Protecting Drinking Water Sources in Your Community

Tools for Municipal Officials

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About This Document

This publication provides case studies, Source Water Protection (SWP) topics of concern, and tools for municipal leaders. Building off the original 2004 SWP toolkit, it incorporates updates informed by a survey of local partners in SWP who identified key concerns and challenges. Input from NEIWPCC's Source Water Protection Workgroup also provided guidance and new materials for the toolkit. Special thanks to Kira Jacobs, Richard Friesner, Beth MacBlane, Cheyenne Ellis, Amy Magin, Kathy Romero, Catherine Hamilton, Pierce Rigrod, Ashley Hodge, Laura Ranker, Noreen Gallagher, Kristin Martinez, Kim Czapla, and countless others for their assistance with the toolkit revision process.

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NO RELIANCE ON INFORMATION AND DISCLAIMER

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CHAPTER 1 – INTRODUCTION

Protecting a Critical Resource: Our Drinking Water

This toolkit provides the most current and useful information for municipal water professionals, officials, and community volunteers interested in protecting local drinking water supplies. As water quality standards and protection regulations, populations, resources, land uses, and the climate all change over time, water supply protection plans also need to do so.

Protecting drinking water is critical for a variety of reasons. Safe drinking water is central to human health, well-being, and economic viability. Water supplies are limited and threatened by an increasing number of diverse pollutants. And climate change impacts, such as more extreme weather events in the Northeast, are having consequences on drinking water supplies in localities that are not appropriately prepared.

Drinking water protection efforts often involve select board members, municipal administrators, planning and zoning boards, wetlands and conservation commissions, departments of public works, boards of health, schools, and other entities. All these groups make decisions that may affect the quality of a communities' water supply. Municipalities can also partner with the state, the local business community, and their water suppliers to adopt protective policies and measures.

CRITICAL FOCUS AREAS

Source water assessments in the states of the Northeast revealed five critical areas of focus, which drive the structure of this toolkit:

- Local regulations and ordinances governing land use practices.
- Underground storage tanks.
- Hazardous waste.
- On-site septic systems.
- Stormwater runoff.

Specifically, this toolkit provides information on how municipal officials can use local land-use regulations, ordinances, and conservation easements as important tools for protecting source water. Other key points include communicating proper management strategies for underground and aboveground storage tanks, managing storage of hazardous materials, proper maintenance of on-site septic systems, and stormwater management techniques.

DID YOU KNOW?

Readily available freshwater from surface and groundwater sources represents less than 1% of all the water in the world — and it is almost all the same water that was on the earth from day one.

KEY TERMINOLOGY

NONPOINT SOURCE (NPS) POLLUTION
Pollution that occurs when runoff from rainfall or snowmelt moves over or into the ground, picking up pollutants and carrying them into streams, lakes, wetlands, and groundwater. This pollution becomes diffuse and widespread as runoff moves over the ground or through the soil, making it challenging to contain or keep away from water resources.

POINT SOURCE POLLUTION
Pollution that enters waterways and waterbodies at specific, identifiable points, such as sewage system or wastewater plant output pipes.

SOURCE WATER
Untreated water from streams, lakes, reservoirs, or groundwater that is used to supply drinking water.

RECHARGE AREA
The watershed area that contributes water to a groundwater aquifer, accessed by a supply well as a water source.

THE CHALLENGE

Today in the United States, most people have the luxury of turning on the tap and enjoying clean, potable water, which is not the case in many parts of the world. However, increasing populations and associated human activities are taxing the quality and quantity of local water supplies. Federal and state drinking water requirements have become increasingly protective to address pollutants, including metals such as lead and mercury, chemicals such as per- and polyfluoroalkyl substances (PFAS) and 1,4-Dioxane, and microbial organisms such as E. coli and cyanobacteria.

According to the EPA, the leading cause of water quality degradation is NPS pollution, which includes sources such as runoff from farms, construction sites, roadways, and parking lots, or pollutant leakage from fuel storage tanks or on-site septic systems.

Communities — from small rural villages to major metropolitan areas — depend on lakes, reservoirs, rivers, and groundwater for their sources of drinking water. All drinking water sources are vulnerable to a variety of contaminants associated with a vast range of human activities. Climate change-driven impacts, like extreme weather events, alter fuel needs for heating and cooling, and new distributions of pressure on drinking water supplies following changing population patterns further raise the risk of increasing pollution and strain on local source water supplies. If existing or new sources of pollution render the water unsafe to drink, a community will have to choose between expanding treatment infrastructure and finding a new drinking water source. Both options can be very expensive, and these costs are often passed on to citizens.

CHAPTER 2 – RESOURCES AND INFORMATION

FEDERAL LAWS AND REQUIREMENTS FOR SOURCE WATER PROTECTION

SWAP and Source Water Assessment reports

The U.S. Congress called for the establishment of a Source Water Assessment Program (SWAP) as part of the Safe Drinking Water Act Amendments of 1996. The keystone of this program was a requirement for states to assess the susceptibility of source water at all public water systems to pollution, and to provide the public with a summary of these findings. These reports are now 20 years out of date and in need of review across the Northeast. However, the information on potential and known areas of source water contamination are still valuable baselines to use in developing plans to help communities protect source waters and from which to generate updates. For example, New York State began a new source water protection program in 2021 through volunteer community participation, and Vermont published its in 2018.

SWAs are designed to encourage and help water suppliers, local officials, and residents to take steps to keep their water supplies safe. The assessment reports contain detailed information on potential threats to municipal drinking water supplies, and include the following key components:

- A map showing the delineation, or outline, of public drinking water assessment areas.
- An inventory of known and potential sources of contamination in the delineated areas.
- An assessment of the susceptibility of water supplies to the identified potential contamination sources.

Find EPA Region 1 SWAP contacts:
https://www3.epa.gov/region1/eco/drinkwater/epacontacts.html

ACCESS YOUR SOURCE WATER ASSESSMENT (SWA) REPORT

SWA programs are handled by different offices in different states. The EPA maintains contact information (below) for relevant staff in state-specific offices for SWA programs and related water protection and management efforts.

https://www.epa.gov/sourcewaterprotection/source-water-assessments
See Chapter 10 – Resources for information on how to obtain a community's Source Water Assessment (SWA) Report.

TOOLS OF THE TRADE: MAPPING APPLICATIONS

The EPA developed the online Drinking Water Mapping Application to Protect Source Waters (DWMAPS) specifically to help local and state water professionals update assessments and protection plans. The tool combines information reported from public and private utility provider's reports. The application accesses an area's information about known drinking water sources and the threats to these resources and responds to changing or new information such as recent accidental spills or releases of potential contaminants.

View DWMAPS here: https://www.epa.gov/sourcewaterprotection/drinking-water-mapping-application-protect-source-waters-dwmaps

Each Northeast state reports the results of the SWAs and supporting information – such as geographic data or assessment methods – to the public, usually through their environmental protection or public health departments.

Inventory lists in SWA reports provide information on the potential risk of all documented releases into the environment and potential contaminant sources or activities of concern to drinking water supplies within a source water protection area. This inventory is a snapshot representing a particular point in time when the last report was completed; however, some states have systems in place for communities to report new potential threats or make complaints.

The susceptibility ranking, found in the reports, indicates the level of concern assigned to each potential risk by ranking, rating, or prioritizing them based on the relative threat compared to other potential source contaminants. Rankings of specific contaminant sources are based on a number of factors, including the type and quantity of a chemical generated, characteristics of the contaminants (e.g., toxicity), the behavior and mobility of the pollutants in soil and groundwater, existing regulatory authority to control the threat, existing conditions, and the effectiveness of mitigation measures. Northeast states typically assign susceptibility rankings of high, moderate, or low to each water source.

America's Water Infrastructure Act and source water vulnerabilities information

Understanding the parts of water supply systems can inform how communities protect their source water resources against emerging concerns and critical challenges. Congress took an important first step in enhancing water security by passing the Bioterrorism Act in 2002. This Act requires documentation and reporting of water system components and their vulnerabilities to different types of threats. It requires water suppliers to look at the major components of their water systems, identify the threats to each component, and then estimate the potential effects of those threats on their system and its operations. This accounting from private water suppliers is important information to gather when assessing local water supply vulnerabilities and is accessible to local and municipal officials.

To increase local government awareness and preparedness for risks to water sources, Congress passed the America's Water Infrastructure Act (AWIA) in 2018. The AWIA requires that drinking water systems and utility providers which serve more than 3,300 people conduct or update risk assessment and emergency response plans. They must also receive an initial certification and are subject to a five-year recertification. Assessments must include risk and resilience information of the water system, such as:

- The level of risk faced by the water system from natural hazards, vandalism, or other intentional harmful acts.
- The resiliency of the physical infrastructure for the transportation, source water, treatment, and distribution systems, including computer and automated security.
- System monitoring procedures.
- Funding for the source water system.
- How the system uses and stores chemicals.
- Operational and maintenance standards for the water system.

UPDATING A SOURCE WATER PROTECTION ASSESSMENT

When it is time to update a SWA, a municipality should consult with several specific stakeholders and resources.

Work with water utilities to update SWA information and maps. Community volunteers, such as watershed associations, civic groups, and high school students, can help verify and update report information. Consider adding additional features to the maps, such as the 100-year floodplain, tax map information, soils information, and high-density development.

Compare general assessment findings with watershed features and actual water quality conditions to validate results and review technical assumptions. Many of these assessments were completed as early as 2000, and the information may not have been verified and updated. Water systems and municipalities are encouraged to forward corrections or new potential sources of contamination in their source water protection area to the state Drinking Water Program on an annual basis.

In 2006, EPA created a How-To Manual on Updating and Enhancing Your Local Source Water Protection Assessments.

Vermont's flyer, "Preparing a Source Protection Plan Update," includes the following steps:

- Inspect the source protection area and update potential contamination source maps and inventory.
- Weigh risks from new potential contamination sources and identify risk management measures.
- Update the landowner list.
- Communicate with relevant landowners in the source protection area about actions they can take to protect water.
- Summarize progress in reducing threats to a source.

This flyer can be found at:
https://dec.vermont.gov/sites/dec/files/dwgwp/sourceprot/pdf/howtoupdateyourspp.pdf

For more information on the requirements for government and utilities' reporting on these risks and other concerns, see the EPA's Water Resilience information on the AWIA: https://www.epa.gov/waterresilience/awia-section-2013

Resources for incorporating climate change into SWAPs

Threats to source water and drinking water quality due to climate change include more intense and frequent storms, erosion, drought, saltwater intrusion, and conditions which increase the occurrence of harmful algal blooms (HABs). Community responses to these changes can also increase their impacts on source waters if not properly planned for, accounted for, and managed in SWP plans.

Adaptation and resiliency built into SWP plans have been implemented and documented in successful case studies outside of the Northeast in other areas of the U.S. — for examples, see *Wellspring: Source Water Resilience and Climate Adaptation*, 2019 (https://www.nature.org/content/dam/tnc/nature/en/documents/Wellspring_FULL_Report_2019.pdf)

The EPA collected and organized specific databases, interactive tools, and workbook-based resources to help state and local water planners look at and adapt for specific climate change-driven source water impacts:

Tools for Water Related Climate Change Adaptation, Climate Change Adaptation Resource Center: https://www.epa.gov/arc-x/tools-water-related-climate-change-adaptation#tab-2

For more information on the impacts of climate change in your state in relation to potential water source planning concerns, the EPA has a series for state-by-state resources explaining specific climate change to explore local information and risks: https://www.epa.gov/climateimpacts/state-and-regional-climate-impacts

CHAPTER 3 – GETTING STARTED

GETTING STARTED ON SOURCE WATER PROTECTION

Safe drinking water is a basic human need. Whether a water supply source has relatively few potential threats, or it has extensive industrialized land uses, the way to ensure adequate quantity and safe water quality for the future is to protect water supply resources.

ESTABLISH A SOURCE WATER PROTECTION ACTION TEAM

To keep water protection goals on the community radar, municipalities need to designate a person, entity (e.g., health department, planning department, conservation commission), or team responsible for source water protection. This team will set priorities, incorporate recommendations into municipal plans and ordinances, identify emerging concerns, work with other communities in the watershed, and keep local officials and the public involved, educated, and informed on a continuing basis.

While larger communities may have the staff and resources to tackle SWP in-house, collaboration among stakeholders engages the diverse experience and expertise of the community as a whole — municipal departments, regional agencies and associations, businesses, educators, citizen organizations, and residents. The team approach can also help

procure advocates and craft long-lasting partnerships that will facilitate source water planning, implementation, and public acceptance.

Establish community water quality goals and action priorities

SWP requires an ongoing community-wide commitment, and clear source protection goals (e.g., maintaining water quality, improving water quality). With these goals in mind, communities can employ a science-based strategy which includes community participation and municipal expertise for establishing priorities, determining which land uses need attention, and developing a framework for action.

Updating and reviewing SWP programs allow communities to address new information, the changing nature of potential threats, and local needs. Management practices for controlling development impacts are continually evolving and local development standards need to be reviewed and updated to reflect state-of-the-art standards.

Monitor known and potential contamination sources to ensure compliance with federal, state, and local requirements

Research the compliance history of the owners of identified pollution sources by contacting the enforcement and compliance division of your state environmental agency. This would include having the water supplier or municipality conduct compliance visits.

Explore new concerns and plan for a more climate-resilient future

When planning for drinking water safety and accessibility in the future, municipal officials and community members should be aware of the evolving threats from climate-related changes to local areas. The National Oceanic and Atmospheric Administration (NOAA) developed a free online tool to help communities increase their climate resiliency. The U.S. Climate Resilience Toolkit (https://toolkit.climate.gov) is a community-level tool that helps municipal officials better understand and assess their locality's climate-related risks, while also providing examples of success stories The tool includes examples of climate-resiliency programs and efforts from across the country and workable suggestions to enhance local resiliency measures on a variety of topics, including protecting drinking water supplies. The toolkit can be used to help get support from community members to update SWPexplore what other states and communities have done to prepare for climate change and inform better SWP measures.

Investigate funding options

See Chapter 9 for details on financing the development and implementation of a SWP program.

Case Study

New York State Municipal Drinking Water Source Protection Program

The New York State Drinking Water Source Protection Program (DWSP2) offers free technical assistance to support communities with the development and implementation of long-term SWP programs. DWSP2 is the result of an initiative co-led by New York State's Departments of Environmental Conservation and Health, along with the Departments of State and Agriculture and Markets. Through these collaborations, shared resources and outreach networks allow for the state to best assist communities in achieving local source water protection goals. The program began working with communities in 2021.

Communities complete an application to work with free technical assistance providers to develop and begin implementation of a DWSP2 program tailored to the community's needs. As a part of the process, the identification of stakeholders both within and outside of the community encourages collaboration between municipal and state agencies engaged in source water protection. Communities also benefit from a variety of technical support, including creating or updating maps of source water protection areas, identifying potential contaminant sources, selecting to protect or mitigate against potential contaminant sources, and identifying state and federal funding programs for plan implementation. Once the DWSP2 plan is developed, communities work with their technical assistance provider and/or other partners to implement the identified protection methods.

Ultimately, DWSP2 plan development and implementation will help communities proactively prevent pollutants from entering their drinking water supply, create long-lasting partnerships, and connect with resources for future source water protection efforts.

To guide this process, NYS has prepared A Framework for Creating a Drinking Water Source Protection Program. This document contains information on key aspects of the planning and implementation process, including the formation of a stakeholder group and goals, preparation of a drinking water source assessment, identification of protection and management methods, and designating a plan management team to maintain progress of the program over time.

For more information on DWSP2 visit the NYSDEC website:
https://www.dec.ny.gov/chemical/115250.html

TOOLS OF THE TRADE: EPA'S FUNDING INTEGRATION TOOL FOR SOURCE WATER (FITS)

FITS is an interactive tool that provides an overview of federal funding sources for activities that protect drinking water supplies. The tool details funding sources (ex: DWSRF, CWSRF, 319), planning steps for a SWP program, and examples for reference.
https://www.epa.gov/sourcewaterprotection/fits

EDUCATE AND INVOLVE THE PUBLIC IN SWP PROGRAMS

A successful SWP program relies heavily on public support. An outreach and education strategy that engages all sectors of the community can include information about the importance of protecting drinking water sources, what is being done at the local level, and suggested best management practices (BMPs). Opportunities for public commentary and/or participation in SWP programs include town meetings or town halls, hearings, or via online tools that allow the public to report source water threats or make complaints.

BEST MANAGEMENT PRACTICES

Established practices used to help reduce the impacts of activities (e.g., industrial activities, construction, road building, agriculture) that have the potential to threaten water quality.

Public education can be accomplished in many ways, including:

- **Surveys of the public:** Assess water knowledge and prioritize activities to address public concerns.
- **Signage:** Raise awareness about watershed and recharge areas, water quality, and conservation.
- **Guidance materials:** Provide BMPs on such subjects as protecting critical areas, storing household hazardous waste, lawn care and gardening, and septic systems.
- **Speakers:** Provide experts on various source protection topics with community groups.
- **Newsletters:** Keep the public up to date on issues and events.
- **Media coverage:** Encourage local papers and radio and television stations to help keep the community informed about issues, events, and BMPs.
- **Social media:** Keep social media pages up to date with the latest news and tips to help the public protect their source water and environment.
- **Schools:** Encourage school districts to participate in source protection activities and incorporate source protection into their curriculum.
- **Volunteer monitoring**: Encourage students and adult community members to participate in collecting and analyzing surface water samples for a variety of constituents, evaluating the health of aquatic biological communities, and inventorying watershed conditions and land uses.
- **Watershed festivals:** Create events to celebrate water in the community.
- **Household hazardous waste collection days:** Hold a special day for having the community take their household hazardous waste to a central location for proper disposal. This is also a good way to educate the public on these issues.
- **Local government:** Make sure all departments are aware of and participating in the SWP program.

SOURCE WATER PROTECTION WEEK

In 2021, the American Water Works Association (AWWA) recognized the first Source Water Protection week. This initiative was started to raise awareness about the importance of caring for drinking water sources. Bring Source Water Protection Week to your community by accessing AWWA's outreach materials and learning ways to celebrate.

BE PREPARED

Make sure you have a security plan and up-to-date emergency response plan for drinking water sources in your community. Communities and water suppliers should have a plan in place to ensure drinking water security and a response to plan should a water supply become compromised, vandalized, or contaminated.

