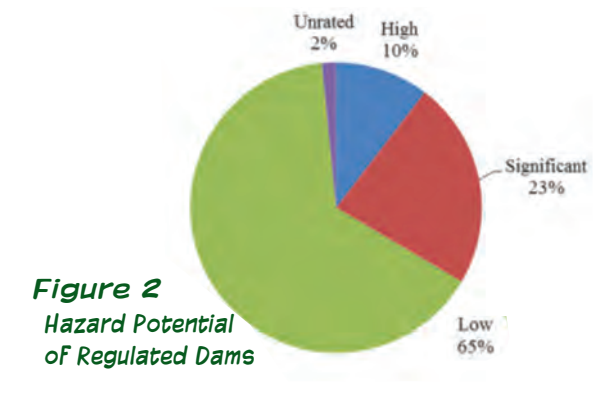



*Figure 2*
*Hazard Potential of Regulated Dams*

## CONDITION

The VTDEC Dam Safety Engineers have jurisdiction over non-federal, non-hydroelectric dams that impound at least 500,000 cubic feet. Each dam has a designated hazard classification that is based on the United States Army Corps of Engineers system that describes the potential loss of life and property damage if the dam fails. The VTDEC Dam Safety Engineers strive to inspect the jurisdictional 40 high-hazard-potential dams annually, 113 significant-hazard-potential dams every three to five years, and 289 low-hazard-potential dams every five to ten years[i]. Inspections of the significant-hazard-potential and low-hazard-potential dams have lagged by 2% and 37% recently due to lack of adequate staffing and, in a few cases, the inability to access private propert[vi]. An additional Dam Safety Engineer is needed to achieve the target inspection schedule.

Based on inspections completed in 2013, 126 dams of 364 inspected are in poor condition (35%).[i] Fourteen more poor condition dams exist now than in 2010. Based on the results of periodic safety inspections, VTDEC provides the owner with the findings and makes recommendations for maintenance, repairs, or further evaluation. Owners are liable for the safety of the dam and responsible for maintenance and repair costs. If the owner does not address safety concerns, interested parties or a town can petition the state to investigate the safety of a dam or VTDEC can begin an investigation on its own. The Vermont Agency of Natural Resources has a Compliance Division with attorneys that the VTDEC Enforcement Division works with as needed. If the state finds a dam to be unsafe, it can issue an order requiring action to eliminate the hazard. The order can be appealed to state court, yet this process can be time-consuming and expensive. The Dam Safety Engineers focus efforts on education and voluntary compliance that includes trying to meet with dam owners on site when they do inspections.


*Photo by: Jessica Louisos*

FERC Staff Engineers inspect high-hazard-potential and significant-hazard-potential dams annually and low-hazard-potential dams every three years. Additionally high-hazard-potential dams undergo a detailed safety inspection every five years by an independent consultant. FERC dams have all been maintained in good condition.[ii] The responsibility for repairs and maintenance is the financial responsibility of the owners.

Hydroelectric dams in the state not falling under the jurisdiction of FERC are regulated by the Vermont Public Service Board (PSB). Inspections are to be completed by a consultant hired by the dam owner every

five years for a high-hazard-potential dam and every ten years for a significant-hazard-potential dam[vi]. The PSB does not have engineers or inspectors on staff to assess condition and take corrective action if a dam is deficient. PSB dams are generally maintained in good condition due to their income-generating potential associated with hydroelectric power.[iii]

VTDEC desires to have an Emergency Action Plan (EAP) on file for each of the high-hazard-potential dams in the state to be used in case of an emergency. EAPs now exist for 82% (50 of 61) of the high-hazard-potential dams regulated by VTDEC.[i] Five EAPs have been prepared since 2010. Through a Dam Safety FEMA grant, VTDEC has an initiative to prepare the remaining EAPs for high-hazard-potential dams over the next few years.

The Vermont Dam Inventory includes all jurisdictional and non-jurisdictional dams identified by the state. With the abundance of small dams in the region, it can be assumed that many small, privately-owned dams are not listed in the state inventory. For example, a study in the White River Basin that has 108 dams on the state inventory identified the presence of 13 additional dams.[vii] The undocumented dams were found by word-of-mouth or observed near known dams. It is important to note that a comprehensive, basin-wide search for dams was not performed. The White River Study suggests that there could be on the order of 150 dams in the state that are not in the dam inventory. It is expected that unlisted dams would be small, non-jurisdictional dams (not falling under the jurisdiction of Chapter 43).

While Vermont has been fortunate not to have a major dam failure in recent years, Vermont must remain vigilant about dam safety failures and near failures sustained by neighboring states and throughout the country. In 1996, a dam failure in Alton, N.H. resulted in the loss of a life and an estimated $8 million in property damage. In 2005, a dam failure in Fort Ann, N.Y., resulted in an estimated $4 million in property damage.

Several Vermont dams were under close watch during Tropical Storm Irene in 2011 where the threat of failure and concerns for downstream populations existed. No major dam failures took place during Irene, yet many smaller Vermont dams were overtopped and scoured due to the flooding that occurred. Additionally, over the last decade or so, news out of New Hampshire, Massachusetts, and Rhode Island during times of large storm events has included many stories of dams being under watch for signs of failure as they have been filled to capacity. Age, extreme weather events, and climate changes are all issues that could impact dams in Vermont moving forward. A review of 75 years of long-term gauge records on unregulated rivers in the northeast U.S. shows a trend of increasing flood magnitude and frequency.[x]

## INVESTMENT NEEDS

In Vermont, financing for structure maintenance, upgrade, and repair is the responsibility of the owner of a dam.[v] VTDEC's Dam Safety Section was staffed with three full-time personnel prior to 2006, one full-time employee from 2008 to 2010, and two full-time employees since 2010. Statutory requirements and program responsibilities are estimated to require the time of a minimum of three full-time employees.[i]

An estimated $275,000 is needed to complete the 11 remaining EAPs for the high-hazard-potential dams.[i] To improve the safety of the 126 poor-condition dams via repairs an estimated $35 million is needed (assuming an average repair cost of $275,000 per dam).[xii]

Dam removal is emerging as a more common dam safety alternative to eliminate poor-condition obsolete structures, operation and maintenance costs, and liability. Removal of the 126 poor-condition dams in the state would cost an estimated $22,000,000 (assuming an average removal cost of $175,000 per dam based on project examples in the state and region). Dam removal would

thus lower the economic burden of poor condition dams by $13,000,000. Vermont has removed eight obsolete and unsafe dams over the past five years, with three of the removals taking place in 2013.[ix] There is only-tenth of a full-time employee's time available as part of the VTDEC Rivers Program to facilitate dam removal projects.[xi]

In February 2014, VTDEC implemented rules to establish an unsafe dam revolving loan fund under 10 VSA §1106. This new funding opportunity provides loans and grants for repair or removal of unsafe (§1095) municipal or privately-owned dams (a minimum of 83% of the dams in the state). Although a step in the right direction to bolster funding for improving dam safety, limited funding is expected in the revolving loan fund in 2014. Capital improvement funding is the only funding source specifically earmarked to help maintain safety for dams owned and operated by the Agency of Natural Resources. The Dam Safety Section encourages other state agencies to include capital needs in their budget during the state budget process for repair or removal of dams owned by that agency.