Recognizing the risks and costs of replacing a water supply source can help get the public's attention and support for source water protection efforts. Drinking water security relies on many different people working together. For this reason, it is important to communicate with and help educate law enforcement officials and others in the community about drinking water security. For more information, visit the EPA's resiliency resources:
https://www.epa.gov/smartgrowth/regional-resilience-toolkit

For information on how communities can address cybersecurity, Massachusetts has compiled tips, and resources here: https://www.mass.gov/info-details/public-drinking-water-system-operations#cybersecurity-.

Top 10 Steps Municipal Officials Can Take to Ensure Drinking Water Security

1. Communicate with drinking water utility personnel and become familiar with local water utility operations and facilities.
2. Prepare for emergency situations by coordinating community emergency plans with utility emergency operating plans.
3. Promote the development of vulnerability assessments for drinking water utilities.
4. Inform water utilities of any threats or suspicious activities associated with drinking water supplies.
5. Establish “Community Watch Groups” to help notice and report any suspicious activity in and around local water utilities.
6. Include community source water protection areas in routine inspections or patrols.
7. Fully investigate vandalism or tampering of water supplies.
8. Prepare to respond to water supply emergencies, and practice for them.
9. Provide funding for security upgrades for drinking water systems and sources.
10. Update emergency contact lists for drinking water facilities.

CASE STUDY

ANNUAL DRINKING WATER OUTREACH PACKAGE TO MASSACHUSETTS BOARDS OF HEALTH

Municipal officials and staff have a responsibility to protect sources of public and private drinking water and are key partners with state agencies. It is important to stay connected with state agencies regarding the protection of drinking water and to obtain support for this challenging task.

The Massachusetts Department of Environmental Protection (MassDEP)'s Drinking Water Program sends a letter and outreach package to all Boards of Health each summer to support health officials and staff in protecting local drinking water. The package contains important drinking water updates, an inventory of public water systems in the community, and information on topics about which MassDEP receives consumer questions.

Examples of topics in the 2022 Board of Health outreach package include:

- Per- and polyfluoroalkyl substances (PFAS).
- Annual recreational camp requirement.
- Underground injection control/Title 5 systems.
- Water supply emergency declarations, boil orders and other public health orders.
- Consumer notification requirements.
- Source water protection & drinking water supply protection grant program.
- Home and green burials.
- Lead in school drinking water.
- Cybersecurity.
- Controlling legionella in health care facilities.
- Cyanobacteria and cyanotoxins.
- Emerging issues.

View the 2022 MassDEP Board of Health outreach package:
https://www.mass.gov/lists/drinking-water-information-for-boards-of-health.
For more information, please contact MassDEP's Drinking Water Program at program.director-dwp@mass.gov.

Kagere, Joanita (August, 2022). MassDEP.
Romero, Kathy. (2016)

CASE STUDY

LEGISLATION AS AN OPTION

The Massachusetts Community Preservation Act (CPA), enacted in 2000, has proven to be an effective way for municipalities to enhance their water supply protection efforts. Approximately 50% of the cities and towns in Massachusetts have adopted the CPA. To date, over 3,000 acres of open space land located in water supply protection areas have been acquired through municipal CPA Programs, protecting public drinking water supplies throughout Massachusetts.

Once a municipality has adopted a CPA Program, it must establish a committee to make project recommendations and oversee expenditures. A local CPA Program is funded through a real estate property surcharge of up to 3%. The revenue raised is then matched by funds from the Commonwealth. Among the eligible uses of CPA funds is acquiring open space land. Although open space land differs from public water supply land in that the latter must be under the control of the public water system, which can prohibit public access and is subject to MassDEP regulations, open space land can provide significant protection when located in watersheds and aquifer recharge areas.

To ensure permanent protection, lands acquired with CPA funds must also be protected by a conservation restriction with an authorized third party, such as a land trust. This additional layer of protection prevents the sale or use of the land for another purpose. A local CPA program can borrow against future expected CPA revenue, which is useful in instances when prioritized land becomes available prior to the annual revenue collection, or for acquiring lands whose cost exceeds the annual collection.

Romero, Kathy. (2016) http://www.communitypreservation.org/

CHAPTER 4 – LAND USE

The most effective way to protect a water supply is to limit or restrict how the land can be used. These measures can minimize or prevent pollutants from entering key recharge or drainage areas which impact the quality of source waters. Many of the strategies discussed in this chapter may already be in place in a community; check your state requirements and statutes.

SYNCING A LAND USE AGENDA WITH SOURCE WATER PROTECTION

Home rule — as it pertains to land use in the Northeast states — places most of the responsibility for land use regulation, and consequently, source water protection with local governments. While there are a variety of federal and state requirements and programs that address water quality issues, the day-to-day decisions associated with land use and resource protection are made by municipal officials, planning and zoning board members, conservation commissioners, wetlands commissioners, health officers, town sanitarians, and zoning boards of appeal.

Most municipalities have sufficient authority to control land use activities and conditions that threaten their drinking water supplies. It is helpful to have clear drinking water protection goals, know how to minimize the cumulative risks of land uses to drinking water resources and what authorities and options are available to ensure the future health of a water supply.

SWA reports can be a powerful tool for reviewing existing policies, regulations, codes, standards, ordinances, and other land use controls to see if they support source water protection.

- Substantiate SWA reports with regard to known and potential threat inventories and action priorities and determine who has the authority to address specific types of threats.

Resource protection philosophies and strategies continue to evolve as the result of lessons learned about the long- and short-term effects of land use activities on the environment. SWP strategies should take into account the most current, science-based BMPs available, leaving the door open to effective, innovative techniques.

CLIMATE CONNECTION: SEA LEVEL RISE AND GROUNDWATER RESOURCES

Coastal areas of the Northeast are vulnerable to sea-level rise and saltwater intrusion into freshwater sources and delicate ecosystems as a result of climate change. For example, a 2007 report noted that Cape Cod, Massachusetts, faces pressure from multiple climate change driven factors: sea level rise, more frequent and more extreme storms, and saltwater intrusion into the aquifer supplying local drinking waters. Additionally, population growth is driving increased municipal water withdrawal as development levels outpace the ability of local regulations to protect important systems related to drinking water resources. Long Island and parts of New Jersey face similar realities of combined threats from storms and saltwater intrusion into groundwater-based supplies for drinking water. Zoning and local regulations can address climate impacts by encouraging development away from stressed land areas or areas facing saltwater intrusion, and protecting recharge areas for aquifers from land uses which slow infiltration.

Source and more information:

"Climate Impacts in the Northeast." (2017). United States Environmental Protection Agency, Climate Change Impacts. https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-northeast_.html

Frumhoff, P.C., J.J. McCarthy, J.M. Melillo, S.C. Moser, and D.J. Wuebbles. (2007). Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions. Synthesis report of the Northeast Climate Impacts Assessment (NECIA). Cambridge, MA: Union of Concerned Scientists (UCS).

STRATEGIES FOR ACTION

Align water resource protection goals with the comprehensive municipal plan.

SWP areas should be clearly identified in a municipal plan as a protection priority. Work with other communities in the watershed, wellhead protection area, or service area.

Target critical water resource protection areas for land conservation.

The most effective way to protect a water supply is to limit or restrict how the land can be used. Ensure that a community and/or water supply region has a plan for land conservation that is compatible with watershed and recharge area protection.

Land conservation invests in the long-term health and welfare of both people and the environment. It is also a means of linking existing open spaces, preserving important wildlife habitats, providing the public with low-impact recreational opportunities, and most importantly, guiding growth away from sensitive water resources. There are several ways to secure land for conservation:

- **Purchase land:** A strategy for water suppliers, the community, a group of communities, or a land trust. (See Chapter 9 - Financing for information on funding options.)
- **Purchase development rights**: Protects the land from development, while allowing the landowner to retain all other rights associated with land ownership.
- **Select subdivision open space areas** (e.g., greenways, habitat corridors, expanded wetland buffers, protected forest fragments): These are typically identified in the municipal open space plan and should be targeted during the subdivision approval process.
- **Use conservation easements:** A transaction whereby the landowner transfers rights to develop a given area of land to a recipient organization (e.g., municipality, water utility, land trust) that assumes responsibility for monitoring the land to ensure that easement restrictions are met.
- **Transfer of development rights:** Establishes special zones whereby development rights (through donation or purchase) are transferred away from sensitive areas to other areas in the community that are better able to accommodate growth.

PLANNING & ZONING SOURCE PROTECTION TOOLS

Tools communities can use to protect drinking water sources include:

Zoning ordinances – The primary means by which municipalities control the type of development allowed in a particular area. The assignment of land use "zones" allows a community to, among other things, control incompatible uses, promote public health and welfare, regulate the size of open space and population density, and protect existing and potential drinking water supplies.

Subdivision and site-plan review regulations – Local guidelines for the control of development. This authority sets forth design and engineering standards and construction practices that must be met to gain subdivision or site-plan review approval. These regulations are powerful tools for controlling stormwater runoff, erosion, and sedimentation.

Cluster zoning and conservation development – Options that can significantly reduce the amount of additional impervious surfaces in a source protection area. Developers can "cluster" housing units together in less sensitive areas and leave more vulnerable areas (e.g., riparian zones, wetlands, buffers, areas with highly erodible soils) as permanent open spaces.

Vegetated buffer zones – Highly effective means for protecting critical areas around surface water supplies by requiring vegetated (e.g., shrubs, tall grasses, trees) areas between development and sensitive water bodies. These zones can be created through such mechanisms as zoning ordinances, subdivision regulations, conservation easements, and landowner agreements.

Overlay protection zones – Watershed or recharge areas that are classified as environmentally sensitive and where development and high-risk land uses would threaten source water quality. These zones are designated (e.g., wellhead protection zone) by a community and can be used as a basis for prohibiting land uses.

Low impact development (LID) techniques – Use various site design practices simultaneously to conserve and protect natural resource systems and reduce infrastructure costs. This is a highly effective and creative approach to controlling nonpoint source pollution and preserving groundwater recharge. (For more details on LID, see Chapter 8 - Stormwater.)

Additional tools are listed in subsequent chapters.

CASE STUDY: CONNECTICUT'S AQUIFER PROTECTION AREA PROGRAM MUNICIPAL MANUAL

Connecticut's Aquifer Protection Area Program protects major public water supply wells in sand and gravel aquifers to ensure a plentiful supply of public drinking water for present and future generations. Aquifer Protection Areas (sometimes referred to as "wellhead protection areas") are designated around the state's 127 active well fields in in sand and gravel aquifers that serve more than 1,000 people. Land use regulations are established in these areas to minimize the potential for contamination of the well field. The regulations restrict development of certain new land use activities that use, store, handle, or dispose of hazardous materials and require existing regulated land uses to register and follow best management practices.

The success of Connecticut's Aquifer Protection Area Program is attributed the implementation at the local level by the Municipal Aquifer Protection Agencies and the support and tools developed by the CT Department of Energy and Environmental Protection (DEEP) that include:

- A technical guidebook - *Connecticut's Aquifer Protection Area Program Municipal Manual*: https://portal.ct.gov/DEEP/Aquifer-Protection-and-Groundwater/Aquifer-Protection/Municipal-Manual
- A free online course - CT DEEP Aquifer Protection Area Program Technical Training: https://portal.ct.gov/DEEP/Aquifer-Protection-and-Groundwater/Aquifer-Protection/Aquifer-Protection-Program
- An interactive GIS mapping tool – Aquifer Protection Area Interactive Map: https://portal.ct.gov/DEEP/Aquifer-Protection-and-Groundwater/Aquifer-Protection/Aquifer-Protection-Area-Maps
- A list of municipal contacts – Connecticut Aquifer Protection Agency Directory: https://portal.ct.gov/-/media/DEEP/aquifer_protection/apagencydirectorypdf.pdf
- An educational video – *What is an Aquifer?:* https://portal.ct.gov/-/media/DEEP/aquifer_protection/apagencydirectorypdf.pdf

Czapla, Kim. (2022)

TOOLS OF THE TRADE: GROUNDWATER RESOURCES

Protection of groundwater resources through land use planning at the local level is essential for preventing drinking water contamination. Visit these sites for more information on drafting groundwater protection ordinances and communicating the importance of groundwater protection to your community.

- EPA site for groundwater.
- NH State Groundwater Reclassification Guide: WD-11-24 A Guide to Groundwater Reclassification (nh.gov) and Model NH Groundwater Protection Ordinance.
- MA Groundwater Protection Model Regulations and Model Groundwater Protection District Bylaw/Ordinance.

See the Resources chapter (9) for links to your state's groundwater resources.

Involve and educate individuals, local agencies, organizations, and neighboring communities

The responsibility of land conservation does not stop with water suppliers. More and more communities are working with their water suppliers, nonprofit organizations, and neighboring communities to develop regional open space and recreation plans that target specific parcels of land for conservation. Individual community members and property owners can also make a positive impact for better land conservation based on informed choices for lawn maintenance and household chemical usage.

Involving individuals alongside organizations can help achieve more efficient land conservation by targeting two major challenges to land conservation for source water protection. These challenges include better management of critical land areas which may cross jurisdictional boundaries but are important drainage areas for water resources. Another challenge is educating small property owners or large property managers about better chemical usage options to minimize contaminants from entering source water drainage areas in the first place.

TOOLS OF THE TRADE:

EPA GUIDE FOR LAND TRUSTS AND WATERSHED PROTECTION

The EPA Advancing Watershed Protection Through Land Conservation guide provides an overview of how land trusts can facilitate water quality protection through land conservation and stewardship. The guide gives background on the Clean Water Act, EPA programs, and the watershed approach to inform how trusts can develop watershed management plans and engage communities.

SOURCE WATER COLLABORATIVE GUIDE FOR LAND USE PLANNERS

The guide includes resources for mapping land use planning and reviews options for incorporating source water protection into the planning process.
https://www.sourcewatercollaborative.org/guide-for-land-use-planners/

CASE STUDY

TOWN TAKES THE LEAD

Plaistow, New Hampshire is a community with limited groundwater resources and historical land use activities resulting in groundwater contamination; therefore, Plaistow's water resources are of the utmost importance to the town's municipal officials. In 2015, with funds from the New Hampshire Department of Environmental Services, Plaistow updated their 2001 SWP plan and instituted a town-wide best management inspection program after significant contamination events. Plaistow's Source Water Protection Committee, Planning Department, Building and Code Enforcement staff, and Conservation Commission and Planning Board worked together to implement a new SWP management plan. Parts of this plan included conducting an education and outreach campaign, posting drinking water source protection area signs, and implementing a best management practice inspection program to ensure harmful substances at commercial properties were properly managed in accordance with state regulations.

Plaistow's Source Water Assessments identified many of the risks to Plaistow's groundwater sources, many of which involved petroleum products and regulated substances. A Best Management Practice (BMP) Inspection Program was developed for commercial activities that use regulated substances to make sure they are stored, transferred, and used in a manner that minimizes releases to ground or surface waters. BMP inspection programs are important because they ensure proper management of harmful substances, protect public health, and promote awareness of the need to protect groundwater. BMP programs can provide economic benefits as clean groundwater is an important factor to economic development and property values. Businesses can attain social capital by participating in environmentally conscious actions such as taking proactive measures to assess hazardous chemicals. Overall, the town and its municipal officials play an active role in protecting the town's groundwater quality and future availability.

The Town of Plaistow's 2015 Source Water Protection Committee. (August 2015). "Source Water Protection Plan for Public Drinking Water Sources in Plaistow, New Hampshire."

https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/plan-plaistow.pdf

Review land-use ordinances and bylaws to see if the areas identified in local SWA reports are protected from incompatible land uses now and in the future.

One of the most difficult challenges communities face is determining how much risk they are willing to accept. If a potential contamination source cannot be kept out of the source protection area — the most risk-free solution — it may be possible to limit the size or scale of the potential source or ensure that BMPs are being used.

Measures to minimize risk include passing zoning ordinances in high-risk areas, and conducting build-out, or future growth, analyses to determine future risk to critical areas. In instances where future risks are notably higher than current conditions, ensure that permitted uses are consistent with SWP goals. Another option is to re-zone threatened areas to lower-density land uses or create standards for site design and BMPs to minimize risk.

Subdivision and site-plan review regulations can help minimize impacts to source protection areas by setting forth design and engineering standards and construction practices. For example, these regulations can include provisions and standards for effective stormwater drainage and runoff controls, sewage disposal, erosion and sedimentation controls, vegetative cover and buffer zones, and storage of hazardous materials.

PFAS Contamination and Land Use

PFAS (poly- and perfluoroalkyl substances) are a group of organic compounds that have been manufactured since the 1940s in items like adhesives, fire-fighting foams, cosmetics, paper products, and stain and water repellents. PFAS are extremely resistant to environmental degradation and as a result, remain in the environment and contaminate drinking water sources. In high exposure, PFAS are associated with harmful human health effects. Understanding how PFAS chemicals threaten SWP areas is crucial for protecting environmental and community health. Even before widespread PFAS testing is implemented, communities can identify potential sources based on land use.

The correlation of land use categories and PFAS concentrations:

1) **Airports and firefighting training facilities** which use aqueous film forming foam (AFFF) to suppress fires.
2) **Industrial or commercial facilities** that manufacture or use PFAS (ex: chrome plating, electronics, and certain textile and paper manufacturers).
3) **Landfills** that contain PFAS products or food waste and produce leachate.
4) Wastewater treatment facilities have:
   a) Effluent containing PFAS due to use of contaminated food, packaging, or household products.
   b) Food production/agricultural areas that can have high PFAS concentrations from contaminated biosolids used as fertilizer. This occurs when municipal wastewater facilities treat PFAS contaminated water and produce sludge for biosolids.
5) **Decentralized septic systems** can have high concentrations of PFAS due to contaminated food or homeowner use of PFAS products.

PFAS contamination tends to be localized around the source. As a result, new land use zoning ordinances can prevent PFAS producing facilities from being placed near drinking water areas. Furthermore, zoning ordinances already in place can help identify areas of concern for potential spills. With this information, officials can set additional requirements to monitor water quality.

It is crucial to limit PFAS before it enters the environment rather than relying on treatment remedies later in the process. Understanding how to identify threats to source water from PFAS provides insight for municipalities on how to respond to future emerging contaminants.