The Association of Dam Safety Officials performs periodic surveys of state dam safety programs that include determining the number of dams per dam safety staff to rank dam safety staffing levels between states. In the 2012 national survey, Vermont ranked 33rd with 221 dams per full time employee. The national median number is 205 dams per full time employee.[viii]

The Vermont House of Representatives contemplated Bill 590 in 2014 that would establish a registration procedure and fee for dams, create a method to designate an abandoned dam, and required disclosure of dam ownership at the time of a property sale. The registration fee would be used to implement Chapter 43. If it had been adopted, this bill would have improved dam safety in Vermont.

## RECOMMENDATIONS

Vermont's current staffing levels and funding are inadequate for the given number of high-hazard dams in the state. A large need exists for increased dam safety inspections and improved maintenance considering the age and number of dams in the state. Private and municipal dam owners are reluctant to fund required maintenance and repair of their dams, and the state has limited regulatory ability to force proper maintenance. Implementation of 10 V.S.A. Chapter 43 is an important step forward for improving dam safety in Vermont.

Vermont ASCE makes the following recommendations:

- Increase the staffing in the VTDEC Dam Safety Section from two to three full-time employees to assist with dam statutory and program obligations.
- The PSB should revise their rules to require the inspection of high-hazard dams annually, significant-hazard dams every three to five years, and low-hazard dams every five to ten years.
- Increase staffing in the VTDEC Rivers Program to one full-time employee in order to adequately develop projects and assist with removal of obsolete and failing dams.
- Vermont real estate statutes should require disclosure of dam ownership and a safety inspection of jurisdictional dams by a qualified engineer at the time of sale of property.
- Seek passage of legislation similar to H.590, introduced in 2014, to implement the requirements of 10 V.S.A. Chapter 43.

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*Photo by: Jessica Louisos*

# MUNICIPAL DRINKING WATER

VERMONT SECTION ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

REPORT CARD
FOR VERMONT'S
INFRASTRUCTURE

# MUNICIPAL DRINKING WATER

## GRADE: C-

Vermont has a total of 1,377 active public water systems, and 97% of these are small community systems. Vermont needs $510 million over the next 20 years to meet the demands of the Small Community Water Systems (CWS), and additional resources are needed for the 24 medium and 7 large systems. Vermont is one of 15 states that receives the minimum federal loan program allotment of 1%. Annual funding deficits range from $10 million to $40 million over the past four years, providing only about half of the funding needed for Vermont's drinking water systems. While 30 public water systems issued boil water notices as a result of Irene impacting more than 16,500 people, the damage and repairs required have not been fully reported.

## BACKGROUND

As of 2009, the State of Vermont had 1,365 active public water systems in Vermont consisting of 444 community water systems, 242 non-transient non-community (NTNCs) water systems, and 679 transient non-community (TNCs) water systems (Refer to Table 1 for Public Water System Definitions)[i]. The TNCs represent the largest number of water systems in the State of Vermont.

*Table 1*
*Community Water Systems in Vermont*[ii&iii]

| TYPE OF COMMUNITY WATER SYSTEM[iv] | NUMBER OF SYSTEMS[ii&iii] |
|---|---|
| *Very small* – serve between 25 and 500 people | 1346 |
| *Small* – serve between 501 and 3,300 people | |
| *Medium* – serve between 3,301 and 10,000 people | 24 |
| *Large* – serve between 10,001 and 100,000 | 7 |
| *Very large* – serve greater than 100,000 people | 0 |

A public Community Water System (CWS) is one that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.[i] As of March 2014, Vermont has a total of 1,377 active public water systems[ii]. The classifications of CWS based on the number of people served and the breakdown of these systems in Vermont is provided in Table 1 below. The drinking water infrastructure needs in the state are largely focused on these small community systems given that they make up over 97% of the public water systems.

The Drinking Water and Groundwater Protection Division (DWGWPD) is charged with oversight and enforcement of the Vermont Drinking Water Program.[iii] The DWGWPD is responsible for enforcing the Vermont Water Supply Rule (last adopted in December 2010), which was crafted with the purpose of protecting public health by assuring safe, affordable drinking water from public and non-public water systems. The purpose of the Water Supply Rule is also to implement and enforce the provisions of the Federal Safe Drinking Water Act.[iv] Under the purview of the Water Supply Rule, the DWGWPD issues permits and establishes requirements for CWS with respect to specific treatment techniques, monitoring, reporting, and documentation to ensure that the water being distributed is safe for human consumption.

The United States Environmental Protection Agency (EPA) has set two types of regulations for drinking water protection. The National Primary Drinking Water Regulations (NPDWR), also referred to as the Primary Standard, is a legally enforceable standard that applies to public water systems. The Primary Standards protect drinking water quality by establishing permitted limits for levels of certain contaminants that can adversely affect public health and are known or anticipated to occur in water delivered through a public water system. These levels are referred to as Maximum Contaminant Levels (MCLs) and the EPA has over 80 contaminants that are regulated.[v] The National Secondary Drinking Water Regulations (NSDWR), also referred to as the Secondary Standard, is a non-enforceable guideline for contaminants, which may cause cosmetic and or aesthetic effects.[viii] The EPA recommends the Secondary Standards to water systems but does not require that the public water systems comply with these secondary regulations. However individual states may choose to adopt these Secondary Standards as enforceable standards. Vermont has adopted the Primary Standards with increased requirements on Uranium and Nickel as well as the Secondary Standards requiring all new public systems to monitor for the Secondary Standards.[vi] The DWGWPD also oversees the state Source Water Protection Program. The program helps communities develop plans to delineate their source areas, identify potential contamination points, define adjoining land uses, and plan for potential hazards in an effort to protect the water supply from contamination.

## CONDITION

Drinking water infrastructure consists of several components that in combination with each other form a functional system to produce/gather, treat, store, and transmit clean, safe drinking water to the general public for consumption. Nationally, the largest need for water systems is for distribution and transmission infrastructure. This critical portion of infrastructure is often overlooked as it is mainly below ground, however this component accounts for most of a typical system's capital value. As the EPA states, "Failures in transmission and distribution lines can interrupt the delivery of water and possibly allow for the contamination of water."

Drinking water infrastructure in Vermont is aging and in need of repairs and retrofits. Every four years, the EPA conducts an assessment of the nation's public water systems' infrastructure needs (20-year capital investment needs), as mandated by the Safe Drinking Water Act. These findings are used to allocate available funds to the Drinking Water State Revolving Fund (DWSRF) – a loan program that serves as the primary means of financing infrastructure upgrades and retrofits in the states[viii]. In the most recently published report in April 2013,[ix] the EPA reported a $510 million need for Vermont to meet the demands of Small Community Water Systems (CWS). This does not include the needs of the 24 active medium CWS and 7 active large CWS in the state,[x] which will increase the total need by a significant percentage.

## INVESTMENT NEEDS

The Vermont funding for drinking water infrastructure improvements is provided through user fees and taxes. Loans are available through the Drinking Water State Revolving Fund (DWSRF), which receives funding each year through the USEPA. The DWSRF offers construction, planning, and source protection loans. Through the DWSRF program, municipalities may be eligible for loans with rates ranging between -3% and 3%, depending on the municipal need. In certain cases where municipalities are offered a -3% loan this can equate to approximately a 40% grant over the life of the loan.

Vermont prioritizes projects on a yearly basis through an application process that is completed by municipalities or water system administrative boards. Through this process, Vermont creates a "priority list" which they use to allocate funding for each year up to their maximum available funding from USEPA. A breakdown of the available funding and projects that received funding and those that didn't is shown in Table 2.[xi]

*Table No. 2*
*Funding Comparisons From 2010 – 2013*
*(Compiled From Intended Use Plans)*[ii]

| FISCAL YEAR | 2010 | 2011 | 2012 | 2013 | 2010 |
|---|---|---|---|---|---|
| Amount Funded (Millions) | $17.10 | $14.36 | $18.57 | $12.32 | $16 |
| Amount Not Funded (Millions) | $37.02 | $14.61 | $27.35 | $10.74 | $37.4 |
| **Total Need** | **$54.12** | **$28.97** | **$45.92** | **$23.06** | **$53.6** |

Funding can also be obtained through the Vermont Agency of Commerce and Community Development (ACCD), which funds municipalities interested in a broad range of community development projects, including water and wastewater planning, and infrastructure improvements.[xii] Other examples of funding opportunities include the Water and Waste Disposal Direct Loans and Grants through the U.S. Department of Agriculture, Rural Development.[xiii, xiv]

## RECOMMENDATIONS

EPA estimates that Vermont needs $510 million to meet the demands of small CWS in the state through 2013. These small systems meet the needs of 54% of Vermont's population. Vermont is one of 15 states that receives the minimum DWSRF allotment of 1%, and was offered the option of surveying only the large systems in the state, and not collecting data for medium sized systems to encourage focusing efforts on the largest systems. However, the data in the report only include the needs of the small CWS. Given that there are 24 active medium CWS and seven active large CWS, in Vermont, the $510 million in needs for Vermont's drinking water infrastructure is underreported.

Funding aside, the lack of coordinated information gathering and access to data on municipal facilities not funded by the DWSRF makes it hard to ascertain the existing condition and needs of the drinking water facilities in the state. All of these concerns do not completely take into account various municipal drinking water facilities that may have suffered damage from storm and flooding related disasters from 2011 to 2013. While 30 public water systems issued boil water notices as a result of Irene impacting more than 16,500 people, the damage and repairs required have not been fully reported. In addition, Tropical Storm Irene's severe flooding (including evacuation and displacement) in the largest state office complex in Waterbury has resulted in the loss of important paper records, making it even more difficult to obtain all necessary information.

Vermont ASCE makes the following recommendations:

- Explore various funding instruments and mechanisms within the state (such as trust funds) to fund water infrastructure projects.
- Support and encourage the development of a central reporting instrument (state or non-profit agency managed) that will track all water infrastructure in the state, not just those funded under the DWSRF.
- Build upon the fledgling work on water infrastructure security and asset management in the state.
- Promote the funding of research to provide new cost effective technologies in drinking water infrastructure treatment and distribution.

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# MUNICIPAL WASTEWATER

Photo Credit: Louis Porter

# MUNICIPAL WASTEWATER

## GRADE: D

Vermont has over 7,000 miles of rivers and streams, 300,000 acres of wetlands, and 812 lakes and ponds, totaling over 230,000 acres. There are 91 wastewater treatment facilities that treat approximately 44 million gallons of sewage and discharge the treated effluent to the waters of Vermont each day.[vii] To address Vermont's clean water needs, $156 million is needed annually to do wastewater and stormwater sewer repairs, retrofits, and facility upgrades. Of this, $18 million is the annual need specifically for municipal wastewater infrastructure. Proposed budget cuts in the state's Clean Water State Revolving Fund – the primary funding mechanism for financing clean water infrastructure upgrades and retrofits – do not support the municipal wastewater systems in the state that are trying to keep the water clean.

## BACKGROUND

Many of these wastewater systems must implement improvements to maintain or attain compliance with state and federal clean water standards to protect public health and the environment. These infrastructure improvements are in addition to the repairs that result from storms such as Irene, which resulted in compromised operations at 17 wastewater treatment plants. Even though most problems were addressed within 24 hours, a total of about 10 million gallons of raw sewage was discharged into the state's waters.[viii] Seventeen failed septic systems were also reported. Emergency situations aside, illicit discharges and climate change impacts from increased precipitation events add to the complexities of managing wastewater in the state.[viii]

## CONDITION

The primary rules for managing these water resources is the Clean Water Act (CWA). The CWA allows only permitted discharges into the waterways, to be made under the National Pollutant Discharge Elimination System (NPDES).[ii] Individual homes connected to a municipal system or use a septic system or do not discharge any pollutant to surface waters are not required to have an NPDES permit.[iii] However, Onsite Wastewater Management Systems (OWTS) such as septic systems are required to have a water and wastewater disposal permit to their connection or disposal field. OWTS that process over 6,500 gallons of wastewater per day are permitted through the Indirect Discharge Program.[iv] The CWA currently provides incentive programs to identify, assess, monitor and control nonpoint source pollutants from farmland and forestry operations. Nonpoint source pollution represents the largest source of pollution nationwide.

The CWA established a Water Quality Standards (WQS) Program where states and tribes are required to designate uses of water bodies within their areas of authority.[v] Water quality criteria are established for each body of water based on this designated use and the existing characteristics of the body of water. If these standards cannot be met, the EPA and the State will establish Total Maximum Daily Loads (TMDLs) for each pollutant specific to that body of water.[vi] WQSs are intended through the CWA to be developed and monitored on a regular basis by each individual state, tribe or territory. Of Vermont's four major watersheds, three are currently undergoing the TMDL process - including Lakes Champlain and Memphremagog for phosphorus and Long Island Sound for nitrogen.

Recognizing the need to raise public awareness on these issues, Vermont State Legislature passed Act 138 in 2012, directing the Vermont Agency of Natural Resources (VT ANR) to prepare a Water Quality Remediation, Implementation, and Funding Report. This report published in 2013, offers $156 million as the ten-year average annual need in Vermont based on 19 categories – including but not limited to municipal wastewater systems.[i]

## INVESTMENT NEEDS

Since 1955, state and federal governments have invested a total of $656 million in wastewater treatment in Vermont.[i] From the 2008 EPA Report to Congress, the nation's 20-year national wastewater need, estimated at $381.6 billion, based on the inclusion of the nonpoint and decentralized wastewater sources as shown below:[ix]

*Table No. 1*
*Act 138 Annual Report Needs Summary*[i]

| CATEGORY | AMOUNT |
|---|---|
| **Group 1:** Municipal operations for nonpoint source pollution reduction | $81.3 M |
| **Group 2:** Agricultural and forestry operations for nonpoint source reduction | $81.3 M |
| **Group 3:** River, floodplain, and lake shoreland management | $1.7 M |
| **Group 4:** Municipal infrastructure and regulated stormwater programs | $63.8 M |
| **Total** | **$155.6 M** |

- Combined Sewer Overflow (CSO) Correction – $63.6B
- Secondary Wastewater Treatment – $59.9B
- Advanced Wastewater Treatment - $45.3B
- Stormwater Management - $42.3B
- New Sewers: New Collector Sewers - $21.4 B; New Interceptor Sewers - $19.4B
- Sewer Rehabilitation: Infiltration/Inflow (I/I) Correction – $8.2 B; Replacement/ Rehabilitation of Sewers - $33.7B
- Unofficial Cost Estimates – $36.8B
- Decentralized Wastewater Treatment Systems - $23.9B
- Non-Point Source Pollution - $22.8B
- Recycled Water Distribution - $4.4B

Through the CWSRF Program in Vermont, Combined Sewer Overflow (CSO) projects are eligible to receive loans of up to 100% of the total project costs, depending on the source of the CWSRF.[xi] In addition to the CWSRF, municipalities also have access to Vermont Municipal Bond Bank (VMBB) loans, currently less than 4% interest, so rather than an overall funding shortage, it is the subsidized loan funds that are limited.