For more information see the EPA's PFAS Analytic Tools, recommendations for monitoring unregulated contaminants in drinking water, and the AWWA Source Water Evaluation Guide for PFAS.

Additional Sources:
Addressing Challenges of PFAS: Protecting Groundwater and Treating Contaminated Sources. EPA. (2021, September 20).
Per- and Polyfluoroalkyl Substances (PFAS). EPA. (2022, January 11).

Consider hiring a local or regional environmental enforcement officer.

In many cases local plans and regulations are comprehensive, but there is no identified staff member to monitor and enforce current activities. Municipalities and water suppliers can identify ways to ensure compliance with local regulations, including hiring a local or regional environmental enforcement officer or designating existing town staff (e.g., health director, building inspector, planner, conservation commission officer) to conduct field inspections, educate landowners, homeowners, businesses, and developers, and pursue enforcement actions. In some cases, a local building or conservation agent works part-time for more than one community, providing a comprehensive background that benefits all the communities.

Maintain forested buffers to wetlands and surface waters.

Establish setbacks from wetland and surface waters in drinking water protection areas to create buffers, which improve water quality by trapping pollutants and sediments.

CASE STUDY

SOLAR PANEL DEVELOPMENT AND SOURCE WATER PROTECTION

As towns consider projects and spaces for siting solar photovoltaics (PV), it is important to consider the impact of solar panels on groundwater sources, especially for projects located in or near a source water protection area.

To avoid impact on environmentally sensitive areas, placing solar panels in industrial and commercial districts or on vacant, disturbed areas repurposes the land for additional benefits. In Shrewsbury, Massachusetts, a solar array was constructed during the redevelopment of the Home Farm Water Treatment Plant. In 2018, the town utilized the Massachusetts's State Revolving Fund Program to partially finance an update to the water treatment facility's ability to treat high manganese levels. The town demolished the old facility and constructed a new facility on the adjacent land.

With funding from a Massachusetts Department of Environmental Protection Gap II Grant, the Town of Shrewsbury utilized the flood slab left in place from the old facility as the location of a 59.2 kW ground mounted solar array. The project, completed in 2020, offsets the plant's electricity costs and carbon emissions. Furthermore, the location of the solar panels on the concrete slabs also reduces the risk of groundwater contamination from materials in the panels.

Repurposing vacant land within industrial zones for solar panels can help communities avoid siting facilities within SWP areas. Furthermore, this case study exemplifies how municipalities can utilize state funding resources for projects that benefit climate mitigation and SWP goals.

Read more about the Shrewsbury solar project:
https://shrewsburyma.gov/DocumentCenter/View/7742/Shrewsbuty-WTP-Gap-II-GrantProjectSummary_Outreach-1

TOOLS OF THE TRADE: SMART SITING OF GROUND-MOUNTED SOLAR ARRAYS

The Rhode Island Department of Environmental Management created a guide for Freshwater Wetlands Program and Stormwater Construction permitting applications for siting ground mounted solar arrays. The guide outlines tips for situating solar panel systems to conserve natural resources, protect freshwater wetlands, and consider stormwater regulations.

For more information on permitting application guidance and tips: https://dem.ri.gov/media/29786/download

Establish service boundaries for water and sewer facility plans.

Water and sewer districts may set limits for future sewer and water extensions into source water areas. Review and update the process for how applications to change established utility districts are handled in relevant states.

TOOLS OF THE TRADE: SAMPLE WATER SUPPLY PROTECTION CHECKLIST

The MassDEP Sample Water Supply Protection Checklist for local project review promotes coordination among local officials for SWP. With the checklist, officials identify potential threats to water supply areas, as well as the entities and officials that need to be informed. Coordination among municipal entities helps incorporate SWP for projects prior to receiving permits. This checklist can be replicated by municipalities to fit community needs.

Download the checklist sample here: https://www.mass.gov/doc/sample-water-supply-planning-checklist-0/download

Use best practices with equipment and properties.

MassDEP suggests the following checklist, which can be downloaded at https://www.mass.gov/files/documents/2016/08/uf/spdpw.doc?_ga=2.104927306.871641836.1573831159-36509054.1573831159

- Contain and cover road salts and road-construction materials at municipal garages.
- Ensure runoff is treated according to state environmental standards and directed away from drinking water sources.
- If vehicles are washed at municipal garages and fire stations, all wash water should drain to a municipal sanitary sewer or tight tank.
- Handle hazardous materials and waste according to state environmental regulations.
- Develop and implement a stormwater management plan.
- Use street sweeping and structural solutions such as swales and catch basins to best manage stormwater from streets and parking lots.
- Route stormwater drains away from drinking water sources.
- Inspect and clean out stormwater catch basins on a regular basis. Catch-basin cleanings are classified as solid waste and must be handled and disposed of in accordance with all state environmental regulations, policies, and guidance.
- If local municipalities do not already have household hazardous waste collection, help to set up collection, or work with neighboring communities to set up regional collections.
- Develop and follow a turf management program for athletic playing fields and municipal recreation areas that minimize fertilizer and pesticides, especially near water supplies.
- Have copies of the local emergency response plans on hand and be aware of the location of water supply protection areas in case the fire department and other municipal officials need help in emergency response.
- Implement standard operating procedures regarding proper storage, use, and disposal of hazardous materials at public buildings.

Provide SWP education to residents.

Many contaminants can be present in source water originating from residential land use runoff including bacteria from pet waste, excess nutrients from fertilizers, chemicals from de-icing salts, hydrocarbons from oil leaks, and metals from vehicle tire wear.

Land use and management choices include quick and lower-cost options like avoiding lawn management products that contain nutrients or chemicals which are carried into waterways through storm runoff. Constructing or installing vegetated BMPs to protect source water areas can be opportunities for community engagement and education through volunteering and signage around BMPs. Vegetated BMPs can range in size and cost and require maintenance — consider this when choosing from these on-site property management options with stakeholders.

Heating fuel and automobile fluid spills are a potential risk to polluting source water with volatile organic chemicals and metals. Make sure home heating systems are installed according to code and inspected periodically for leaks. Regular tune-ups and inspections can help keep automotive waste and by-products from contaminating runoff. If oil drips or fluid does spill, it should be cleaned up quickly. Dirty car parts and other vehicle waste should be kept out of reach from storm drains. Residents should dispose of used motor oil and antifreeze by bringing it to recycling centers, and never dispose of it down a drain. Lastly, washing cars on the lawn, rather than the pavement, will allow the greasy water to be filtered by the soil. Also encourage bringing cars to a commercial carwash where dirty water is treated properly.

Pet waste should be disposed of properly, as it can pollute local waterways if not taken care of. Pet waste should be flushed down the toilet or wrapped in the trash. Agricultural waste and

livestock manure should also be prevented from entering water sources. Bacteria, viruses, and any organisms it may carry can pollute drinking water.

Household chemicals like detergents and cleaning products may contain harmful contaminants such as 1,4-dioxane, which is a likely human carcinogen and has been found in groundwater sites throughout the United States. Encourage homeowners to use non-toxic chemicals or water-based substitutes whenever possible, such as phosphate free detergents. Buy these chemicals only in the amount needed and use them as directed. Unwanted chemicals should be brought to hazardous waste collection centers, and never poured down the drain.

The last key issue to address regarding residential land runoff is **lawn care**. Fertilizers are a source of excess nutrients such as nitrogen and phosphorus. If this enters your town's source water, it can increase nitrates in drinking water and encourage algae growth, making the water unsafe for swimming and drinking. Pesticides, herbicides, insecticides, and de-icing salts can also contaminate the water with chemicals. Water-friendly lawn care tips include:

- Minimize or eliminate the use of pesticides.
- Spot spray pesticides/chemicals instead of spraying the whole lawn.
- Use slow release, organic, or low-toxicity fertilizers.
- Apply an integrated approach for controlling unwanted insects, weeds, and animals such as pulling weeds, spraying pests off plants with water, using naturally occurring parasites and predators, or barrier fences.
- Pesticides, fertilizers, and outdoors chemicals should be applied when no or only light rain is forecasted within the next 24 hours and only on unsaturated soils or areas with little slopes.
- Keep excess fertilizer and debris off of driveways/sidewalks and out of storm drains.
- Grass clippings, leaves, and other yard waste should be swept off paved surfaces and onto lawns away from flow routes.
- Mow your lawn no shorter than 2 inches to promote its vigor and discourage weeds.
- Compost leaves and other yard waste.
- Store chemicals in waterproof containers in a garage, shed, or basement that is protected from stormwater.
- Minimize de-icing salt use, do not use it at all, or use an alternative.
- Direct gutters away from pavement and onto the grass (or a vegetated area).

NEIWPCC. "Regional Clean Water Guidelines for Fertilization of Urban Turf"
http://www.neiwpcc.org/turffertilizer/turf-docs/finalreport.pdf

Wall Township Clean Water and Lawn Conservation Program.
http://www.wallnj.com/DocumentCenter/Home/View/1223

CASE STUDY

RECREATION IS A PRIVILEGE, NOT A RIGHT

Public Water Works' main land management goal is to protect and preserve their water supply and its quality. A simple and safe way to do this is to prohibit public access to and recreational use of water supply lands. This minimizes the chance of the introduction of contaminants including disease causing agents to the water supply.

Not all states prohibit recreational uses by the public in and near water supplies. To manage this complex issue, municipal officials should be aware of what types of recreational activities occur on or near the source intake or well. Once the recreational uses are understood, rules can be established with proper enforcement to protect source water. Signs should be posted prohibiting people from entering sensitive areas and reminding the public to pick up their trash and dog waste. There should be sufficient patrol staff based on the average number of users in order to adequately enforce the rules.

CHAPTER 5 – FUEL STORAGE

LEAKING FUEL STORAGE TANKS

Leaking fuel storage tanks are a significant and widespread threat to water quality in the United States. Petroleum storage tanks can be found in virtually every community in the Northeast, and each has the potential to leak. Leaking underground storage tanks (LUSTs) can impact groundwater resources from within the soil and through subsurface movement to surface waters. Aboveground storage tanks (ASTs) can impact surface waters, soils, and subsurface waters and groundwater. Northeast states have made great progress in developing programs to prevent releases of gasoline and other petroleum products into the soil and groundwater environment. For the most part, municipalities have relied on their state underground storage tank (UST) programs to regulate these pollution sources. ASTs are typically regulated under the EPA's Water Programs for oil pollution prevention (Title 40 CFR 112).

It is more cost effective and less risk-prone to address poorly maintained, leaking, or abandoned fuel storage tanks before they impact water quality. Remediation costs and the risk to community health and safety increase over time. Communicate effectively with community members and homeowners to address this challenge.

ADDRESSING LEAKING USTS

In 1983, the CBS program 60 Minutes aired a story that brought national attention to families suffering from the effects of leaking USTs on their groundwater supplies. Less than a year later, Congress enacted the Subtitle I RCRA Amendments, calling for the U.S. EPA to develop UST regulations to protect human health and the environment. The resulting rules spelled out a number of technical and financial responsibility requirements and timetables.

But the federal rule did not cover all storage tanks. While Northeast states adopted UST regulations that were more stringent than the federal program, there are still gaps and unsolved problems. For example:

- Many abandoned USTs are still in the ground and may still contain petroleum products.
- Some owners are not properly operating and maintaining their UST systems.
- No tank system is "leak proof." Even if a system has state-of-the-art secondary containment and leak detection, leaks can still go undetected.
- Careless fuel-delivery and vehicle-fueling practices can compromise a tank owner's best efforts.
- Equipment compatibility with emerging fuels has also created countless new challenges.

Unfortunately, states often do not have sufficient resources to conduct on-site compliance inspections as often as necessary. Backlogs have been expanding rapidly in recent years. Northeast states' programs vary in terms of when and who conducts inspections.

In 2015, EPA updated regulations to stress the importance of proper operations of tanks in the protection of groundwater. These are the first revisions since the original 1988 legislation and include stipulations to increase operator training, updated maintenance requirements, and incorporated language to account for new fuel blends.

TANKS COVERED BY FEDERAL SPCC REGULATIONS

Very large storage tank facilities are subject to the requirements of federal Spill Prevention, Control and Countermeasure (SPCC) regulations, under the authority of the Clean Water Act. It is best if any such facility is not located in a SWP area.

A facility subject to SPCC rules must meet three criteria:

1. It must be non-transportation related.
2. It must have an aggregate aboveground storage capacity greater than 1,320 gallons or a completely buried storage capacity greater than 42,000 gallons.
3. There must be a reasonable expectation of a discharge into or upon navigable waters of the United States or adjoining shorelines.

A prospective installation plan must show how facility owners will prevent any discharge of product into navigable waters. Preparation of the SPCC plan is the responsibility of the facility owner and must be certified by a licensed professional engineer.

EPA has developed a series of questions to help facilities determine if they are subject to federal SPCC regulations, which can be found here: https://www.epa.gov/oil-spills-prevention-and-preparedness-regulations/does-spill-prevention-control-and-countermeasure

Regardless of whether or not a facility is federally regulated, each facility must also adhere to regulation at the state level. These requirements vary widely by state; check each state's website for details:

- **Connecticut:** http://www.ct.gov/deep/ust
- **Maine:** http://www.maine.gov/dep/waste/ust
- **Massachusetts:** http://www.mass.gov/eea/agencies/massdep/toxics/ust
- **New Hampshire:** https://www.des.nh.gov/business-and-community/fuel-storage-tanks
- **New York:** http://www.dec.ny.gov/chemical/287.html
- **Rhode Island:** http://www.dem.ri.gov/programs/wastemanagement/ust
- **Vermont:** http://dec.vermont.gov/waste-management/storage-tanks

The work of keeping petroleum products out of the environment is ongoing. Tank systems in source protection areas should be in compliance with all applicable regulations and properly operated and maintained on an ongoing basis.

It is important to know how to identify and what to do about abandoned, or "orphaned," tanks that have not been properly closed and removed. Tank systems in source protection areas should be designed and installed such that the risk of a release is minimized to the greatest extent possible.
Below are some Strategies for Action municipalities can take to minimize threats to their water supply sources from underground and aboveground storage tanks. As a general rule, always check your state requirements and statutes.

Strategies for Action

Preventing tank-related contamination of drinking water

If a community's SWA report has identified land uses that are likely to have USTs (e.g., gas stations, automobile dealerships, trucking and busing companies, public works facilities, homes with heating oil tanks), these are areas to focus on for potential source water threats. Calculate the number of storage tank systems identified in the SWA and determine if any regulated or non-regulated tanks are missing from the report. This will help ensure that all municipally owned tank systems are in compliance with state regulations.

Ultimately, the community and water supplier determine how much risk they are willing to accept in the watershed or groundwater protection area. Communities can adopt more stringent regulations (than federal or state regulations) for all tanks, including those not regulated by the state. Many local governments address residential USTs through board of health regulations, zoning bylaws, or general bylaws or ordinances. Begin by reviewing your state UST regulations to see what is covered and what might be lacking.

The initial effort of establishing a municipal tank program can be time-consuming, depending on the tank population, and it requires a long-term commitment. It is important to identify a local entity that has authority over tanks, such as the board of health, planning department, or fire department.

Climate Connection: Extreme Weather Emergencies & USTs

With climate change increasing storm intensity and frequency, UST owner/operators should be prepared for emergencies. In an extreme weather event, tank systems, owner/operators, and water resources all stand to lose. Emergency responders, UST programs, and municipal officials should be able to advise a tank owner/operator on proactive steps to take in the face of disaster-related environmental threats and possibly in an order of magnitude above what has been seen before. Department tank inspectors should also know what to do after a storm, such as key threats/vulnerabilities and the reopening procedure.

When Hurricane Irene hit Vermont in 2011, floods overwhelmed storage tanks. Gas stations, mini marts, and other facilities with USTs were hit hard, in addition to a hundred home heating oil tanks which spilled their contents. Several UST systems were damaged, and in two cases, the tank systems were destroyed. Even USTs that had been properly closed were severely compromised, with the rough waters lifting the concrete slabs and tanks out of the ground. The gasoline was washed out of the tanks and the tanks were filled mostly with water. Those UST systems were completely destroyed.

Source: Frye, Ellen. (December 2011). L.U.S.T. LINE: A Report on Federal and State Programs to Control Leaking Underground Storage Tanks. "Extremes: Can Tank Systems and Tank Owners Weather High-Octane Disasters?" Bulletin 69: Pages 4-6. Retrieved from: https://neiwpcc.org/wp-content/uploads/2020/07/lustline_69.pdf

CASE STUDY

FLOOD RISK AND RESILIENCY: VERMONT MOBILE HOME PARK ASTS

In 2011, Hurricane Irene's impacts in Vermont highlighted the vulnerability of mobile home parks (MHPs) to flooding and the damages to unsecured aboveground fuel storage tanks (ASTs).

To address this vulnerability, the MHP project in Vermont was created as an interagency collaboration between Vermont Department of Health, the Agency of Commerce and Community Development (ACCD), the Department of Environmental Conservation (DEC) Drinking Water and Groundwater Protection Division (DWGPD), and the DEC Waste Management and Protection Division.

The project began with a pilot study in a MHP in Berlin, Vermont. Project staff assessed 21 tanks identified by the park as needing flood prevention updates and surveyed owners for their approval and participation. The pilot project successfully identified and replaced tanks and pads for enhanced flood protection in Berlin, and further expanded the work in two additional MHPs in Vermont. A total of 33 mobile homeowners received AST assistance under the MHP project.

The project expansion was made possible with additional funding from the Vermont DWGPD through the use of DWSRF set aside funds, purposed for source water protection implementation. Priority was determined with three criteria: flood risk, ACCD Park Information (including park conditions and owner interest) and a Source Protection Area (SPA) assessment. The use of a source protection assessment is critical for establishing boundaries of areas where leaks from flooded fuel tanks are likely to impact the quality of a drinking water source.

The project identified 21 parks at risk of flooding, 10 of which were eligible for funding assistance. It was determined, based on need and funding, to contract work for two of these parks.

The prioritization criteria created a useful tool for evaluating risk and identifying parks vulnerable to similar flooding damage and source water contamination. Through interagency collaboration, the MHP project was successful in utilizing resources for technical evaluations, outreach, and implementation to achieve SWP. In addition, the work conducted under the MHP project has resulted in the identification of other priority vulnerable MHPs. This groundwork can be used to further develop interagency programs and funding opportunities that support the protection of drinking water supplies and source protection areas from the risk of contamination from AST.

DeBell, Tom and Laura Ranker (2022). Vermont Department of Health

Take advantage of readily available GIS map resources to inventory all storage tanks in your source protection area.

When a petroleum release occurs, state and local regulators can use GIS mapping information to identify proximity to source protection areas. GIS maps can be updated as new information is available.

To conduct a UST inventory, first verify the SWA or other documentation by conducting drive-by surveys, consulting sources such as local fire department records, and questioning residents, businesses, public works officials, and fuel distributors. For each tank facility, identify the owner or operator, number of tanks, location of tanks (usually on a plot plan), age of tanks, type of construction and material, and location on a GIS map.

Make a special effort to locate and remove or properly close all abandoned tanks.

A surprising number of abandoned or orphaned USTs lie buried and forgotten throughout the Northeast. These tanks are of interest because they are old, made of bare steel, prone to corrosion, and likely to eventually spill their contents into the environment. They may be identified on existing maps, but you may also want to investigate further by checking with long-time residents and going back to historic municipal records, maps, and aerial photos. Many state or local authorities insist that these tanks be removed and allow abandonment in place only if a tank is in or near a building and removal would compromise the structure of the building. Check state guidelines to find out if there are programs to help pay for the removal of these tanks.

To aid in this effort, EPA developed a tool to enable municipalities to inventory their underground storage tanks, “UST Finder.” Resources for accessing and using the UST Finder and its data can be found here: https://www.epa.gov/ust/ust-finder.

Contact the state UST program to find out which UST facilities in a source protection area are in the state regulatory database, when those facilities were last inspected (facility compliance records), and what can be done to address facilities of concern.

Municipalities should not assume that state-regulated USTs are inspected regularly or that they are in compliance. It is suggested to cross-check the UST-facility database with the state’s database, coordinate with the state to target facilities of concern for more frequent inspections, and make sure enforcement action is taken where necessary.

EMERGENCY RESPONSE PLANNING

Sources of drinking water are especially vulnerable to risks such as:

- Spills and accidental releases from public and private discharges.
- Accidents related to vehicles, railroads, airports, boats.
- Utility easements.
- Fixed site releases at industrial and public facilities.
- Inappropriate use of pesticides and fertilizers.
- Improper disposal of household hazardous waste.
- Illegal dumping of a variety of substances.

These potential sources of contamination can cause immediate, expensive, and sometimes permanent harm to a public drinking water source.

The Emergency Planning and Community Right-to-Know Act (EPCRA) requires each community to develop comprehensive emergency response plans, including SWP emergency response measures. The plan should include standard operating procedures in the event of contamination, regulatory notification requirements, a list of local emergency responders' phone numbers, and maps of water sources, geographic features, and potential spill locations.

A geographic response plan (GRP) provides a site-oriented plan, often created by municipal officials with environmental groups and experienced pollution responders.

GRPs are intended to guide initial responders when a contamination occurs. They include a description of the location, tactic maps, a response strategy, implementation plans, and response resources. They should also mention the site's accessibility, what resources will be protected and special considerations. Lastly, the GRP should have site photos and local contacts making it easy to be used in the field.

The advantage to using GRPs is that unlike a comprehensive emergency response plan, the GRP has strategies tailored to a small geographic area. It provides a starting point for local responders and pre-identifies collection and staging areas. The GRP should be available to all municipal officials and responders within the site which will help prioritize response actions and assist with resource management.

Sources

Carew, J. US EPA Region 1 & Popovich, M. Nuka Research and Planning Group. (2016). New England Inland Rivers Geographic Response Plans (GRP) Project Update. [PowerPoint Slides]

MassDEP. (2023). Emergency Response Planning at Public Surface Water Sources. Retrieved from https://www.mass.gov/service-details/emergency-response-planning-at-public-surface-water-sources

Develop municipal ordinances, overlay zones, best management practices, or regulations to address potential threats from petroleum storage tanks in your source water protection area.

Local governments have various options for controlling potential water supply threats depending on your state, including:

- Prohibiting new USTs in sensitive areas.
- Establishing rules for storing residential heating oil tanks, including prohibiting underground storage.
- Registering tanks.
- Requiring the upgrade or removal of existing tanks.
- Restricting the location of new storage tanks.
- Establishing installation, construction, testing, and monitoring requirements.
- Ensuring that tanks are inspected to enforce the rules.
- Reviewing system designs with state UST program staff.
- Requiring certification of UST installers and removers (if the state does not have a program).
- Requiring installation of groundwater monitoring wells near tanks located in source water areas.
- Providing a cost-share arrangement for removing tanks.

If a community is not ready to adopt a comprehensive storage tank program to protect water supplies, they can consider adopting protective measures. These include requirements to register all tanks or just heating oil tanks, which mandates an assessment and alerts officials of the location of the tanks more accurately in the event of a leak, spill, and contamination situation.

Registration information can be linked with SWP areas and be used to establish an effective tank management and education program. It can form the basis for further regulation, such as testing and removal requirements.

CASE STUDY

UST STRIDES AT VERMONT MARINAS

Fuel locations directly on or near a source water pose obvious potential threats and risks to water quality. Although Vermont has no coastline, there is still boat traffic and supporting marina and fueling stations. Fueling and underground storage tanks located on these marinas are in sensitive environmental areas. These USTs can include systems such as uncontained dispensers and underwater pressurized gasoline lines. The Petroleum Equipment Institute published, "Recommended Practices for the Installation of Marina Fueling Systems" in 2009. By 2011, Vermont revised their UST rules so that all new Category 1 underground storage systems located at marinas had to be installed in accordance with the new PEI provisions. Systems already in-place had to be retrofitted to meet the same standards.

Unfortunately, even with the new regulations in place, there were still many non-compliant USTs in Vermont marinas, partially because many marina owners did not know how to comply with the new rules. Moreover, there were very few permit applications, which meant that few marina owners were upgrading their facilities. The Vermont Environmental Assistance Program stepped in to help with outreach to marina owners, but since each marina had a unique setting and dock design, standardized installations of fueling systems were not feasible. The revised designs took much more time for review and approval than a typical gas station.

In 2013, UST contractors and marina owners started working in earnest to upgrade their old fueling systems and huge improvements were made. Now Vermont marinas have transition boxes and solenoid valves, gate valves with dry breaks and improved under-dispenser containment. Some challenges remain because of a lack in resources, but overall Vermont marinas have made great strides to improve marina fueling systems to reduce the risks of accidental spills and protect water source quality.

Source: Unkles, Ted. USTs at Marinas in Vermont: The Good, the Bad and the (very) Ugly. (2015).

Ted Unkles, UST Program Coordinator, VT DEC
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Educate all tank owners about the need for enhanced vigilance in SWP areas.

Without proper education, tank owners may not know if their tanks are in a SWP area, or if the tanks are a threat or liability. Work with the state, local businesses, oil distributors, and homeowners to communicate that enhanced vigilance for preventing leaks avoids the high cost of future contamination and supports local efforts to reduce risk.

Educate homeowners around safer tank options, such as replacing USTs with aboveground tanks located either indoors or outdoors on a concrete slab in a protected area. Most homeowner's insurance policies do not cover LUSTs and self-contamination. (See Self-Inspection Checklist below.) Extra precautions for tanks that are in SWP areas include providing clear and simple guides for such topics as removing tanks and BMPs for residential heating oil, such as informational checklists, brochures, and websites.

See Chapter 9 Resources for state-specific fuel storage tank requirements and recommendations.

CASE STUDY

MAINE PROGRAM ADDRESSING ASTS WITH SUPPORT FOR LOW-INCOME FAMILIES

The Maine Department of Environmental Protection (DEP) works with Maine's Community Action Agencies to develop grants to support low-income, single-family, residential property owners to remove or replace on-site petroleum tanks. The DEP and Community Action Agencies work together to help homeowners work through the eligibility and application requirements.

The program also contains helpful, accessible, and community-friendly information on checking oil tanks and testing for links. For more information on this program and its resources, please see below.

Source:
Maine Department of Environmental Protection. (2019). Aboveground Home Heating Oil Storage Tank Replacement Program.
https://www.maine.gov/dep/waste/abovegroundtanks/replacement.html

For more information regarding Maine's home heating oil tanks programs, contact David McCaskill at 592-8054 or email david.mccaskill@maine.gov.

HEATING OIL TANKS: CHECKLIST FOR HOMEOWNERS

If you answer "YES" to any of the following questions, call your oil burner technician for a more detailed inspection and corrective measures.

Of course, the best thing to do is to remove your UST and switch to aboveground storage.

- ☐ **ARE YOU USING MORE FUEL THAN NORMAL?**
- ☐ **IS YOUR TANK TAKING ON WATER?**

  Is the rise in the water level of your tank greater than 0.5 inches per 8-12 hours?

  Your oil burner technician can check for water or provide you with water-finding paste so you can check yourself.
- ☐ **ARE THERE SIGNS OF OIL SHEENS IN NEARBY STREAMS, WETLANDS, OR DRAINAGE DITCHES?**
- ☐ **ARE THERE SIGNS OF DISTRESSED (WITHERED) VEGETATION OVER OR DOWN SLOPE OF THE TANK?**
- ☐ **ARE THERE SIGNS OF SPILLS AROUND THE FILL PIPE OR THE VENT PIPE?**
- ☐ **IS THE TANK VENT CLOGGED OR RESTRICTED BECAUSE OF ICE, SNOW, OR INSECT NESTS?**

  Screened vents can be used to prevent insect nest problems.
- ☐ **IS THE OVERFILL WHISTLE SILENT WHEN THE TANK IS BEING FILLED?**

  Ask your delivery person.

CHAPTER 6 – HAZARDOUS MATERIALS

Zoning based on updated information about hazardous waste source locations and changing climates can help ensure that new harmful chemicals and wastes are not located in source water protection areas. The focus should be on management activities in existing facilities. Large chemical and petroleum storage of both virgin and waste materials, if poorly sited and managed, present major risks to public health and capability of a public water system to continue to deliver potable water.

To address the huge volumes of municipal and industrial waste generated nationwide, Congress enacted the Resource Conservation and Recovery Act (RCRA). Since 1980, under Subtitle C of RCRA, U.S. EPA has developed a comprehensive program to ensure that materials defined as hazardous wastes (see more information on this below) are managed safely from the time they are generated to their ultimate disposal — from cradle to grave. Most Northeast states have authority to implement their own RCRA programs that are consistent with, if not more stringent than, the federal program.

EPA HAZARDOUS WASTE DEFINITION

To be considered a hazardous waste under RCRA, a material must first be classified as a solid waste. U.S. EPA defines solid waste as garbage, refuse, sludge, or other discarded material (including solids, semisolids, liquids, and contained gaseous materials).
Note: Each state has specific hazardous waste laws, so be sure to check with your state program.
If a waste is considered to be solid waste, businesses must then determine if it is a hazardous waste. These wastes are specifically named on one of four lists of hazardous wastes, or if they have certain characteristics:
Listed wastes – known to be harmful to human health and the environment when not managed properly, regardless of their concentrations.
Characteristic wastes – If a waste does not appear on a hazardous waste list, it still might be regulated as a hazardous waste if it exhibits one or more of the following characteristics:

- Ignitability
- Corrosivity
- Reactivity
- Toxicity

Information on defining hazardous wastes can be found on EPA's website at https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes

Hazardous waste generators must manage their waste according to regulations for three specific generator types, based on how much waste they generate in a calendar month.

Large Quantity Generators (LQGs) – generate 1,000 kg or more of hazardous waste per month, or greater than 1 kg of acutely hazardous waste per month.

Small Quantity Generators (SQGs) – generate more than 100 kg but less than 1,000 kg of hazardous waste per month.

Conditionally-Exempt Small Quantity Generators (CESQGs) – generate 100 kg or less of hazardous waste per month, and 1 kg or less of acutely hazardous waste per month. (Some states do not recognize this class.)

Generators must comply with whichever standard is applicable for a given month. In many cases, small businesses that fall into different categories at different times choose to always satisfy the more stringent requirements. Certain wastes, such as those that are reclaimed or recycled continuously on site, are not counted under the federal regulations.

TYPES OF BUSINESSES LIKELY TO PRODUCE HAZARDOUS WASTES

- Automobile maintenance and body shops
- Electroplaters and metal fabricators or finishers
- Printers
- Photographic and x-ray processors
- Dry cleaners
- Chemical laboratories (including schools and universities)
- Furniture manufacturers and strippers
- Construction
- Pest control
- Chemical manufacturing
- Textile manufacturing
- Funeral services
- Arts and craft studios

EPA maintains a list of industrial processes that are likely to produce hazardous waste, and what types of waste they often produce, located here: https://www.epa.gov/hwgenerators/typical-wastes-generated-industry-sectors

Congress also passed the Emergency Planning and Community Right-to-Know Act (EPCRA) in 1986 with the intent to help communities be prepared for chemical emergencies. The EPCRA requires the reporting of full inventories of hazardous substances, their uses, and any incidents resulting in the release of these substances by industry to federal, state, and local governments and tribes. Governments are in turn required to prepare emergency response plans for reported and potential risks to protect their communities.

This cradle-to-grave management program for hazardous waste is one of the most comprehensive requirements that EPA has ever developed. It addresses issues such as the following:

- Hazardous waste identification.
- Large and small hazardous waste generators.
- Hazardous waste transportation.
- Recycling, treatment, storage, and disposal.
- Land disposal restrictions.
- Hazardous waste permitting.
- Cleanup of hazardous spills or releases.

U.S. EPA and the states continue to improve the RCRA program by promoting new initiatives, such as encouraging waste minimization, improving the federal/state partnership in the

hazardous waste program, and aiding state and local governments in reaping the environmental and economic benefits of source reduction and recycling.

RCRA programs regulate the generation and storage of hazardous waste, but they typically do not have jurisdiction over facilities that use hazardous non-waste materials or the location of facilities. Many hazardous materials (e.g., those used at homes, schools, public works facilities) are not subject to RCRA regulations — this is where community efforts are particularly important.

CASE STUDY

UPDATING TIER II INFORMATION

The New Hampshire section of the Merrimack River supplies drinking water to over 165,000 individuals. Although it has the capacity to meet the region's needs, it is also very susceptible to contamination from accidental release of hazardous substances as it is surrounded by many commercial and industrial activities. A lot of these facilities located along the Merrimack are subject to Tier II reporting requirements under the Emergency Planning and Community Right to Know Act (EPCRA) due to the quantities and types of hazardous materials stored on-site.

New Hampshire's Granite State Rural Water Association (GSRWA) evaluated the risks and improved the current inventory of EPCRA Tier II facilities within the Pennichuck Water Works hydrologic area of concern. First, a project advisory committee was formed which included state and federal officials, emergency responders, facility managers, regional planners and drinking water suppliers. A total of 109 known and potential Tier II facilities were identified and the GSRWA conducted over 60 voluntary site visits. Information was collected on the type and quantity of chemicals stored on-site, emergency contact information was updated and GPS data points at storage locations were taken. To follow-up the site visits, letters were sent to participating facilities providing them with emergency contact information for near-by water sources and a map showing their location relative to those sources.

Overall, facilities were found to be accurately reporting substances and quantities stored on site; however, accurately reporting what may be on-site on any given day is inherently difficult as inventories change frequently. Facility GPS points were often found to be inaccurate by up to 12 miles. At times, contact information for facilities was found to be outdated as well. The updated Tier II data supplied by this project was useful to local fire departments, as well as state and federal agencies tasked with responding to emergencies at these facilities.

This project was successful in identifying deficiencies in Tier II reporting, providing updated facility information to emergency responders, and reminding facility owners of their role in protecting water resources. However, this project's greatest success was in the creation of a committee to oversee future projects, and foster communication between environmental regulators, emergency responders, and industry representatives.

Source: Healy, K., Currier, M. et al. (April 2016). Improving Source Protection for Drinking Water Supplies in the Merrimack River Corridor through EPCRA Tier II Inventory Improvements and Emergency Response Coordination Final Report

For a municipality, any threat to drinking water is a concern, so consider following some basic common-sense tenets:

Be aware: Identify what types of materials are located in the source protection area and how to deal with any spills, accidents, and fires. Businesses and other facilities that produce, use, or store hazardous materials in significant quantities are considered potential contamination sources. Homeowners may be engaging in activities that threaten source water (e.g., lawncare, disposal or storage of hazardous materials), but they aren't regulated. Education to homeowners and businesses about such threats and what they can do to protect the water supply is essential.

Keep contamination out: The best way to protect a water supply is to keep potential contamination sources out of the source protection area. When this is not possible, try to limit the size or scale of the risk.

Enforce proper maintenance and practice: If a business or facility is using a potentially hazardous material, make sure proper best management practices (BMPs) are in place to protect the water supply. Use a multi-barrier approach, so that if there is an accident, there is a backup to protect the water supply. For example, water suppliers or municipal entities can work with local industries/commercial businesses by setting up a voluntary inspection program where the entity meets with the business periodically to review the types of chemicals stored on-site and how they are used, stored, and disposed of.

CLIMATE CONNECTION: GREATER CONTAMINATION RISKS AND THE NEED TO UPDATE MANAGEMENT AND REMEDIATION PRACTICES

Increased risk of flooding, alongside sea level rise facing coastal communities, is a threat to consider when planning or updating the management plans for sites storing or using hazardous wastes and materials.

When planning to redevelop a contaminated brownfield site, a property in which the reuse may be complicated by the presence of a hazardous substance, local organizations and the township in Barre, Vermont took enhanced climate resiliency for the site into account. The partnership financed an analysis of the site to include the most up-to-date regional climate models. The Analysis of Brownfields Cleanup Alternatives report and partnership helped guide the redevelopment and local-level planning to prevent contamination risks from flooding and increased storms which would overwhelm previous remediation measures, such as engineered caps and storage measures.

Sources and example tools used in this case:
"Barre City, Vermont Accounts for Climate Change within a Brownfield Redevelopment Plan." United States Environmental Protection Agency, *Climate Change Adaptation Resource Center*. Retrieved 26 July 2021. https://www.epa.gov/arc-x/barre-city-vermont-accounts-climate-change-within-brownfield-redevelopment-plan

"Climate Adaptation and Contamination Site Management." (2021). United States Environmental Protection Agency: *Climate Change Adaptation Resource Center*. Retrieved 27 July 2021. https://www.epa.gov/arc-x/climate-adaptation-and-contaminated-site-management

Know when there is a problem: Require facilities with hazardous materials located in the source protection area to promptly notify the town and water supplier when there are spills or accidents involving hazardous materials. Consider potential future uses.