Annual need and funding levels for the past four years were provided by Vermont Department of Environmental Conservation (VTDEC), Financial Management Program, Facilities Engineering Division, and are summarized in Table 2. As you can see, the funding available in 2014 is greater than the estimated funding need. It is important to note that the CWSRF, as well as the other funding sources, is largely reserved for loans to municipalities, with only a small portion going towards administrative costs of the program and subsidizing project costs. Furthermore, both CWSRF and VMBB loans require a local bond vote, which explains why funding availability is larger than the documented need.[ii] Municipalities will not apply for a loan, documenting their need, unless the local bond vote is approved. This also accounts for the unused funds in previous years that are to "carry forward". Many towns are too broke to apply to the CWSRF even as they are trying to recover from the recession and rebuild post Irene. Voters have repeatedly rejected attempts by towns to take on this debt, and unless municipalities pass a bond authorization, they are not eligible for the CWSRF funds. Additional factors that have contributed to a lower demand in 2014 include uncertainty about the TMDL in Lake Champlain, nutrients in the Connecticut River basin removals requirement, and evolving storm water requirements.

**Table No. 2**
*Annual Need and Funding Levels for Federal Fiscal Years 2011 through 2014*[xi]

| FEDERAL FISCAL YEAR | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|
| EPA Capitalization Grant (Millions) | 9.6 | 6.63 | 6.26 | 6.85 |
| State Match | 2 | 1.38 | 1.3 | 1.37 |
| Clean Water State Revolving Fund (Millions) | 10.22 | 6.04 | 22.68 | 10.06 |
| Carry Forward | 0.5 | 7.41 | 20.95 | 33.64 |
| Total Annual Funding Available (Millions) | 22.32 | 21.46 | 51.19 | 51.92 |
| **Total Annual Need (Millions)** | **51.98** | **69.2** | **58.21** | **~37.9+** |

Furthermore, on June 10, 2014, President Obama signed into law the Water Resources Reform and Development Act of 2014 (WRRDA). Among its provisions are amendments to Titles I, II, V and VI of the Federal Water Pollution Control Act (FWPCA). [xi] This promises further changes in several programs and increases uncertainty with implications for future "needs" and "demands".

Several federal agencies also have invested in clean water systems in Vermont. For example, the USEPA, the Lake Champlain Basin Program, The USGS, FHWA, US Department of Agriculture, US Fish and Wildlife Service, and FEMA invested over $11 million in 2012. The anticipated $5.3 million for 2013 is less than half of the 2012 totals, again increasing the gap between need and funding availability.[vii]

Moreover, average annual cost over ten years to address just nonpoint source items alone is $91.7 million. A new plan to clean up Lake Champlain (focused on nonpoint sources of pollution, in addition to effluent discharge from wastewater treatment plants) was submitted to the EPA by the VTDEC on April 1, 2014. With a reported shortcoming of a detailed funding plan for the proposed activities in the cleanup plan, a EPA disapproval of the cleanup action(s) may result in costly mandates on the state.[xii] The plan reports that wastewater treatment plants in the Lake Champlain Basin will not be allocated any additional phosphorus reductions, given that their contribution to the phosphorus load in the basin is approximately 3% of the total[xiii] (This proposal was rejected by the USEPA in a letter to Commissioner Mears on May 8, 2014).[xiv] The Act 138 Annual Report lays out a suite of recommendations on ways of generating revenue to support the activities that would meet the clean water needs of the state. However, in trying to balance budgets and address the more serious concerns of nonpoint sources of pollution, funding to municipal wastewater facilities will be lowered. For example, one recommendation is to increase the points allotted to projects addressing nonpoint sources of water pollution in the state, so these projects received a higher standing on the priority list of projects that the state funds.[i] While this will ensure funding for such projects, it will push other projects down or off the list.

## RECOMMENDATIONS

Many aging distribution systems are in poor condition resulting in leaks and pipe bursts. Increased development over the past several decades, in combination with erratic weather patterns adding frequent surcharges beyond sewer capacities, place undue strain on existing wastewater treatment systems. While Vermont is way ahead in addressing concerns with CSOs compared to major metropolitan areas, and many larger communities across the state are very active in stormwater management activities to collect and effectively convey stormwater to appropriate storage, and treatment locations; CSOs continue to pose a problem and require larger portions of capital appropriations from congress and ultimately from the individual states. Green infrastructure projects are especially key in addressing these concerns and are also being targeted for funding.

One recommendation in the Act 138 Annual Report was to add more weight to infrastructure projects focused on addressing the stormwater or non point source related improvements. While this is the step in the right direction to address nonpoint source pollution demands, taking monies away from wastewater treatment facilities that will have to repair aging infrastructure and upgrade facilities to meet new regulations based on revised TMDLs for nutrients (and possibly to address micronutrients and other contaminants of concern such as pharmaceuticals and personal care products) in the near future is of great concern for the overall wastewater infrastructure management in the state. With a projected deficit of $18 million each year, based on current numbers and probability of reduced federal funding in the future, given proposed reductions in the EPA budget[xv], with the greatest reduction in funding for the State Revolving Funds, Vermont ASCE is not confident that the improvements in wastewater infrastructure in Vermont will keep pace with the need. To further exacerbate the wastewater issue in

Vermont there are several looming changes to the TMDLs, especially related to nutrients such as phosphorus and nitrogen. If in the event that these changes come to fruition it will only add to the already high cost of treating wastewater by requiring more strict limitations. Wastewater Treatment Facilities throughout the state would require a significant investment in more advanced treatment of wastewater to meet these potential needs.

Vermont ASCE makes the following recommendations:

- Continue efforts to fully fund the wastewater infrastructure needed for clean water across the state.
- Support and encourage the development of federal and state infrastructure trust funds to provide a reliable source of loan assistance for the design, construction, and repair of clean water infrastructure.
- Fully explore recommendations in the Act 138 Annual Report to meet current needs.
- Promote research to provide new cost-effective technologies in wastewater infrastructure treatment and distribution.
- Develop more reliable and accurate information on the needs of municipalities statewide.

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# ROADS

*Photo by: Lars Gange & Mansfield Heliflight*

VERMONT SECTION ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

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# ROADS

## GRADE: C-

Vermont ranks 28th in the nation in state highway performance and cost effectiveness, moving up 14 spots from 42nd in the previous year. This was due largely to the influx of emergency funding that Vermont received in the aftermath of Tropical Storm Irene which significantly impacted Vermont's roads. To continue making improvements at the same rate since 2011, VTRANS estimates a funding need of $700 million per year, at least through 2018. Positively, state legislators and the Governor passed the largest investment ever made in the state's transportation infrastructure which contains $685.7 million in transportation funding for 2015. The 2015 Transportation package provides $115.7 million for paving, $108.7 million for town highway programs, $50 million for maintaining and improving roadways, and $13.3 million for highway safety and traffic operations. Vermont has also made progress on road safety with its Strategic Highway Safety Plan cutting road fatalities by nearly half since 2006.

## BACKGROUND

The Vermont roadway system includes 14,400 miles of highway managed by state and local jurisdictions. There are over 11,200 miles of city and town roads. The state's transportation agency, the Vermont Agency of Transportation (VTRANS) is responsible for 3,200 miles, or about 22% of the total mileage. Vermont's highway system is critical to the states 626,000 residents and visitors, providing access to homes, employment, shopping, agriculture, tourism, and recreation. Better roads improve safety and efficiency of the highway system providing greater mobility for both commercial and personal use. This Report Card focuses its attention on the 3,200 miles of VTRANS controlled roads. This includes 2,707 miles in the state highway system, 139 miles of class 1 town highways and 320 miles of interstate. This system provides the backbone of Vermont's transportation network. The remainder of the roads in the state are maintained by cities and towns.[vii]

## CONDITION

Vermont's highway system is a necessary but expensive network of infrastructure that is continually degrading from "wear and tear." Harsh winter weather in the northeast followed by thaw during "mud season" leaves roadways in almost constant need of repair. It is also important to note that much of the "engineered" roadway system in Vermont, as with most other states, was constructed in the 1920-30s when the National Highway System was constructed and in the 1960s-70s when the interstate system was constructed. The structures built in the 1920-30s are over 80 years old, are approaching the end of their useful lives, and many need to be replaced. The structures built in the 1960-70s are over

50 years old and require major rehabilitation if their useful lives are to be extended.[i] That being said, Vermont was ranked 1st in urban interstate pavement condition by the 20th Annual Report on the Performance of State Highway Systems.[iv]

The VTRANS Highway Safety and Design Annual Report in the 2014 VTRANS Fact Book uses automated surveys, conducted annually, to determine pavement conditions across the state. Each segment of road is rated on a scale of 1 to 100 based on rutting, cracking, and roughness. These are then weighted by their respective traffic volumes. The VTRANS goal for this performance measure is 70. The total weighted average network condition in 2013 was 66, up from 64 in 2010. The following are the pavement condition descriptions:[vii]

**Good: 38% in 2013** *(up from 28% in 2010)*

- Like New Pavement with few defects perceived by drivers
- Composite Pavement Condition Index 80-100

**Fair: 22% in 2013**
*(down from 24% in 2010)*

- Slight rutting, and/or cracking, and/or roughness become noticeable to drivers.
- Composite Pavement Condition Index 65-79

**Poor: 19% in 2013** *(down from 20% in 2010)*

- Multiple cracks are apparent, and/or rutting may pull at the wheel, and/or roughness causes drivers to make minor corrections.
- Composite Pavement Condition Index 40-64

**Very Poor: 21% in 2013** *(down from 28% in 2010)*

- Significant cracks may cause potholes, and/or rutting pulls at the vehicle, and/or roughness is uncomfortable to occupants. Drivers may need to correct to avoid defects.
- Composite Pavement Condition Index 0-39
- The Agency's goal is to limit a rating of very poor condition to 25% or less of the portion of network it manages. In 2012, the Agency met this goal.

Currently, this level of detailed information about local roads in Vermont is not available. In future versions of this Report Card we hope to include an evaluation of local roads, as information becomes available.

## SAFETY

To address highway safety, Vermont implemented a Strategic Highway Safety Plan (Plan) in 2006. The mission of the Plan was to minimize the occurrence and severity of crashes, related human suffering and economic losses on the Vermont transportation network. The Plan accomplished this by identifying and implementing achievable and effective education, enforcement, engineering, and emergency response initiatives. The Plan set a goal to reduce the number of major crashes, defined by VTRANS as fatal or incapacitating injury crashes to 350 or fewer annually by 2010. This goal was met with 330 major crashes recorded in 2010[iii] and again in 2011 with 320 major crashes recorded.[xi] Historically, the total number of major crashes was substantially higher; for example, 643 crashes were documented in 1992 alone. Vermont fatality rates in 2011 remain below the national average with a fatality rate of 0.77 per 100 million Annual Vehicle Miles Travelled (VMT) compared to the national rate of 1.10[xi]. Vermont highway fatality rate ranks 18th in the nation based on the Reason Foundation's 20th Annual Highway Report.[iv]

## CAPACITY

Vermont is mostly a rural state with low-population density and only one designated urban area – Chittenden County. Therefore, the highway system constitutes the most important component of Vermont's transportation network. Private vehicle travel is the predominant mode of transportation for the vast majority of Vermonters. Daily traffic flows indicate that the interstate system and sections of the National Highway System carry the heaviest traffic in the state, while congestion is mainly experienced by motorists in urban areas of the state, primarily during peak-hour traffic. Based on responses to surveys conducted for the 1995 and 2002 Long-Range Transportation Plans, the overwhelming majority of Vermonters surveyed indicated that congestion is not considered to be a major problem and it does not adversely affect their quality of life.[v] This is supported by the 20th Annual Highway Report which indicates that in 2009 Vermont ranked 7th in Urban Interstate Congestion with only 3% congested, as compared to the national average of 47% congested.[iv]

In 2006, Vermont announced "The Road to Affordability" policy. This policy focuses on managing mobility through a more effective use of what is essentially a completed transportation network, making additional capacity investment in the infrastructure only when warranted. In summary, Vermont does not have a current issue with capacity and congestion, nor does it plan to prioritize this area for improvement in the near future. Transportation Infrastructure projects in Vermont are prioritized based on traveler safety and the preservation of existing infrastructure.[xiii] Efforts have recently focused on Corridor Management Planning, Intelligent Transportation Systems and Transportation Demand Management to solve and prevent transportation problems.

## VEHICLE MILES OF TRAVEL

Total Annual Vehicle Miles of Travel (VMT) is a measure of the total vehicle miles traveled in an area's transportation system. Annual VMT on Vermont's state highway system in 2011 was 7.14 billion miles. This equates to about 11,400 miles traveled per capita, as compared to the national average of about 9,500 miles per capita. The 20% greater distance per capita is due to sparse land development patterns resulting in comparatively larger distances between residences and work, school, and shopping attractions. Vermont has the 10th highest level of vehicle miles traveled per capita among the states.[xii] Annual VMT has historically increased in Vermont since the record began in 1920; however, since 2002 the Annual VMT has been declining. Two