CASE STUDY

THE IMPACTS OF SUPERSTORM SANDY

A year after hurricane Irene hit coastal Long Island, the New York State Department of Environmental Conservation (NYSDEC) was preparing for what was later aptly named Superstorm Sandy. Response vehicles were stocked with response equipment, oil absorbent supplies, and had full tanks of gas. The record storm surge caused water levels to rise seven to 14 feet, causing extensive tidal flooding. Floating and tipped heating oil tanks were reported to NYSDEC, and in just a few hours, dozens of teams of oil spill response contractors were dispatched to recover oil from tanks and accumulated floodwaters.

Inspection of the tanks revealed that floodwaters had entered aboveground storage tanks (ASTs) through fill necks or vents and displaced oil or left a mix of oil and water in the tanks. Around 4,000 spills were reported with the majority caused by residential heating oil tanks spills, followed by damaged transporters. The floodwaters tipped, disconnected, and then carried outdoor ASTs elsewhere. Large debris thrown around by water and wind also damaged tanks that stayed planted.

Some residents who had switched to natural gas, but never removed or emptied their out-of-use ASTs, experienced spills or water intrusion into their tanks. Other residents were unaware of gas connections and abandoned tanks in their homes and were similarly caught by surprise when they were impacted by tank flooding and spills in the aftermath of Superstorm Sandy.

For six weeks, working 12- to 16-hour days, NYSDEC spill responders assessed impacted areas, pumped out tanks, corralled oil, and used all available means to maximize product recovery so that residents could begin to restore their homes. Responders even lassoed floating tanks and hauled them onto docks so contractors could pump them out. In total, NYSDEC pumped more than 225,000 gallons of oil/saltwater from more than 1,300 locations with floating, tipped, or unstable tanks; tanks where an oil/saltwater mix prevented power or heat restoration; impacted basements or crawlspaces; yards with floating oil; storm drains; and canals. NYSDEC also provided absorbents to residents to pad up small amounts of oil indoors and outdoors and advised residents on how to clean residual oil on indoor structures to alleviate oil odors.

NYSDEC's experience highlights the importance of removing and properly abandoning unused tanks before they become environmental and safety hazards, such as following unpredictable or extreme weather events. In New York, bulk storage facilities with less than 1,100-gallon capacity are below the regulatory threshold. However, local jurisdictions are now considering stricter controls in flood prone areas. As storms continue to become more frequent and intense, all states should consider regulatory options to protecting ASTs against environmental factors. Measures should be taken to secure the fuel storage and delivery infrastructure to withstand another Sandy-like event.

Source: Gomez, Karen. (June 2013). L.U.S.T. LINE: A Report on Federal and State Programs to Control Leaking Underground Storage Tanks. Bulletin 73: Pages 1-3. Retrieved from: https://neiwpcc.org/wp-content/uploads/2020/07/lustline_73.pdf

Here are some of the Strategies for Action municipalities can employ to minimize threats to their water supply sources from hazardous wastes and materials. As a general rule, always check state requirements and statutes.

Strategies for Action

Consider establishing a comprehensive hazardous materials management program to prevent the contamination of present and future source water.

A hazardous materials management program can include information on who is responsible for inspecting hazardous materials facilities and educating owners, local household hazardous waste disposal programs, and local ordinances and BMPs that address hazardous materials users and hazardous waste generators. Use GIS maps to inventory land uses that might handle hazardous wastes/materials in a source protection area.

Municipalities should have up-to-date information on the location of hazardous waste generators in GIS. This information should be verified and updated within the SWA map or any other planning map for emergency response purposes.

Identify the relative risks of different storage facilities.

By identifying which facilities are potentially a larger threat to source water, municipalities can better utilize their limited resources to protect source water. Criteria that can be used to assess a facility's threat level includes the distance to a designated SWP area, residential property, irrigation or private well, or surface water body. The type and volume of material being stored at the facility should also be considered, as well as the permeability of the soil and type of storage container in use.

CASE STUDY

MUNICIPAL RESPONSE TO HAZARDOUS WASTE SPILLS

Without protective measures in place, hazardous waste spills can have significant impacts on nearby water sources. A study of PFAS concentrations in the Connecticut Farmington River examines the environmental impact following two releases. In June 2019, a fire suppression system malfunction at Bradley International Airport released 40,000 gallons of Aqueous Film Forming Foam (AFFF) water containing PFAS into the environment. Foam was carried through the sewer into the wastewater treatment plant, which then discharged PFAS containing effluent into the Farmington River. A B-17 plane crash at the airport released an additional 25,000 gallons of AFFF and water containing PFAS into the river later that year.

Testing was implemented following the releases to determine PFAS concentrations in surface water, fish tissue, and sediment over time. The consultants were able to tie elevated levels of PFAS to these spills because they established a baseline through collection of upstream samples. To understand the impact of hazardous material spills, municipalities can allocate resources for monitoring SWP areas in proximity to industrial land use areas.

Early action in response to hazardous material spills can mitigate the contaminant levels found in the environment. Interagency collaboration between municipal entities in response to spills is also essential for protecting community and environmental health. For instance, the Department of Public Works or Fire Department should notify the Board of Health when spills occur near SWP areas. Communication with community members is also key to building trust and engaging stakeholders in decision-making processes about potential risks.

For more information on risk communication for hazardous waste spills or contaminants of emerging concern see the ITRC's Risk Communication Toolkit for Environmental Issues and Concerns and the EPA's Risk Communication strategies for RCRA.

Municipalities can also prepare a hazardous waste emergency response plan like that of the Cambridge Water Department to lay out steps for mitigation, preparedness, response, and recovery. Similarly, emergency response plans recommended by MassDEP for public surface water sources include prevention measures that identify information for emergency responders, compile a communication list of contacts, and outreach materials. *Check your state requirements for further guidance reporting spills.*

McIntosh, Lisa. (2022, April 6). *Understanding the Distribution of & Changes to PFAS in a Riverine System: A Case Study* [Conference Presentation]. The Science of PFAS: Public Health & the Environment, Marlborough, MA, United States.

Review municipal regulatory/best management requirements to see if potential threats from hazardous materials and hazardous wastes are addressed adequately in your source protection area.

Take the following steps:

- Review and update zoning in source protection areas and consider prohibiting the siting of new facilities that use, store, or generate hazardous materials and wastes.
- Regulate storage of hazardous materials in the same way that hazardous waste is regulated.
- Identify areas where new lower-risk commercial/industrial facilities may be permitted by right or by special exception in less critical portions of the source water protection area.
- Establish a hazardous material and waste management ordinance that includes performance standards for design, siting, regular site inspection, recordkeeping, and monitoring for both proposed and existing uses.
- Encourage businesses and municipal operations to train employees so they understand the regulations and why they are important.

The following are examples of BMPs for chemical use that communities can use as guidance when putting together their own set of land use regulations:

- Recycle, reuse, and reduce hazardous materials, using non-hazardous chemicals whenever possible.
- Identify, store according to hazard, and properly dispose of waste materials that are abandoned on the property or awaiting pickup.
- Store drums of materials and wastes outside of the building on an impervious surface and have secondary containment (e.g., berms), if drums are stored outside. Roofed coverings are advisable. Empty and clean drums.
- Store road salt in a shed so that stormwater cannot wash it into a water body or contaminate groundwater.
- Label drums, tanks, and other containers with the name of the material they hold (e.g., waste oil), the type of hazard they present (e.g., flammable), and the date when contents were first added.
- Be sure lids are tight-fitting and sealed, and bungs are closed.
- Ensure that there are no leaks or spillage in chemical or waste storage areas, including around solvent sinks, pumps, pipes, hoses, and valves.
- Connect floor drains to the sewer (with approval from sewer authority) or connect them to an approved tight tank that is pumped regularly by a licensed hauler.
- Ensure that there are no cracks in the floor that would allow spills to penetrate.
- Ensure that a spill prevention (SPCC) plan has been prepared and is on file at facilities that are required to do so by federal law. (See Chapter 5 – Fuel Storage for more SPCC information.)
- Permit waste oil furnaces by appropriate state agency or local fire departments (as required).
- Be sure the facility has written contingency plans for fire prevention, emergencies, and spill control, posted near potential sources of spills.
- Be sure spill-control materials are available on-site.
- Be sure Materials Safety Data Sheets (MSDSs) are available for all chemicals.

- Store drained waste fluids such as waste oil, antifreeze, and solvents in separate drums or tanks.
- Ensure that waste oil is removed by a licensed transporter or burned on-site in an approved heater.
- Puncture oil filters and hot drain them over a waste oil drum for the required amount of time and recycle or dispose of them properly.
- Use a licensed transporter to pick up and recycle solvents or dispose of solvents as hazardous waste.
- Handle parts cleaner filters as hazardous waste.
- Store batteries in a single layer on pallets of shelving with a non-corrosive base, and properly recycle them.

PROMOTE SCHOOL CHEMICAL CLEANOUTS

Stocks of outdated, unidentified, excessive, or unnecessarily hazardous chemicals are present in many schools. These chemicals can pose safety and health risks to students and staff, and a number of widely reported incidents involving such chemicals have resulted in school closures and costly cleanups. In some cases, bomb squads have been called in to remove shock-sensitive chemicals from schools.

Identifying and removing these regulated wastes from schools is a key step in preventing accidents and protecting the environment. Once a school has removed its unnecessary chemical hazards and good purchasing and management practices are in place, periodic cleanouts can be a final touch in ensuring a chemically safe school environment. It is important that chemical inventories be conducted prior to cleaning out chemicals from schools. Chemical inventories and cleanouts should only be undertaken by those with the technical qualifications to identify potentially dangerous situations and properly handle the chemicals.

NEW HAMPSHIRE'S POLLUTION PREVENTION IN SCHOOLS PROJECT

The New Hampshire Pollution Prevention Program (NHPPP) is helping schools address their hazardous materials management responsibilities through outreach, site visits, and assistance with school cleanouts. NHPPP staff are available to provide on-site assistance in schools, focusing on the science, art, industrial arts, technology education, and custodial departments.

To learn more about DES environmental education programs and publications for teachers, visit https://www.des.nh.gov/business-and-community/greening-your-business/schools

Establish a program to reduce, eliminate, recycle, or reuse hazardous materials and wastes in all municipally owned facilities.

Identify town-owned facilities that use or store hazardous materials. Evaluate management practices at these locations as well as in routine operations, such as road maintenance and landscape care. Install model practices at town facilities. Coordinate these activities with Phase 2 stormwater planning. (See Chapter 8 – Stormwater).

Educate homeowners, businesses, and local officials about the importance of proper hazardous materials and waste management, and provide them with guidance on proper operation and maintenance.

Prepare and distribute audience-specific outreach materials on hazardous materials/waste management requirements and practices. Educate the regulated community through inspections and presentations to civic groups and business association meetings. The state may have outreach materials or other guidance to support such activities. Hold hazardous waste collection days for businesses and residents.

TOOLS OF THE TRADE: EPA HOUSEHOLD HAZARDOUS WASTE RESOURCES

Visit the EPA website for information on the safe management of household hazardous waste and ways to reduce hazardous waste within your community:

- Household Hazardous Waste Homepage: https://www.epa.gov/hw/household-hazardous-waste-hhw
- EPA Safer Choice program which provides products that are safer for health and the environment https://www.epa.gov/saferchoice.

Explore financing options for the various aspects of your hazardous materials management program.

For information on financing your community's hazardous waste materials program, see Chapter 9 - Financing.

CHAPTER 7 – SEPTIC SYSTEMS

Onsite wastewater treatment systems can be powerful tools for planning for community growth, health, and sanitation—however, they need to be managed properly by often untrained homeowners. Municipal water professionals need to know the location, efficiency, and vulnerability of these systems to change, and there are tools available to help make these assessments on septic systems.

More than one in five households in the U.S. utilizes a septic system. Many of these systems are outdated, and were installed when septic system rules were nonexistent, substandard, or poorly enforced. In the more rural states of Vermont, Maine, and New Hampshire, on-site systems serve close to 50% of all households. On-site systems at converted seasonal camps and auto repair/service businesses that use engine fluids, fuels, and cleaning solvents are of particular concern.

While many municipalities have made important strides in establishing effective on-site sewage disposal regulatory programs, most have not adopted comprehensive management approaches that oversee the full range of issues—planning, siting, design, installation, operation, monitoring, and maintenance. Most do not require homeowner accountability for system performance. Improving the management and performance of decentralized wastewater treatment systems should be an essential component of your community's SWP program if your SWA report or other source has identified threats of nitrate, nutrients, and microbial contamination.

On-site Wastewater Treatment System
A passive or active method for treating and disposing of wastewater into the soil.

PLAN FOR THE LONG HAUL

When on-site systems fail, they present a serious threat to public health, drinking water resources, and aquatic life. Septic systems are among many known contributors of pathogens and nutrients to surface and groundwater. They have contributed significantly to the eutrophication, an enrichment of nutrients that encourages biologic growth, of ponds, lakes, and coastal estuaries—not to mention the degradation of property values.

Properly managed septic systems are a viable long-term solution for wastewater disposal. Communities that depend on septic systems can take steps to adopt and implement creative, disciplined, and comprehensive management programs designed to achieve long-term sustainability.

While state and local health officials and state and federal water pollution control agencies recognize that on-site systems must be sited, constructed, and managed for the long haul, the regulation of these systems is often fragmented among state, county, and local jurisdictions. Most communities do not routinely oversee septic system operation and maintenance or detect and respond to changes in wastewater loads that can overwhelm a system. The decentralized nature of septic systems also makes it difficult to link on-site system planning and siting to larger groundwater and watershed protection efforts.

Decentralized Wastewater System Management
A comprehensive, life-cycle series of elements and activities that address public education and participation, planning, performance, site evaluation, design, construction, operation and maintenance, residuals management, training and certification/licensing, inspections/monitoring, corrective actions, recordkeeping/inventorying/reporting, and financial assistance and funding.

The Decentralized Approach to Wastewater Management

A conventional gravity-based on-site treatment system, which consists of a pipe from the home to a septic tank, a drainfield, and the soil, is essentially the responsibility of untrained and often uninformed system owners. As a result, system performance is monitored primarily by complaints or failures. Failures are typically caused by unpumped and sludge-filled septic tanks, which lead to clogged absorption fields and hydraulic overloading.

Decentralized wastewater management systems can perform effectively when managed properly. In fact, many community development strategies use decentralized management approaches rather than traditional centralized infrastructures that often give rise to sprawling development, traffic congestion, environmental degradation, and diminished quality of life. These systems can deliver communities significant up-front and long-term financial savings and provide benefits in the form of preserved and restored waterways and more open space.

The wastewater management paradigm involves a cooperative, coordinated, integrative approach to protecting public health and water resources. It includes the use of performance-based management approaches rather than traditional prescriptive code requirements for system siting, design, and operation.

Communities are experimenting with performance-based approaches, while retaining prescriptive requirements for technologies that have proven to be effective under a wide range of site conditions. Contemporary on-site treatment technologies are more complex than conventional systems and incorporate pumps, recirculation piping, aeration, and other features that require ongoing or periodic monitoring and maintenance.

Take a Closer Look

It is important for municipalities to review their septic system management programs and address the following challenges:

- How to be sure that septic systems are not impacting drinking water sources.
- How to make sure existing septic systems will not impact source water in the future.
- How to address future development so that decentralized wastewater treatment system siting, design, operation, and maintenance are optimized.
- How to take into account the cumulative impacts of on-site systems on the water supply region or watershed.
- How to change public and political attitudes toward the value of and need for an effective decentralized sewage management program.
- How to fund an effective decentralized wastewater management program.

STRATEGIES FOR ACTION

Consider establishing a comprehensive decentralized wastewater system management program to prevent the contamination of present and future drinking water from septic systems.

If your water system's SWA report or other source has highlighted a potential source water pollution threat from septic systems, this should be given top priority. A decentralized wastewater system management program could include information about:

- The status of existing septic systems and projections for future development.
- The frequency of septic system failures in the community.
- Details on the on-site system inspection program, if one exists.
- Septic tank pump-out requirements.
-

Responsibility for on-site wastewater treatment oversight rests with local boards of health, health directors, or sanitarians. Consider hiring a consultant to work with the community on developing a comprehensive on-site management program.

Use GIS map resources to inventory all septic systems.

SWA reports should accurately depict the septic system population in a source water area using up-to-date location information for septic systems on GIS. SWA maps can be verified by the town/city sanitarian or health director.

Cesspool
A buried, usually cylindrical, vault that acts as both a septic tank and leaching system. It is bottomless and/or has holes in the side to allow the wastewater to go into the ground. Cesspools do not provide proper primary treatment prior to discharge and are prohibited in Northeast states.

CASE STUDY

MASSACHUSETTS COMMUNITY SEPTIC MANAGEMENT PROGRAM

One of the challenges with decentralized septic systems is ensuring homeowners have adequate resources to maintain systems and prevent contamination. To protect drinking water sources across the state, Massachusetts established a program connecting communities and homeowners to state funding for septic system repair.

The Massachusetts Community Septic Management Program provides low-cost loans to communities for septic management plan development. The program was developed through an inter-agency collaboration between MassDEP, the Executive Office of Administration and Finance, the Office of State Treasurer, and the Department of Revenue. The Massachusetts Clean Water Trust provides the funding to communities through State Revolving Funds (SRFs). *For more information on using SRFs see the Finance Chapter (9).*

The program provides communities with pre-loan financial assistance to develop either a Community Inspection Plan or a Local Septic Management Plan. The development of a plan will identify environmentally sensitive areas that require protection from septic system contamination in each community.

After the inspection or management plan is developed and accepted by the DEP, communities receive the state loan amount. With the loan, the community provides financial assistance to homeowners through betterment agreements to repair or replace failing septic systems. With this process, communities develop priorities for funding projects based on their source water protection needs.

The Community Septic Management Program successfully connects communities and homeowners with state funding resources for drinking water quality protection. A key aspect of this success is the facilitation of communication between municipalities and homeowners on septic system management. With the use of state loans, municipalities establish plans for the management of decentralized septic systems in their community.