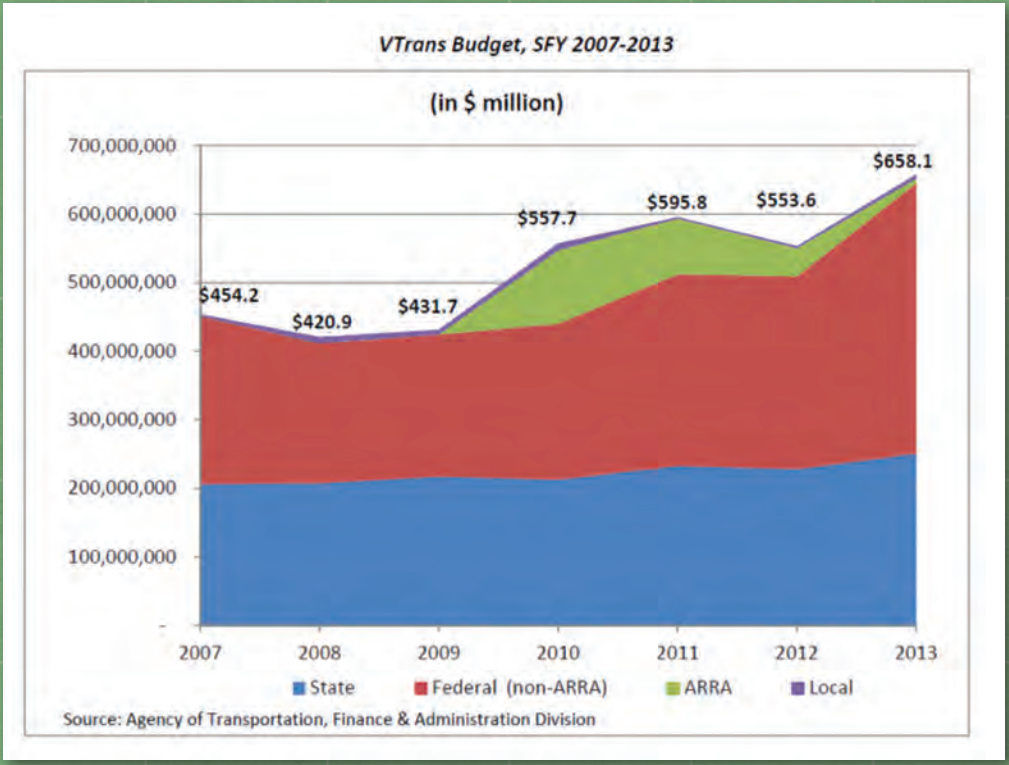
different methods of estimating future VMT growth based on past trends results in a range between 8 and 13 billion annual miles traveled by the year 2020.[v]

## INVESTMENT NEEDS

Highway investment needs from 2000 to 2010 in Vermont mirrored that of the rest of the country and were defined by weak revenues, rising material costs, and aging infrastructure. Vermont ranked 21st in the nation for highway disbursements per mile based on the 20th Annual Highway which provides data through 2009.[iv] However, since 2009, VTRANS has obtained a number of temporary funding sources that resulted in a significant improvement to its transportation network:

- American Recovery and Reinvestment Act (ARRA): Since 2009, the federal government has provided $245 million dollars in additional funding for highway, rail, aviation, and public transit projects in an effort to immediately impact employment in construction and transportation industries.
- Federal Emergency Management Agency (FEMA) and Federal Highway Administration (FHWA) Emergency Relief funding: Between August 2011, when Tropical Storm Irene hit, and the close of SFY12, FEMA and the FHWA had provided Vermont with approximately $85 million in additional funding.
- Transportation Infrastructure Bond (TIB): The TIB, which was introduced in 2010, was originally funded by a 2% assessment on fuel, and provided 6% of the state's transportation fund. In 2010 and 2011, the fund was ramping up, but from 2012 to 2013 the fund remained constant at approximately $22 million annually, accounting for 9% of the state's transportation funding in 2013.

These funding increases, with the exception of TIB, are temporary. Without additional state or federal funding, the improvements that Vermont has gained on its transportation infrastructure will also be temporary.[xiv] VTRANS' budget for 2013 was $658.1 million, while the 2012, 2011, and 2010 budgets came in at $553.6, $595.8, and $557.7 million, respectively. These budgets are a significant jump from the 2009 transportation appropriations that totaled $431.7 million.[xiv]



## FUTURE NEEDS

In 2012, the Vermont Legislature passed Section 40 of Act 153, which establishes a Committee on Transportation Funding to estimate the gap between transportation costs and revenue sources, and determine potential new revenue sources for Vermont. The Committee found that it would take approximately $700 million per year between 2014 and 2018 to maintain, operate, and administer Vermont's transportation system. This is only a slight increase over the 2013 VTRANS' budget of $658.1 million, but it is a significant increase over the available annual budget, which is estimated at an average $457 million per year through 2018. This results in an average annual funding gap of more than $240 million per year, as seen in the table below:[xiv]

| *Future Needs* | |
|---|---|
| **PROGRAM** | **TOTAL** |
| Highway/Safety | $252,000,000 |
| Bridges (including Town Highway bridge) | $152,000,000 |
| Maintenance & Buildings | $76,503,815 |
| Town Highway Aid Programs | $54,977,244 |
| Rail | $50,459,144 |
| Aviation | $6,267,000 |
| Public Transit | $28,285,565 |
| Park and Ride | $4,000,000 |
| Transportation Alternatives | $3,000,000 |
| DMV, Admin, Rest Areas, Multi-Modal | $70,844,111 |
| **Total Needs** | **$689,336,870** |
| **Available Funding** | **$457,028,894** |
| **Deficit** | **$241,307,976** |

The funding needs estimate focuses on the cost to preserve Vermont's existing transportation system in a state of good repair. It is in line with the "Road to Affordability" policy, and, therefore, only includes the necessary funding to preserve existing bridges and roads. The estimate does not include expansion of rail or transit beyond existing levels of service and does not include any major roadway expansion beyond projects already underway.

This estimate is consistent with the previous gap analyses provided by the Joint Fiscal Office and Vermont's Long Range Transportation Business Plan. The Joint Fiscal Office estimated a gap of $203 million per year and Vermont's Long Range Transportation Business Plan estimated an additional need of $210 to $435 million annually through 2025.

Vermont has already taken some steps towards increasing state revenue for transportation projects using the recommendations of the Committee on Transportation Funding. The House-Senate H.510 FY-14 Transportation Program becomes effective on May 1, 2013, and will increase revenue on gasoline sales by 5.9 - 8.2 cents-per-gallon by levying a new 2% Transportation Fund Assessment on the quarterly average retail price of regular gasoline excluding all state and federal levies. Meaning, when the price of gasoline is $3.86 per gallon or less, the increase in revenue will be 5.9 cents-per-gallon. As the price of gasoline rises to $5.06 per gallon, the increase in revenue will rise to and be capped at 8.2 cents-per-gallon. The Program will further increase the 2% Transportation Fund Assessment to 4% effective July 1, 2014, increasing revenue on gasoline sales by 6.5 to 11.1 cents-per-gallon. The program lists various other changes including increasing the diesel tax, authorizing use of federal toll credits, issuance of TIB bonds, and reducing allocation of transportation funds to the state police budget. The Program is expected to increase revenue available to VTRANS by $1.62 million in 2013, $34.2 million in 2014, $24.7 million in 2015, and $31.2 million in

2016 [xv]. Unfortunately this Program only makes a dent in the estimated $240 million annual deficit in transportation funding, but it will assist in keeping up with the needs.

Vermont's transportation budget is highly dependent on federal funding. Vermont did very well with the federal transportation authorization called the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005, and as a result received significantly more funding from the federal Highway Trust Fund than the state put in. However, the authorization of the Moving Ahead for Progress in the 21st Century Act (MAP-21) in 2012 increased the amount of Highway Trust Fund payments that would be returned to states to a minimum of 95%, from the 92% minimum stated in SAFETEA-LU, which decreased the available funding for improvement projects. However, the Highway Trust Fund, which is the "bank account" of the federal transportation program, is anticipated to reach insolvency in May of 2015 without Congressional action because spending from the federal Highway Trust Fund over the last decade has generally exceeded revenue, relying on transfers from the U.S. general fund to remain solvent. This is due primarily to a lack of increase in user fees coming from federal gasoline taxes since 1993. Given the current federal budget challenges and an inability by Congress to dedicate the necessary revenue to grow the federal program on a sustained basis, Vermont should brace for less support from the federal government when it comes to being a reliable transportation partner.[xiv]

## RECOMMENDATIONS

Highway investment needs in Vermont mirror that of the rest of the country and are defined by weak revenues, rising material costs, and aging infrastructure. Generally, the condition of Vermont's roads is degrading; however, improvements have been made over the last two years due to funding in the aftermath of Tropical Storm Irene, and state leaders have kept up their investments. Highway safety ranks well compared to the rest of the nation. System mobility is not a great concern in Vermont because it is largely a rural state; therefore, Vermont's policy directs constrained resources towards preservation and safety of the highway system. Fortunately, the Governor passed the largest investment ever made in the state's transportation infrastructure which contains $685.7 million in transportation funding for 2015. However, it is uncertain if Vermont will be able to maintain that level of funding for the years to come.

Vermont ASCE makes the following recommendations:

- Index fuel taxes and fees to keep up with inflation.
- Fund town highway aid to keep up with inflation.
- Continue to reduce transfers out of the State's Highway Fund to programs not related to transportation.
- Plan for a future revenue source such as a road user fee to replace fuel taxes as the primary source of state transportation revenue.
- Monitor program performance and document success and failure in order to efficiently allocate funds.
- Continue new innovative financing like the Transportation Infrastructure Bond fund.
- Continue the policies established by the Road to Affordability and the Strategic Highway Safety Plan.
- Search for opportunities to partner with the private sector to provide new capacity projects.

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xv. House-Senate H.510 FY-14 Transportation Program, prepared by the Vermont Legislative Joint Fiscal Office, May 1, 2013

xvi. Vermont's Roadmap to Resilience, prepared by the Institute for Sustainable Communities, 2013


# SOLID WASTE

Photo Credit: VT ANR Solid Waste Section

# SOLID WASTE

## GRADE: C+

Vermonters generated approximately 600,000 tons of municipal solid waste (MSW) or trash in 2012.[i] Of that, over 200,000 tons were recycled or otherwise diverted from landfills or incinerators. This represents a 35% diversion rate, almost three times the 12% rate in 1987 before implementation of Vermont's first robust solid waste management law (Act 78). Though progress has been made in managing solid waste since passage of Act 78, the diversion rate has flattened around 30% to 35% over the last two decades. However, in an effort to increase the waste diversion rate, Vermont enacted a new Universal Recycling law which could increase Vermont's diversion rate almost 50% by 2020.[ii]

## BACKGROUND

MSW is commonly known as trash or garbage and comes from homes, schools, hospitals, and businesses. Approximately 65% of Vermont's MSW is either disposed of in Vermont landfills or hauled out of state for disposal. The MSW diversion rate is 35%; that is, the remaining 35% of MSW generated in Vermont is recycled or otherwise diverted from landfills or incinerators. Vermont also generates and disposes over 100,000 tons of construction and demolition (C&D) debris and other wastes such as biosolids and contaminated soils (Figure 1).

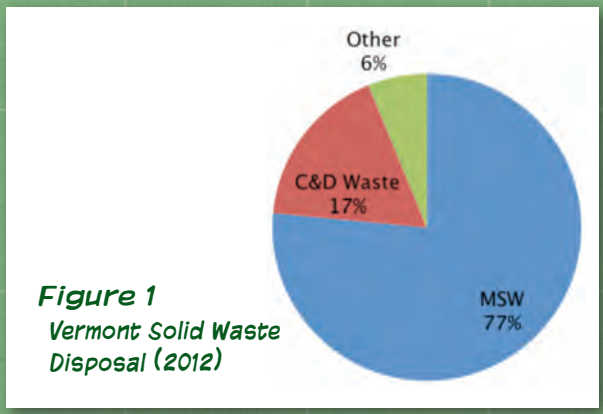


*Figure 1*
*Vermont Solid Waste Disposal (2012)*

In an effort to increase the waste diversion rate, Vermont enacted the Universal Recycling law (Act 148) in 2012. Act 148 seeks to improve the capture and diversion rates for certain materials including recyclables, food scraps, and yard debris. Implementation of the law was phased in over a nine-year period, beginning July 1, 2014, to allow time to establish the additional collection and processing infrastructure. The Vermont Department of Environmental Conservation (VTDEC) anticipates that the MSW diversion rate will increase to approximately 50% after Act 148 is fully implemented, no sooner than 2020[ii].

## CONDITION

Solid waste collection in Vermont is primarily performed by private haulers with some assistance from municipalities and solid waste districts. In addition, many households and some small businesses haul their waste and recyclables to transfer stations and drop-off facilities. A total of 148 facilities, primarily operated by municipalities and solid waste districts, are certified to collect MSW refuse and/or recyclables and another 18 facilities are certified to compost materials.[iii]

### *Solid Waste*

Currently, the majority of Vermont's solid waste is hauled to and disposed of in a Resource Conservation and Recovery Act (RCRA), Subtitle D lined landfill facility, located in the northeast corner of the state. Until 2013, a second lined landfill facility located near the center of the state accepted over 100,000 tons of waste per year; however, the landfill has reached its permitted capacity and is not currently accepting waste. In addition, a very limited amount of waste is disposed of in Vermont in two unlined MSW landfills and one C&D landfill. Based on Vermont's remaining solid waste disposal capacity as of 2013, the only operating lined landfill in the state could be filled to permitted capacity by 2020[i]. Some of Vermont's waste (17 percent in 2012) is transported to neighboring states including Massachusetts, New Hampshire, and New York for disposal.[i]

### *Recycling*

In 2012, Vermont diverted over 200,000 tons of MSW through recycling facilities, bottle redemption, direct to market economic recycling, scrap metal facilities, organics composting, and reuse facilities and programs.[i] Figure 2 is a summary of 2012 solid waste diversion by material type.

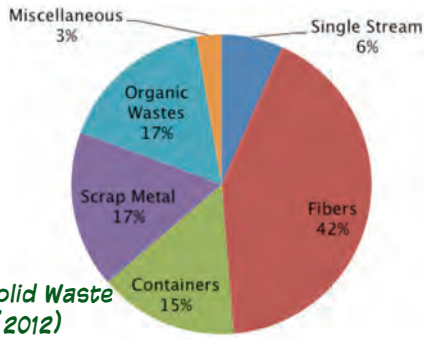


*Figure 2*
*Vermont Solid Waste Diversion (2012)*

A 2012 waste composition study commissioned by VTDEC found that an estimated 100,000 tons of recyclable fiber and packaging materials remain in Vermont's MSW stream.[iv] This shows that while significant efforts have been made to divert recyclable materials, there is still room for improvement. Currently there are few options for C&D materials management facilities in Vermont. The state has limited facilities devoted to reuse and recycling.