Mass.gov. (2022). *The Community Septic Management Program*. Massachusetts Department of Environmental Protection. Retrieved August 4, 2022, from https://www.mass.gov/guides/the-community-septic-management-program

Develop a municipal regulatory/best management program to address potential threats from on-site wastewater treatment systems and cesspools in your source water protection area.

A municipal regulatory/best management program should evaluate future growth to determine how treatment needs will be met, identify funding sources, and propose a long-term strategy for meeting treatment needs.

Such a program could include a public education strategy, a voluntary compliance program in low-risk areas, a mandatory septic system inspection and maintenance program for high-risk systems (e.g. advanced treatment systems, large-flow systems) and high-risk locations (e.g., drinking water supply watersheds, aquifer recharge areas, nitrogen-sensitive coastal waters), and installation specifications or guidelines.

Local governments have various options for controlling potential water supply threats. Here are a few examples:

- A **septic system maintenance ordinance** helps ensure that septic systems are inspected and pumped periodically to prevent malfunction. This type of ordinance could require that system owners:
    - Hire a certified inspector to inspect their system.
    - Send inspection results to the town.
    - Use trained, certified/licensed system installers.
    - Have systems inspected during installation.
    - Close out cesspools.
- A **septic system tracking program** is the computer software system a town uses to keep track of inspection reports and results, monitor compliance, and send reminders and other notices to system owners. Web-based programs help minimize the local staff effort needed to manage the program, enabling staff to concentrate on monitoring results. Town staff may conduct spot checks to ensure local inspectors are conducting inspections properly.
- A **municipal septic system maintenance program** has the municipality assume responsibility for the maintenance and repair of septic systems. Homeowners are charged an annual fee and the municipality ensures that a pumping and maintenance schedule is followed. Or, short of the municipality taking responsibility, offer a municipally sponsored pump-out program, where the town organizes a reduced-rate pump-out program, and participation is voluntary.
- **Standards for installing and siting new septic systems** ensure that siting and design is such that potential threats to source water are minimized. Some states have very strict standards. At a minimum, these standards should include siting systems away from unsuitable areas (e.g., close to surface waters, floodplains, shallow water tables, public supply wells, poorly or excessively drained soil, areas where effluent can't be sufficiently treated before it reaches a water body).

Explore new approaches for siting and managing decentralized wastewater systems.

On-site wastewater treatment authorities should routinely reevaluate and improve their standards to ensure that public health and environmental concerns are being addressed.

Development of on-site systems involves more creative approaches to systems siting and the use of alternative systems to support a more compact buildout on smaller lots to reduce site disturbance, minimize runoff, and preserve open space. Regulators must be attuned to current research technologies and practices, evaluate this information, and incorporate appropriate technologies into their program.

provide a risk-based conceptual approach to on-site wastewater management. The EPA outlines a series of five management tiers in the form of model programs. Areas of a community with few problems and relatively low risk to water resources may choose to opt for a simpler, less comprehensive approach, while those with higher system densities and greater threat to source water may adopt a more protective program. These guidelines can be used to help states and communities meet water quality and public health goals, and they provide a range of cost-effective options.

CLIMATE CONNECTION: THE IMPORTANCE OF PREPARING SITES WITH THE FUTURE IN MIND

Climate change impacts precipitation and local water tables, further impacting the most important part of an on-site septic system: the leach field. Appropriate drainage distance between groundwater supplies and the leach field and nutrient processing bacteria are the keys to a functioning leach field and effective and safe onsite septic system. The increased inputs into a water system from climate change will cause water tables and antecedent saturation levels of soil — the ratio of water to soil particles, or how saturated the ground is — to rise, which will prevent the gradual percolation of water out of a leach field.
With higher volumes of water from wastewater held in leach fields, the waste-processing bacteria become less effective, and the leach fields themselves are more prone to spill over. This outcome has many negative consequences, including impacting homeowners' health and sanitation capacities, risking the contamination of clean aquifer source waters with waste from ineffectively treated effluent, and the considerable costs of remediation.

To protect the environment and health in surrounding communities, municipalities can take steps to manage onsite septic systems. For example, increasing the required **separation distance** for onsite septic systems and groundwater table levels will account for error in seasonal high groundwater table level calculations. Furthermore, it is important to identify and reinforce onsite septic systems located in **flood zones**. Awareness of regional predictions for changing precipitation, temperature, and sea levels should be considered by municipals and wastewater professionals when educating homeowners about onsite septic systems or zoning properties.

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6 July 2021. "How your septic system can impact nearby water sources." United States Environmental Protection Agency, *Septic Systems.* Retrieved 28 July 2021. https://www.epa.gov/septic/how-your-septic-system-can-impact-nearby-water-sources

Coordinate on-site system management with watershed protection efforts.

Aligning on-site wastewater management activities with programs and projects conducted under a watershed approach greatly enhances overall land use planning and development processes. These watershed partnerships provide mutual benefits for the participants, operating efficiencies, and public education opportunities.

CASE STUDY

NEW HAMPSHIRE IMPROVES SEPTIC SYSTEMS TO COMBAT NUTRIENT LOADING

The New Hampshire Department of Environmental Services (NHDES) implemented a Waukewan Watershed Management Plan to address nutrient loading among other things. Lake Waukewan is classified as an impaired water source not supporting the aquatic life's designated use due to low dissolved oxygen levels and as not supporting primary contact recreation due to cyanobacteria. The first phase of the plan was a Septic System Improvement Initiative. Depending on the estimated failure rate of existing septic tanks, the total phosphorus load for the whole Waukewan Watershed is between 286 and 441 kilograms per year.

The town of Meredith, New Hampshire appointed a volunteer Waukewan Watershed Advisory Committee that researched the potential threat of failing septic systems to Lake Waukewan's water quality. As a result of their work, the town adopted a health regulation in 2013 to address subsurface wastewater disposal systems located within 250 feet of Lake Waukewan's shoreline. Seasonal use high-risk septic systems located just in this area are estimated to contribute 13% of the total annual phosphorus load in the watershed. This regulation was passed to protect the lake's surface water which supplies the drinking water for Meredith, the groundwater, which is used in private well water, and for public health.

A SWP grant provided cost sharing incentives to property owners in the designated area to conduct individual sewage disposal system (ISDS) evaluations. Sixteen evaluations were conducted and another eight were completed independently of the grant. The results show the majority (54% or 13 systems) to be found in failure. Furthermore, the inventory shows many properties around the watershed have ISDS over 40 years old which increases the risk of septic system failure and pollutant loading to the lake.

A secondary grant from Section 319 of the Clean Water Act provided financial assistance to those septic systems deemed in failure to improve their existing ISDS. As of January 2016, through the cost share program, nine ISDS were replaced with new systems and five additional systems were replaced because of the health regulation. The estimated reduction in phosphorus loading to Lake Waukewan from the installment of these new septic systems is 5.3 kg.

Tarpey, P. Executive Director of the Lake Winnipesaukee Association (2016, January 29). https://www.meredithnh.org/sites/g/files/vyhlif4681/f/uploads/waukewan_watershed_management_plan_2016.pdf

Educate homeowners, businesses, and local officials about the importance of proper wastewater management and provide them with guidance on proper operation and maintenance.

Public involvement and education are critical to successful on-site wastewater management. Engaging the public helps build support for funding, regulatory initiatives, and other elements of a comprehensive program. Educational activities directed at increasing general awareness and knowledge of on-site management procedures can improve the probability that simple, routine operation and maintenance tasks are carried out by system owners.

Every owner of an on-site wastewater treatment system should have the facts on operation and maintenance on hand. U.S. EPA, the National Small Flows Clearinghouse, and Northeast state health and environmental agencies have prepared various fact sheets for septic system owners. Communities can use this material or adapt it and then make sure it is distributed appropriately. Septage haulers are usually willing partners in the education and distribution process. Local papers can be encouraged to cover the topic periodically.

Key benefits to a comprehensive (or at least adequate) on-site wastewater management program that should be emphasized include:

- Protection of water quality and public health.
- Protection of the owner's investment in home and business.
- Increased life of the on-site service system and cost savings if a system does not need to be replaced.
- Avoidance of transferring water away from the source by conserving groundwater.
- Avoidance of the need to use a community's tax base to finance a centralized sewer system.

Explore financing options

Financing the installation and management of onsite systems can present a significant barrier for homeowners and small communities. While centralized wastewater treatment options are very expensive for communities, properly functioning decentralized management programs also come at some cost. U.S. EPA and other federal and state agencies have developed loan, cost-share, and other programs to help homeowners pay for new systems, repairs, or upgrades. For example, in 2021 Massachusetts finalized a plan for allocating resources from Clean Water State Revolving Fund to upgrade centralized wastewater treatment infrastructure alongside a Community Septic Management Program to support remediation efforts for failed or failing on-site septic systems.

See Chapter 9 – Financing to learn about other funding sources.

TOOLS OF THE TRADE: EPA SEPTICSMART INITIATIVE

For more resources on how to promote homeowner education about septic systems, check out the EPA's SepticSmart Program: https://www.epa.gov/septic/septicsmart.

Specific resources include an outreach Toolkit (https://www.epa.gov/septic/septicsmart-education-materials) with infographics, fliers, and templates for communication about septic system maintenance and information.

CHAPTER 8 – STORMWATER

Stormwater runoff is a natural part of the water cycle of water however, urbanization has interfered with this cycle by altering the natural infiltration capability of the land. Urbanization replaces vegetation like farmlands, forests, and meadowlands with buildings, driveways, parking lots, roads, and sidewalks. These impervious surfaces prevent rain and snowmelt from soaking into soil and recharging groundwater. Instead, stormwater washes over these surfaces, collecting pollutants, gaining speed and volume, raising water temperatures, and ultimately discharging into the nearest storm drain or surface water. Common pollutants collected in stormwater runoff include pesticides, fertilizers, oils, road salt, litter and other debris, sediment, heavy metals, bacteria, and other pathogenic organisms.

Stormwater is both a point source and nonpoint source of potential pollution affecting source waters. There are several strategies to manage both aspects of stormwater-driven challenges at the local level for municipal officials, including NPDES permitting and tracking records, Low Impact Development goals in community plans, Green Infrastructure installations, and other Best Management Practices.

Balancing economic development with environmental concerns can be a struggle for local governments. Stormwater runoff needs to be controlled to reduce flooding and erosion, protect drinking water supplies, maintain the integrity of fisheries, and provide safe water-related recreational activities. Many cost-effective solutions are now available to communities.

SWA reports provide an opportunity to reevaluate a community's approach to development, explore stormwater management techniques and options, and implement sustainable, cost-effective programs. Begin by targeting environmentally sensitive areas, such as source water protection areas and wetlands.

National Pollutant Discharge Elimination System (NPDES)
A U.S. EPA surface water quality permit program mandated by the federal Clean Water Act to control the discharge of pollutants from point sources to waters of the United States.

PERMITTING STORMWATER

In 1987, Congress amended the Clean Water Act to create, in two phases, a comprehensive national program for addressing stormwater discharges. Phase I, promulgated in November 1990, requires NPDES permits for stormwater discharge from a large number of priority sources, including medium and large municipal separate storm sewer systems (MS4s) and several categories of industrial activity, including construction activity, that disturb more than five acres.

The Stormwater Phase II Final Rule expands the Phase I program by requiring operators of small MS4s located in urbanized areas and small construction sites (between one and five acres) to implement programs and practices to control polluted stormwater runoff.

Case Study

New Hampshire's Regional Approach to Stormwater Management

Sharing resources between municipalities helps overcome challenges with meeting state stormwater management requirements. New Hampshire facilitates collaboration between municipal separate storm sewer systems (MS4) municipalities through regional coalitions. The New Hampshire MS4 Resources website provides information on the Lower Merrimack Valley Stormwater and Seacoast Stormwater coalitions.

Monthly coalition meetings are open to representatives from all New Hampshire MS4 permittees and provide updates on New Hampshire's MS4 Permit requirements and information on current areas of concern. This collaborative approach brings together communities facing similar stormwater management challenges ranging from winter maintenance to funding opportunities.

New Hampshire's regional approach to stormwater management connects municipalities with updated information and resources and builds accountability across the state. In addition, the coalitions promote the management of water resources across municipal borders, which is crucial for source water protection.

Visit the NH-MS4 website for more resources on MS4 requirements and New Hampshire's regional approach to stormwater management: https://www.nhms4.des.nh.gov/

Stormwater Runoff BMPs

Stormwater impacts are typically controlled using the following types of best management practices (BMPs) to treat or manage runoff quantity and quality. However, they are not comprehensive. Implementing these BMPs may require amending zoning ordinances and land development regulations. Field inspection and enforcement are always needed.

Pollution prevention measures:

- Collect or properly dispose of waste oil and hazardous waste.
- Reduce use of pesticides, fertilizers, and herbicides.
- Manage animal waste properly.
- Require and enforce erosion and sediment control at all construction projects.
- Minimize the use of road salt and alternative deicers.
- Routinely inspect the watershed for hazardous waste materials transport potential.
- Maintain catch basins and use oil and grit separators.
- Eliminate combined sewer overflows.

Use the pretreatment capacity of soils and vegetation to intercept and treat runoff before it reaches receiving waters.

Site-specific soil mapping by a professional soil scientist is typically needed for all land development to accurately identify soil conditions. Site analysis is needed to identify permeable soil suitable for stormwater infiltration. Integrate planning for non-structural stormwater drainage systems with the site layout.

The following BMPs generally need to be designed by a certified civil engineer or landscape architect and can be considered provided no impacts to groundwater drinking water sources are anticipated:

- Vegetated buffer strips adjacent to waterbodies.
- Vegetated swales along roadways and in parking lots.
- Rain gardens – small, landscaped stormwater infiltration and storage areas.
- Detention basins.
- Sedimentation basins.
- Infiltration basins or trenches.
- Ponds.
- Constructed wetlands.
- Installed filters to treat runoff.

MODIFY DESIGNS OF STRUCTURAL DRAINAGE SYSTEMS TO MINIMIZE IMPACTS TO WATER QUALITY. EXAMPLES INCLUDE:

- Discontinuous pavements with grassy shoulders and vegetated islands.
- Curbless roads that use roadside swales.
- Sediment basins and oil/grit separators to trap pollutants.
- Diverting rooftop runoff to vegetated areas.

MINIMIZE THE CREATION OF NEW IMPERVIOUS SURFACES BY CHANGING CONVENTIONAL PLANNING AND DESIGN STANDARDS. IMPROVED TECHNIQUES INCLUDE:

- Reducing road widths.
- Discontinuing the use of classic roadway grid patterns.
- Using cluster development patterns whenever possible.
- Prohibiting asphalt driveways in source water protection areas.

EPA further finalized provisions of the NPDES system in 2019 following a multi-year review and public commentary period. They made a series of targeted updates to both the NPDES application and program regulations. The goal of these updates was to address three areas of regulatory requirements which help the permitting process be more accessible and allow for a more time-efficient submission and permitting process to protect public health and the environment: regulatory definitions, permit applications, and public notice procedures. Under these new updates, states must update their own NPDES permit forms — except Massachusetts, New Hampshire, and New Mexico, along with the U.S. Virgin Islands.

Under Phase II, hundreds of urbanized communities in the Northeast, as well as institutions (e.g., public universities, state highway facilities, prisons) that have separate storm sewer systems are regulated. To comply, they must develop comprehensive stormwater management programs that include:

- Educating and involving the public
- Finding and removing illicit discharge connections
- Controlling runoff from construction sites during and after construction
- Preventing stormwater pollution at municipal facilities

The Phase II requirements provide momentum for urban communities to develop comprehensive stormwater management programs. If stormwater runoff has been identified as a problem in your SWA report, the Phase II requirements can serve as the foundation for creating a comprehensive program that is fine-tuned to your source protection area.

TOOLS OF THE TRADE: EPA'S SOAK UP THE RAIN PROGRAM

Soak Up the Rain (https://www.epa.gov/soakuptherain) is public outreach and education campaign about stormwater management which promotes the use of nature-based solutions to meet state and federal requirements. The website includes tools, lists of resources, and webinars for citizens, municipalities, and other SWP leaders.
Visit the Stormwater Tools in New England page (https://www.epa.gov/npdes-permits/stormwater-tools-new-england) for a list of resources.

THE UNDERGROUND INJECTION CONTROL (UIC) PROGRAM: A STORMWATER INJECTION SAFEGUARD

The UIC Program provides safeguards so that drains connected to structures designed to infiltrate stormwater, known as Class V stormwater drainage wells, don't contaminate underground drinking water. There is increased need for state and municipal vigilance of stormwater injection practices due to the dramatic increase in the use of Class V stormwater drainage wells as an NPDES BMP to dispose of stormwater.

Using a stormwater drainage well can be easier and less expensive than obtaining an NPDES permit for surface discharge. A significant percentage of stormwater drainage wells, however, may have the potential to harm local groundwater drinking water sources. The runoff that enters these wells may be contaminated with sediments, nutrients, metals, salts, fertilizers, pesticides, or microorganisms.

By definition, a Class V injection well is a bored, drilled, or driven shaft, or a dug hole that is deeper than it is wide. Class V wells are designed to inject nonhazardous fluids into or above an underground drinking water source. They are typically shallow injection wells designed to place rainwater or melted snow below the land surface. Example stormwater drainage wells include infiltration structures, such as drywells, infiltration galleries, leaching pits, leaching fields, French drains, and tile drains.

Stormwater drainage wells must be registered, often do not require a permit, must not endanger groundwater drinking water sources, and must comply with state UIC program requirements. Northeast states have responsibility for regulating these wells, and, in many cases, their regulations are stricter than federal regulations.

MUNICIPALITIES CAN HELP:

- Ensure that current and future stormwater system operators using Class V stormwater discharge wells (e.g., car washes, auto repair shops) understand and meet regulatory requirements.
- Identify stormwater drainage systems that may affect groundwater drinking water sources.
- Recommend appropriate BMPs, including well siting, design, and operation.
- Offer an education and outreach effort to prevent misuse.