### *Electronic Waste*

In 2010, the Vermont legislature passed Act 79 related to the recycling and disposal of electronic waste (e-waste). Act 79 bans the disposal of e-waste in landfills and provides a manufacturer-funded recycling program. In the first-year of the program, approximately 2,400 tons (equivalent to 7.7 pounds per capita) of covered devices were collected, exceeding the first-year e-waste recycling goal of 5.5 pounds per person[iii].

### *Household Hazardous Waste and Universal Waste*

Household hazardous waste (HHW) and universal waste is collected and managed separately from MSW to reduce the risk to public health and Vermont's environment from disposal of these materials. Since 1992, each district, alliance, or municipality is required to develop and implement a Solid Waste Implementation Plan (SWIP) that must include a minimum of two HHW collection events per year, as well as a public education

and outreach component. In addition to the collection events, there are five facilities in Vermont that are dedicated to collecting HHW. Currently, between the seasonal collection events and the five collection facilities, the overall participation rate by Vermont residents is 10 percent; therefore, there is still room for improvement.[ii]

## INVESTMENT NEEDS

Successful implementation of Act 148 will require improved recycling infrastructure and services. Many areas in Vermont will need centralized small-to-large-scale organics management facilities to process residential organic material and high volumes of organics from the commercial sector. Building effective statewide infrastructure for organics management will require site development, comprehensive management plans, modified hauling systems, widespread participation in organics diversion and collection, and an increasing market demand for compost. The VTDEC estimated the necessary total capital investments at $42 to $45 million over the nine year implementation period[iii]. Creating incentives and funding opportunities should stimulate the development and expansion of infrastructure needed to support the increased stream of diverted materials.

In addition to developing new infrastructure to support implementation of Act 148, Vermont will need to continue to grow and support programs to manage and divert other materials from landfills including C&D materials, e-waste, HHW, and universal waste. Despite potential increased diversion rates from improved recycling infrastructure and services, there will be a need for landfills for disposing of the portion of solid waste that is not recycled. Because landfills are and will continue to be a primary component of the state's solid waste management program, Vermont will need to ensure that adequate landfill capacity is available for waste disposal beyond 2020.

## RECOMMENDATIONS

Vermont ASCE makes the following recommendations:

- Permit and construct new landfill space in Vermont since current landfills are predicted to reach their permitted capacities within the next decade.
- Create funding programs to encourage the establishment of centralized small-to-large-scale organics management facilities.
- Set up statewide public education and outreach programs to encourage recycling.
- Establish new hazardous waste disposal facilities to improve accessibility and convenience for every region of the state.
- Develop C&D collection, recycling, processing, and disposal infrastructure in underserved areas of the state.

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iv. State of Vermont Waste Composition Study, Final Report, Prepared for: State of Vermont Department of Environmental Conservation, May 2013 Prepared by: DSM Environmental Services, Inc.

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# 2014 REPORT CARD FOR VERMONT'S INFRASTRUCTURE ISSUE BRIEF SUMMARY


| SUBJECT | 2011 GRADE | 2014 GRADE | COMMENTS |
|---|---|---|---|
| Bridges | C- | C | Approximately 30% of Vermont's bridges are deficient, compared to a national average of about 24%. Vermont ranks 23rd in the nation based on the percentage of structurally deficient bridges due in large part to the age of the Vermont bridge network. However, the percentage of structurally deficient bridges declined from 19.7% in 2008 to just over 8% in 2013. The Vermont Agency of Transportation estimated in 2008 that $110 million is needed every year for 20 years to fill the bridges funding gap and address the structural and age issues. In 2014, state legislators and the Governor passed the largest investment ever in the state's transportation infrastructure containing $140.3 million for bridges which will help to improve the overall condition of the state's bridges. |
| Dams | C | C | Vermont has 1,219 dams on its state inventory and 198 (16%) of those structures are classified as high or significant-hazard-potential. Vermont's Dam Safety Program is understaffed and depends on a voluntary action by dam owners or a time-consuming state process for correcting safety deficiencies. Based on inspections completed in 2013, 35% of dams inspected were in poor condition. The Vermont Dam Safety Program relies heavily on educating dam owners of safety risks to motivate repairs. The financial burden of repairing or removing the poor-condition dams is estimated to be $22 million for all removals and $35 million for all repairs. Ten obsolete or unsafe dams have been removed from Vermont waters over the past six years, with five of the removals taking place in 2013-2014. The majority of Vermont dams are the responsibility of private landowners that tend to have limited willingness to invest in maintenance and repairs. Vermont House Bill 590, considered by the Vermont legislature in 2014, would require registration of dams to improve public safety but did not become law. |
| Drinking Water | C- | C- | Vermont has a total of 1,377 active public water systems, and 97% of these are small community systems. Vermont needs $510 million over the next 20 years to meet the demands of the Small Community Water Systems (CWS), and additional resources are needed for the 24 medium and 7 large systems. Vermont is one of 15 states that receives the minimum federal loan program allotment of 1%. Annual funding deficits ranged from $10 million to $40 million over the past four years, providing only about half of the funding needed for Vermont's drinking water systems. While 30 public water systems issued boil water notices as a result of Irene, impacting more than 16,500 people, the damage and repairs required have not been fully reported. |
| Waste-water | D+ | D | Vermont has over 7,000 miles of rivers and streams, 300,000 acres of wetlands, and 812 lakes and ponds, totaling over 230,000 acres. There are 91 wastewater treatment facilities that treat approximately 44 million gallons of sewage and discharge the treated effluent to the waters of Vermont each day. To address Vermont's clean water needs, $156 million of additional funds is needed annually to do wastewater and stormwater sewer repairs, retrofits, and facility upgrades. Of this, $18 million is the annual need specifically for municipal wastewater infrastructure. Proposed budget cuts in the state's Clean Water State Revolving Fund – the primary funding mechanism for financing clean water infrastructure upgrades and retrofits – do not support the municipal wastewater systems in the state that are trying to keep the water clean. |
| Roads | D+ | C- | Vermont ranks 28th in the nation in state highway performance and cost effectiveness, moving up 14 spots from 42nd in the previous year. This was due largely to the influx of emergency funding that Vermont received in the aftermath of Tropical Storm Irene which significantly impacted Vermont's roads. To continue making improvements at the same rate since 2011, VTRANS estimates a funding need of $700 million per year, at least through 2018. Positively, state legislators and the Governor passed the largest investment ever made in the state's transportation infrastructure which contains $685.7 million in transportation funding for 2015. The 2015 Transportation package provides $115.7 million for paving, $108.7 million for town highway programs, $50 million for maintaining and improving roadways, and $13.3 million for highway safety and traffic operations. Vermont has also made progress on road safety with its Strategic Highway Safety Plan cutting road fatalities by nearly half since 2006. |
| Solid Waste | NA | C+ | In 2012, Vermonters generated approximately 600,000 tons of municipal solid waste (MSW). Of that, over 200,000 tons were recycled or otherwise diverted from landfills or incinerators. This represents a 35% diversion rate, almost three times the 12% rate in 1987 before implementation of Vermont's first robust solid waste management law (Act 78). Though progress has been made in managing solid waste since passage of Act 78, the diversion rate has remained flat at 30% to 35% over the last two decades. |

A = Exceptional
B = Good
C = Fair
D = Poor
F = Inadequate

*Categories were evaluated on the based on existing conditions, capacity, operations & maintenance, public safety, risk and current and projected levels of funding.*