CLIMATE CONNECTION: PLANNING STORMWATER BMPS FOR BIGGER, WETTER, MORE FREQUENT STORMS

As the climate changes and subjects the Northeast to more frequent storms with greater precipitation magnitudes and intensities, municipal officials will need to consider the benefits of updating design standards for structural BMPs meant to address stormwater runoff. Most Northeast states updated their design standards in 2009, but some are close to two decades old. These standards are informed by data which described storms of notably lesser intensities, durations, and frequencies, thus making the current IDF threshold curves out of date for the storms of today. The impacts of flooding from Hurricanes Irene (2011) and Superstorm Sandy (2014) are examples of how disruptive floods from these storms can be to energy and power systems, transportation, and work if infrastructure standards are overwhelmed by higher magnitude flows.

However, new data is available to help localities update their design standards to help make more resilient structures in the future, and retroactively install protections to existing infrastructure against stormwater flows. There are several whitepapers and frameworks for this process of updating standards with the incorporation of new climate change data and concerns for the Chesapeake Bay. A less robust, more site-specific application of climate data and local conditions can help municipalities establish more resilient infrastructure for their communities to quickly come up-to-speed with the changing climate for stormwater management.

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https://www.eli.org/sites/default/files/eli-pubs/chesapeake-bay-green-infrastructure-climate-resiliency-white-paper-submitted-2017-08-21.pdf

Low Development Impact (LID)
A site design strategy with the goal of maintaining or replicating the predevelopment hydrology through the use of features that accomplish natural hydrologic functions, such as detention, treatment, and infiltration of stormwater.

LOW-IMPACT DEVELOPMENT DESIGN TECHNIQUES FOLLOW NATURE'S PATH

Utilizing nature-based solutions for adaptations and building community resilience is crucial for managing stormwater runoff. Low-impact development (LID) is an approach to stormwater management that uses land use development techniques of soil restoration, vegetation, and rainwater harvesting to mimic natural hydraulic processes. These techniques increase natural infiltration which reduces stormwater runoff that carries pollutants into drinking water sources.

LID stormwater management practices enhance a community's ability to protect surface water quality, prevent depletion of groundwater levels, increase resiliency to flooding and erosion, and preserve the physical integrity of receiving streams. Increasing natural vegetation also provides benefits to community health, property values, and wildlife habitat through the addition of green space.

LID techniques include:

- **Minimizing stormwater runoff** by reducing imperviousness, preserving natural soil and vegetation, maintaining natural drainage courses, reducing use of pipes, and minimizing clearing and grading.
- **Optimizing infiltration, detention, and interception** to reduce runoff volume and discharge with vegetative buffers or rain/bioretention gardens.
- **Dispersing runoff storage** throughout a site with the use of open swales, flatter slopes, rain gardens, and rain barrels.
- **Strategically routing flows** with vegetative buffers or curb cuts to maintain predevelopment travel time.
- **Outreach to property owners** to use effective pollution prevention measures.

Additional resources on LID:

Mass Audubon LID Factsheets on LID BMPs and Local Zoning Regulations

Building Community Resilience with Nature-Based Solutions: A Guide for Local Communities. FEMA. (2021). https://www.fema.gov/sites/default/files/documents/fema_riskmap-nature-based-solutions-guide_2021.pdf

EPA *Urban Runoff: Low Impact Development*. (2021, June 14). https://www.epa.gov/nps/urban-runoff-low-impact-development

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TOOLS OF THE TRADE: USING LOCAL CODES TO FACILITATE LID

Local building codes for public works, street design, and open spaces created for governmental and operational needs can create barriers for implementing LID techniques. The EPA's factsheet on overcoming this barrier recommends local municipalities review existing codes to identify conflicts with LID Goals.

Common conflicts to look out for include:

- LID practices for vegetation do not count towards open space requirements.
- Requirements for off-street parking, landscaping, and screening.
- Requirements for large streets and parking lots.
- Requirements for landscaping and perimeter screening that do not allow vegetated LID practices.
- Requirements for curbs and gutters that do not allow curb cuts.

Once these conflicts are identified, municipalities can update codes to facilitate LID. Check out the EPA's factsheet for sample language for easier code fixes and more information on how to incentivize LID in your community.

The full fact sheet can be accessed here: https://www.epa.gov/sites/default/files/2021-06/documents/lid_fact_sheet_codes_june_2021_508.pdf

CASE STUDY

MAINE MS4 LOW-IMPACT DEVELOPMENT REQUIREMENTS:
Maine's updated MS4 stormwater permit regulations went into effect in July 2022 and require 30 towns and cities to address contamination from stormwater runoff. This includes increased water quality testing as well as requirements for using low-impact development (LID) practices. By 2024, the 30 municipalities must implement LID practices for the construction and redevelopment of projects that would disturb an acre or more of land.

Within these ordinances, communities must also include measurable standards for LID to help understand implementation requirements. A statewide committee in Maine is working towards providing guidance for municipalities to implement these new requirements.

For more information on the guidance for LID techniques access Maine's **MS4 Final Signed Permit Modification**:
https://www.maine.gov/dep/water/wd/ms4/MS4%20Final%20Signed%20Permit%20Modification%2011-22-2021pdf.pdf

Law, C. (2022, July 8). *Maine requires larger communities to step up fight against Stormwater Pollution*. Portland Press Herald. Retrieved August 2, 2022, from https://www.pressherald.com/2022/07/08/maine-requires-larger-communities-to-step-up-fight-against-stormwater-pollution/

TOOLS OF THE TRADE: MODEL LID BYLAWS

While stormwater regulations are state specific, example stormwater bylaws can be adapted by municipalities for their own use. Below are example LID ordinances from Massachusetts and Maine.

- Massachusetts Model LID Bylaw https://www.mass.gov/doc/smart-growthsmart-energy-bylaws-low-impact-development-lid-bylaw-with-regulations/download
- Maine DEP Model Ordinance (2010): https://www.maine.gov/dacf/municipalplanning/docs/LID_Ord_SZ_model_kvcog_4%209%2010_2.pdf

Examine the local storm sewer management program to ensure it addresses existing and future projections for stormwater patterns and runoff threats to source water areas, funding, public outreach and education, and future development.

STRATEGIES FOR ACTION

Establish a comprehensive stormwater management program to prevent the contamination of present and future source water.

Local responsibility for stormwater treatment oversight rests with such entities as planning and zoning commissions, conservation and wetlands commissions, boards of health, public works departments. Consider hiring a consultant to work with the community if additional expertise is needed.

Identify and implement pollution prevention strategies, seek out priority pollution reduction opportunities, protect natural areas that help control runoff, and begin ecological restoration and retrofit activities to clean up degraded waters. Target “hot spots” that address pollution runoff and have multiple benefits, such as high efficiency street sweeping that addresses aesthetics and water quality.

ROAD SALT DRINKING WATER IMPACTS

During winters in the Northeast, snow and ice on the roads requires de-icing materials to ensure travel is safe. The most common chemical used is road salt/sodium chloride. Chloride, sodium, and additives used in road salts and de-icing materials contaminate drinking water sources through runoff into surface water and infiltration into groundwater. This increases the costs of drinking water treatment and leads to pipe corrosion. Along with managing the application of road salts, improper storage of road salt and de-icing materials also can contribute to surface and groundwater contamination.

Coordinating efforts between the department of public works and the public on best management practices is essential for managing the use of salt and de-icing applications.

Road Salt BMPs

- Use mechanical means to remove snow. (I.e., plowing, shoveling)
- Pre-wet the salt to increase efficiency.
- Anti-icing prior to snow and ice accumulation to reduce chemical use.
- Identify reduced salt areas in environmentally sensitive areas (ex: flood hazard areas, wetland and buffer zones, groundwater discharge zone, or source protection areas).
- Storage and handling: place treatment on impervious surface with drainage controls, away from surface water sources.
- Consider road salt alternatives.

For more information on the use of road salts and best management practices, see the NHDES Road Salt and Water Quality fact sheet.

Take advantage of GIS resources to update information on the stormwater regime (e.g., drains, existing runoff controls, runoff patterns, percent impervious surface) in your SWP area.

Work with water suppliers to undertake a program to thoroughly understand stormwater patterns, pollutant loadings, and recharge capacity to provide a basis for addressing problems in the SWP area. Such an effort requires the guidance of a professional engineer.

Update the stormwater management regulatory program so that it incorporates wise land use planning and zoning, creative and careful site design, and appropriate BMPs in the SWP area.

There are numerous stormwater management approaches that are in sync with natural processes and systems. It is important for municipal officials to provide oversight and enforcement of construction, monitoring, and maintenance of BMPs.

Adopt regulations that protect water quality by controlling stormwater runoff. The following are examples:

- Adopt ordinances that incorporate BMPs listed above.
- Adopt “zero-runoff” ordinances that require all runoff to be treated on site for any new construction.
- Set a maximum allowable percentage of imperviousness within a water supply watershed.
- Create a “stormwater utility” to ensure proper maintenance of stormwater management systems

GREEN INFRASTRUCTURE: A PATH TO UPDATING STORMWATER MANAGEMENT, INCORPORATING THE PRIVATE SECTOR, AND COMMUNITY ENGAGEMENT AND ENRICHMENT

Traditional grey infrastructure like water treatment plants, pipes, and stormwater basins is designed for a specific service. In contrast, green infrastructure offers additional benefits to the environment through water filtration and treatment of runoff. Green infrastructure are installations or strategies often added to buildings or developed areas after their initial construction, which are designed to help manage stormwater runoff, along with providing other benefits such as reducing urban heat island effects, improving air quality, lowering long-term building or grounds maintenance costs, and promoting economic and social development.

Green infrastructure (GI) can help local areas — including individual property owners and building complexes — improve water quality through retaining, treating, or recycling/upcycling stormwater runoff. The recycling and filtration of stormwater not only reduces the pollutant load carried in source waters, but also limits the strain placed on drinking water systems.

Funding green infrastructure: Community-based Public-Private Partnerships (CBP3s) between local governments and a private entity is an option for funding projects. As opposed to traditional Public-Private Partnerships (P3s), community participation in CBP3s promotes local economic growth as well as community interests. With initial support from public funding, private partners take on the implementation and maintenance of projects, which distributes risk and accountability. *For more information on financing SWP projects, see Chapter 9 – Financing.*

Local governments can use CBP3s to finance green infrastructure projects that enable them to meet stormwater runoff management goals. Green infrastructure projects that repair streets, replace damaged sidewalks, upgrade utilities, and redevelop lots to increase green space also benefit community health and wellbeing. These benefits range from increasing property values to improving water efficiency and reducing flooding risk. The focus on long-term investments is crucial for small, underserved communities that lack resources for implementing and overseeing stormwater management programs.

See the EPA page for additional funding opportunities: https://www.epa.gov/green-infrastructure/green-infrastructure-funding-opportunities#:~:text=EPA%20Clean%20Water%20State%20Revolving,including%20stormwater%20and%20green%20infrastructure.

Sources & Additional References:

Green Infrastructure Toolkit. Georgetown Climate Center. (2022).
Financing Green Infrastructure - Is a Community-Based Public-Private Partnerships (CBP3) Right for You? EPA (2022, June 20).
Why You Should Consider Green Stormwater Infrastructure for Your Community. EPA. (2021, June 14)

TOOLS OF THE TRADE: EPA GREEN STREETS HANDBOOK

The EPA's **Green Streets Handbook** provides a comprehensive manual on the development of green infrastructure alongside streets, sidewalks, parking lots, and alleys. These practices reduce stormwater runoff and improve infiltration of excess surface water runoff and evapotranspiration. Green space along streets also reduces the vehicle-associated pollution from road salts, tire wear, and motor oil carried by stormwater runoff into nearby drinking water sources.

Depending on the nature of stormwater challenges in a community, there are various green streets project options.

1. **Bioretention swales, increased tree cover,** and **infiltration trenches** that line larger roads increase infiltration from runoff.
2. **Stormwater curb extensions** in mixed use neighborhoods slow traffic and increase pedestrian safety.
3. **Permeable pavement** infrastructure is best suited for breakdown lanes, on-street parking areas, bike lanes, or sidewalks.
4. **Stormwater planters, tree trenches,** and **bioswales** are optimal for residential streets with curbs.
5. Green infrastructure can also be incorporated into routine updates or rehabilitation. For example, parking lots can be retrofitted with trees to increase shade

For more information on developing a green streets plan in your community see the EPA's 2021 Green Streets Handbook (https://www.epa.gov/sites/default/files/2021-04/documents/green_streets_design_manual_feb_2021_web_res_small_508.pdf)

CASE STUDY

NEW HAMPSHIRE BIORETENTION POND PROJECT

In 2013, the Lakes Region Planning Commission (LRPC) was awarded grant funding to design and install a bioretention pond to intercept roadway runoff discharging directly into Paugus Bay, Laconia's drinking water source. The project was the collaboration between the LRPC, the City of Laconia, and an adjacent condominium complex. The Paugus View Condo Association recognized the importance of protecting the lake and, when approached by Luke Powell of the Department of Public Works, was willing to allow a drainage easement on their property to accommodate the size of the bio-retention garden.

The basin operates with compost and plants to remove pollutants from stormwater. As stormwater enters the basin it passes through an open rock surface, then through a layer of compost two-and-a-half feet thick, which acts like a sponge to remove pollutants. The treated stormwater slowly seeps into the surrounding soils and groundwater, lessening the discharge to the lake. When stormwater ponds in the basin, plants on its slopes absorb it and remove pollutants. Bio-retention basins like this can remove between 80-90% of petroleum residues and between 70-80% of nutrients and metals.

Macheras, Melissa (2022). NHDES

GREEN INFRASTRUCTURE AND GENTRIFICATION

Green infrastructure (GI) projects can be solutions to stormwater runoff and pollution. However, these projects can have unintended impacts on community structure, households, and individual community members. Green spaces can inspire new groups to enter communities and invest in expensive construction projects such as office buildings and new housing developments.

In some cases, the "greening" of communities can result in green gentrification. This occurs when green infrastructure and low impact development projects increase green space in communities and raise surrounding property values. As a result, low-income community members are priced-out of their neighborhoods and social networks. The displacement of racial and ethnic minorities from greener communities' compounds existing environmental injustices in access to green space.

Organizations like UPROSE in Brooklyn, New York are working to develop green infrastructure projects through meaningful community engagement and participation in planning for sustainable development. UPROSE developed a proposal, the Green Resilient Industrial District (GRID), as an alternative to zoning changes that would expand luxury commercial development along Sunset Park's waterfront. The GRID proposal for Sunset Park's industrial waterfront recommends action for sustainable industrial development that incorporates green infrastructure, climate resiliency, and protective measures to avoid displacement.

When developing new green infrastructure and LID projects consider...

1. Community input: public participation in the decision-making process for implementing LID and GI projects helps to ensure that communities benefit from these projects.
2. Policy options for combatting gentrification effects include rent control, community land trusts, and inclusionary zoning.

See the Greening in Place guide for specific anti-displacement BMPs for green infrastructure projects:

Sources & more information:

Chan, A. Y., Son, J. Y., & Bell, M. L. (2021). Displacement of Racially and Ethnically Minoritized Groups after the Installation of Stormwater Control Measures (i.e., Green Infrastructure): A Case Study of Washington, DC. *International journal of environmental research and public health*, 18(19), 10054. https://doi.org/10.3390/ijerph181910054

Isabelle, A., Connolly James, J. T., Hamil, P., Galia, S., Melissa, C., Juliana, M., Kenneth, G., Tammy, L., Andrew, M., & Timmons, R. J. (2019). Why green "climate gentrification" threatens poor and vulnerable populations. *Proceedings of the National Academy of Sciences, 116*(52), 26139-26143. https://doi.org/10.1073/pnas.1920490117

Hart, M., Du, J., & Coccoli, C. (2019, December 12). *How to prevent city climate action from becoming "green gentrification"*. World Resources Institute. Retrieved July 21, 2022, from https://www.wri.org/insights/how-prevent-city-climate-action-becoming-green-gentrification

TOOLS OF THE TRADE: EPA STORMWATER RETROFIT GUIDANCE MANUAL

The Stormwater Retrofit Guidance Manual provides guidance on how to develop stormwater control measures (SCM) that are best suited for specific sites and scales. The manual provides information on how to use the EPA's SCM Performance Curves in the retrofit design process to evaluate the water quality benefit of various SCMs options.

Retrofit Fit Manual and SCM Performance Curve Factsheet
For more information on the manual see: https://snepnetwork.org/stormwater-retrofit-manual/

Educate developers, construction contractors, homeowners, and local officials about the importance of effective stormwater management and provide them with guidance on the use of appropriate BMPs.

Take a lead role in public education efforts through signage, storm drain marking, pollution prevention outreach campaigns, and partnerships with citizen groups and businesses. Community members can help prioritize cleanup strategies, volunteer to become involved in restoration efforts, and mark storm drains with "don't dump" messages.

Let developers know before they submit a new subdivision proposal in a SWP area that a site design that provides for maintenance of predevelopment runoff and groundwater infiltration conditions is needed. Let construction contractors know how to implement specified, appropriate BMPs.

Let homeowners and businesses know how they can protect the community's water resources by reducing the use of fertilizers, pesticides, and herbicides and moving away from manicured lawns to native plantings, especially along water bodies and paved areas. There is plenty of information available from such sources as U.S. EPA, state environmental agencies, watershed associations, and garden clubs. Be present to spread the word at local business and community functions.

For examples and more information on informing your communities and stakeholders about the benefits of effective stormwater management, explore this resource developed by the University of Connecticut: https://nemo.uconn.edu/ms4/index.htm

TOOLS OF THE TRADE: EDUCATION AND OUTREACH MATERIALS FOR STORMWATER MANAGEMENT

Massachusetts has several resources for municipalities meeting MS4 permit requirements, homeowners, commercial entities, developers, and industrial users.
https://www.mass.gov/guides/stormwater-outreach-materials-to-help-towns-comply-with-the-ms4-permit
The EPA's NPS Outreach Toolbox also includes materials for educating the public on stormwater runoff and nonpoint source pollution.

Explore funding options for the various aspects of a stormwater management program.

Recognizing that proper stormwater management, oversight, and enforcement do not come free, municipalities need to explore funding options. Check state statutes to see if you're the local planning board can adopt regulations to require construction performance bonds or fees to

cover the cost of such services as reviewing plans, ensuring that stormwater BMPs and other structures are built according to plan, conducting ongoing inspections, and enforcement.

An alternative to private ownership with public oversight is for the municipality to take ownership and maintenance responsibility for all stormwater BMPs, assessing an annual fee to pay for all costs (e.g., maintenance, repair). A growing number of communities nationwide have established stormwater utilities so that they can assess fees to fund their stormwater programs and provide a wide range of services. The Metropolitan Area Planning Council in Massachusetts produced a presentation describing their process in developing funding and structures in support of a stormwater utility management system. For more information, go to: https://www3.epa.gov/region1/npdes/charlesriver/pdfs/MAPCSWFundingResourceGuide.pdf

CHAPTER 9 – FINANCING

There are several avenues for both federal and state funding to support source water protection efforts.

EPA Resources for Funding Source Water Protection:
https://www.epa.gov/sourcewaterprotection/resources-funding-source-water-protection

EPA FITS: Funding Integration Tool for Source Water -
https://www.epa.gov/sourcewaterprotection/fits
FITS is an interactive tool that provides an overview of federal funding sources for activities that protect drinking water sources. The tool provides information on funding sources (ex: DWSRF, CWSRF, 319), planning steps for a SWP program, and examples for reference.

EPA Water Infrastructure and Resiliency Finance Center -
https://www.epa.gov/waterfinancecenter
Provides an overview of federal funding information for municipalities planning drinking water, wastewater, and stormwater infrastructure projects.

List of Environmental Finance Centers and federal financial technical assistance for water infrastructure: https://www.epa.gov/waterfinancecenter/financial-technical-assistance-and-tools-water-infrastructure

Drinking Water State Revolving Fund

https://www.epa.gov/dwsrf
The Safe Drinking Water Act, as amended in 1996, established the Drinking Water State Revolving Fund (DWSRF) to make funds available to drinking water systems to finance infrastructure improvements. The program also emphasizes providing funds to small and disadvantaged communities and to programs that encourage pollution prevention as a tool for ensuring safe drinking water.
EPA Using Drinking Water SRF Set Asides for Source Water Protection Factsheet -
https://www.epa.gov/sites/default/files/2019-10/documents/protecting_source_water_with_the_dwsrf_-_final.pdf

- **Connecticut:** http://www.ct.gov/dph/cwp/view.asp?a=3139&q=387340
- **Maine:** https://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/srf.shtm
- **Massachusetts:** https://www.mass.gov/service-details/srf-drinking-water-program
- **New Hampshire:** https://www.des.nh.gov/business-and-community/loans-and-grants/drinking-water-state-revolving-fund
- **New York:** https://www.efc.ny.gov/drinkingwater
- **Rhode Island:** https://health.ri.gov/programs/detail.php?pgm_id=127
- **Vermont:** https://dec.vermont.gov/water-investment/water-financing/dwsrf

Clean Water SRF

https://www.epa.gov/cwsrf

The Clean Water State Revolving Fund (CWSRF) program is a federal-state partnership that provides communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects.

EPA Clean Water SRF Source Water Protection Factsheet:
https://www.epa.gov/system/files/documents/2021-07/cwsrf-source-water-protection.pdf

- **Connecticut:** https://portal.ct.gov/DEEP/Municipal-Wastewater/Financial-Assistance-for-Municipal-Wastewater-Projects
- **Maine:** https://www.maine.gov/dep/water/grants/srfparag.html
- **Massachusetts:** https://www.mass.gov/service-details/srf-clean-water-program
- **New Hampshire:** https://www.des.nh.gov/business-and-community/loans-and-grants/clean-water-state-revolving-fund
- **New York:** https://efc.ny.gov/cwsrf
- **Rhode Island:** http://www.dem.ri.gov/programs/water/finance/state-revolving-fund.php
- **Vermont:** https://dec.vermont.gov/water-investment/water-financing/cwsrf

EPA Section 319 Funding

https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/319-grant-current-guidance

Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved nonpoint source management programs. Nonpoint source programs include technical assistance, financial assistance, education, training, technology transfer, and regulatory programs. These funds are passed onto communities, local conservation groups, and other organizations for NPS project, plan, and management efforts.

- **Connecticut** http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325594
- **Maine** http://www.maine.gov/dep/water/grants/319.html
- **Massachusetts** https://www.mass.gov/info-details/grants-financial-assistance-watersheds-water-quality#overview-
- **New Hampshire** https://www.des.nh.gov/business-and-community/loans-and-grants/watershed-assistance#faq37041
- **New York** https://www.dec.ny.gov/chemical/94150.html
- **Rhode Island** https://dem.ri.gov/environmental-protection-bureau/water-resources/financial-assistance/nonpoint-source-funding
- **Vermont** https://dec.vermont.gov/water-investment/cwi/grants

On-site Wastewater Management Funding Resources

- **Funding septic systems with federal and state specific resources:** https://www.epa.gov/septic/funding-septic-systems#c
- **EPA Report:** Financing Decentralized Wastewater Treatment Systems: Pathways to Success with the Clean Water State Revolving Fund Program (EPA)

State Programs

- **Maine:** List of funding programs available for drinking water protection. https://www.maine.gov/dhhs/mecdc/environmental-health/dwp/sitemap/financialResources.shtml
- **Massachusetts:** Water Resources Grants & Financial Assistance https://www.mass.gov/info-details/water-resources-grants-financial-assistance
- **New Hampshire:** Drinking Water-Related Grants | NH Department of Environmental Services.
  The Local Source Water Protection Grant Program funds water suppliers, municipalities, non-profits, and watershed associations for protecting drinking water sources.
  Drinking Water and Groundwater Trust Fund: Source Water Protection grant program (DWGTF SWP). Offers funding to conserve water supply areas through land acquisition and conservation easements.
- **New York:** Ag & Markets Source Water Buffer Program to protect active sources of public drinking water and support water quality protection through the purchase of conservation easements on agricultural lands. - https://agriculture.ny.gov/soil-and-water/source-water-buffer-program
  DEC Water Quality Improvement Project Program (WQIP): WQIP is a competitive, reimbursement grant program that funds projects that directly improve water quality or aquatic habitat, or protect a drinking water source. - https://www.dec.ny.gov/pubs/4774.html
- **Rhode Island:** Water Resources Financial Assistance https://dem.ri.gov/environmental-protection-bureau/water-resources/financial-assistance
- **Vermont:** Funding Opportunities https://dec.vermont.gov/content/funding-opportunities-0

Additional Funding Resources

Rural Utility Service Water and Environmental Programs (WEP) – https://www.rd.usda.gov/programs-services/all-programs/water-environmental-programs
Provides loans, grants and loan guarantees for drinking water, sanitary sewer, solid waste and storm drainage facilities in rural areas and cities and towns of 10,000 or less. WEP also makes grants to nonprofit organizations to provide technical assistance and training to assist rural communities with their water, wastewater, and solid waste problems.

Rural Community Assistance Program (RCAP) – https://www.rcap.org/
Provides technical assistance grants to rural communities with population of 10,000 or less.

National Rural Water Association (NRWA) – https://nrwa.org/
A non-profit organization which helps train, support, and promote water and wastewater professionals serving communities of 10,000 people or fewer in the US. Includes financial resources information and training programs.

Natural Resources Conservation Service (NRCS) – http://www.nrcs.usda.gov/programs/
Provides assistance in a partnership effort to help people conserve, maintain, and improve our natural resources and environment. Two such programs include the Watershed Protection and Flood Prevention Operations Program, and the Resource Conservation and Development Program.

CHAPTER 10 – RESOURCES

Federal and State Source Water Programs

U.S. EPA National: https://www.epa.gov/sourcewaterprotection
U.S. EPA Region 1: https://www3.epa.gov/region1/eco/drinkwater/
U.S. EPA Research and Reports on Source Water Protection:
https://www.epa.gov/sourcewaterprotection/research-and-reports-source-water-protection
U.S. EPA Source Water Assessment Program:
https://www.epa.gov/sourcewaterprotection/source-water-assessments

- **Connecticut**: CT DPH SWP Program CTDEEP https://portal.ct.gov/DEEP/Water/Connecticuts-Water-Resources
- **Maine**: http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/sitemap/swp.shtml
- **Massachusetts**: https://www.mass.gov/source-water-protection
- **New Hampshire**: https://www.des.nh.gov/climate-and-sustainability/conservation-mitigation-and-restoration/source-water-protection
- **New York**: DWSP2: DEC and DOH program to develop and begin implementation drinking water source protection programs. - https://www.dec.ny.gov/chemical/115250.html
- **Rhode Island**: http://www.health.ri.gov/water/about/yourwater/
- **Vermont**: http://dec.vermont.gov/water/drinking-water/public-drinking-water-systems/source-water-protection

Additional Source Water Protection Resources

American Water Works Association – https://www.awwa.org/Resources-Tools/Resource-Topics/Source-Water-Protection

The Clean Water Network – http://clean-water-network.org/
The Clean Water Network under the Environment America Research and Policy Center works to ensure that organizers and advocates across the country have the resources and connections they need to effectively fight to protect waterways.

Source Water Collaborative -- https://www.sourcewatercollaborative.org/
The SWC is comprised of thirty national organizations committed to protecting sources of drinking water. Includes links to federal, state, and local organizations and resources for source water protection.

Smart Growth Network EPA – https://www.epa.gov/smartgrowth
This partnership of government, business, and civic organizations promotes growth that expands economic opportunities while protecting human health and the environment.

EPA Model Ordinances to Protect Local Resources – https://www.epa.gov/nps/urban-runoff-model-ordinances-prevent-and-control-nonpoint-source-pollution

Tools for Water Related Climate Change Adaptation, Climate Change Adaptation Resource Center: https://www.epa.gov/arc-x/tools-water-related-climate-change-adaptation#tab-2

Connecticut: Aquifer Protection Area Program
https://portal.ct.gov/DEEP/Aquifer-Protection-and-Groundwater/Aquifer-Protection/Aquifer-Protection-Program

Massachusetts:
Town officials and public water suppliers
https://www.mass.gov/lists/groundwater-wellhead-protection-and-surface-water-supplies

Board of Health Outreach Packages
https://www.mass.gov/lists/drinking-water-information-for-boards-of-health

Municipal Compliance Fact Sheet: Drinking Water Information for Municipal Officials from the MassDEP Drinking Water Program.
https://www.mass.gov/service-details/municipal-compliance-fact-sheet-drinking-water

Water Supplier Operations: information for owners and operators of public water systems and contact information
https://www.mass.gov/info-details/public-drinking-water-system-operations

New Hampshire: Public Education Clean Drinking Water Groundwater Brochure

Vermont: Ounce of Prevention: A Groundwater Protection Handbook for Local Officials
https://dec.vermont.gov/sites/dec/files/dwgwp/sourceprot/pdf/ounceofprevention.pdf

State Source Water Assessment & Protection (SWAP) Reports

- **Connecticut:** https://portal.ct.gov/DPH/Drinking-Water/DWS/Source-Water-Assessment-Program-SWAP-Reports
- **Maine:** http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/sitemap/swp.shtml
- **Massachusetts:** https://www.mass.gov/lists/source-water-assessment-and-protection-swap-program-documents
- **New Hampshire:** https://www.des.nh.gov/climate-and-sustainability/conservation-mitigation-and-restoration/source-water-protection/assessment
- **New York:** https://www.health.ny.gov/environmental/water/drinking/swap.htm
- **Rhode Island:** http://www.health.ri.gov/water/about/yourwater/
- **Vermont:** http://dec.vermont.gov/water/drinking-water/public-drinking-water-systems/source-water-protection

To Find Out More about GIS in Your State

- **Connecticut**: http://www.ct.gov/deep/cwp/view.asp?a=2701&q=323444
- **Maine:** https://www.maine.gov/geolib/index.html
- **Massachusetts:** https://www.mass.gov/orgs/massgis-bureau-of-geographic-information
- **New Hampshire:** https://www.nh.gov/oep/planning/services/gis
- **New York:** http://www.dec.ny.gov/pubs/212.html
- **Rhode Island**: http://www.rigis.org/
- **Vermont:** http://vcgi.vermont.gov/

Environmental Systems Research Institute (ESRI) – http://www.esri.com/nonprofit
ESRI provides GIS software to qualified nonprofit organizations for a host of applications that include environmental protection and utilities.
EPA DWMAPS (Drinking Water Mapping Application to Protect Source Waters)

Groundwater Protection

- **U.S. EPA:** https://www.epa.gov/ground-water-and-drinking-water
- **National Groundwater Protection Council:** https://www.gwpc.org/
- **National Groundwater Association:** https://www.ngwa.org/
- **Groundwater Foundation:** https://groundwater.org/
- **Connecticut**: https://portal.ct.gov/DEEP/Aquifer-Protection-and-Groundwater/Ground-Water/Protecting-Connecticuts-Groundwater
- **Maine:** https://www.maine.gov/dep/water/groundwater/
- **Massachusetts:** https://www.mass.gov/lists/groundwater-wellhead-protection-and-surface-water-supplies
- **New Hampshire:** https://www.des.nh.gov/water/groundwater
- **New York:** https://www.dec.ny.gov/lands/36064.html
- **Rhode Island**: https://dem.ri.gov/environmental-protection-bureau/water-resources/waters-wetlands/groundwater-wellhead-protection-programs
- **Vermont:** https://dec.vermont.gov/water/groundwater

Fuel Storage Tanks

- **U.S. EPA:** https://www.epa.gov/ust
- **Connecticut:** https://portal.ct.gov/DEEP/Underground-Storage-Tanks/Underground-Storage-Tanks
- **Maine:** http://www.maine.gov/dep/waste/ust/
- **Massachusetts:** http://www.mass.gov/eea/agencies/massdep/toxics/ust/
- **New Hampshire:** https://www.des.nh.gov/business-and-community/fuel-storage-tanks
- **New York:** http://www.dec.ny.gov/chemical/287.html
- **Rhode Island:** http://www.dem.ri.gov/programs/wastemanagement/ust/
- **Vermont:** http://dec.vermont.gov/waste-management/storage-tanks

Hazardous Materials

Federal and State RCRA Programs

- **U.S. EPA:** https://www.epa.gov/hw
- **U.S. EPA Risk Communication:** https://www.epa.gov/sites/default/files/2020-04/documents/risk_communication-rcra_tools-508_compliant_12-20-191.pdf
- **Connecticut:** https://portal.ct.gov/DEEP/Waste-Management-and-Disposal/Hazardous-Waste/Hazardous-Waste-Home
- **Maine:** http://www.maine.gov/dep/waste/hazardouswaste/index.html
- **Massachusetts:** http://www.mass.gov/eea/agencies/massdep/recycle/hazardous/
- **New Hampshire:** https://www.des.nh.gov/waste/hazardous-waste
- **New York:** https://www.dec.ny.gov/chemical/8486.html
- **Rhode Island:** http://www.dem.ri.gov/programs/wastemanagement/facilities/hazardous-waste-oil.php
- **Vermont:** https://dec.vermont.gov/waste-management/hazardous

Household Hazardous Waste

- **U.S. EPA:** https://www.epa.gov/hw/household-hazardous-waste-hhw
- **Connecticut:** Department of Energy and Environmental Protection http://www.ct.gov/deep/cwp/view.asp?a=2718&q=325446&deepNav_GID=1967
- **Maine:** Department of Environmental Protection http://www.maine.gov/dep/waste/publications/hhwbroch.html
- **Massachusetts:** Department of Environmental Protection http://www.mass.gov/eea/agencies/massdep/recycle/hazardous/household-hazardous-waste.html
- **New Hampshire:** Department of Environmental Services https://www.des.nh.gov/waste/household-hazardous-waste
- **New York:** https://www.dec.ny.gov/chemical/8485.html
- **Rhode Island:** Department of Environmental Management https://www.rirrc.org/recycling-composting-disposal/hazardous-waste/household-hazardous-waste
- **Vermont:** Department of Environmental Conservation http://dec.vermont.gov/waste-management/solid/materials-mgmt/HHW

Emerging Contaminants

- **U.S. EPA:** Monitoring Unregulated Contaminants in Drinking Water https://www.epa.gov/dwucmr
- **U.S. EPA:** PFAS Analytic Tools https://echo.epa.gov/trends/pfas-tools
- **AWWA:** PFAS Contaminants of Emerging Concern https://www.awwa.org/Resources-Tools/Resource-Topics/PFAS

Septic Systems

Federal and State Septic System Management Programs

- **U.S. EPA:** https://www.epa.gov/septic
- **Connecticut:** DPH Onsite Sewage Disposal System – CT DEEP Septic Systems
- **Maine:** http://www.maine.gov/dhhs/mecdc/environmental-health/el/business/business-answers-septic-systems.htm
- **Massachusetts:** http://www.mass.gov/eea/agencies/massdep/water/wastewater/septic-systems-title-5.html
- **New Hampshire:** https://www.des.nh.gov/land/septic-systems
- **New York:** https://www.health.ny.gov/environmental/water/drinking/septic_systems.htm
- **Rhode Island** http://www.dem.ri.gov/programs/water/owts/
- **Vermont** http://dec.vermont.gov/water/ww-systems

EPA Septic System Guides

SepticSmart program: https://www.epa.gov/septic/septicsmart
Resources for communicating septic system care and maintenance to homeowners.

Decentralized Wastewater Partnership https://www.epa.gov/septic/epas-decentralized-wastewater-partnership

Stormwater

Federal and State Stormwater Programs

- **U.S. EPA:** https://www.epa.gov/npdes/npdes-stormwater-program
- **Connecticut:** https://portal.ct.gov/DEEP/Water-Regulating-and-Discharges/Stormwater/Stormwater-Management
- **Maine:** http://www.maine.gov/dep/land/stormwater/
- **Massachusetts:** https://www.mass.gov/info-details/stormwater-permitting
- **New Hampshire:** https://www.des.nh.gov/water/stormwater
- **New York:** https://www.dec.ny.gov/chemical/8468.html
- **Rhode Island:** https://dem.ri.gov/environmental-protection-bureau/water-resources/permitting/stormwater-permitting
- **Vermont:** http://dec.vermont.gov/watershed/stormwater

Stormwater Resources & Guides

U.S. EPA Stormwater Phase II Final Rule Fact Sheet Series –
https://www.epa.gov/npdes/stormwater-phase-ii-final-rule-fact-sheet-series
A series of 14 fact sheets covering the small MS4 program, minimum control measures, and permitting.

Urban Runoff: Model Ordinances to Prevent and Control Nonpoint Source Pollution –
https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/urban-runoff-model-ordinances-prevent-and-control-nonpoint
Provides the necessary information needed to develop effective resource protection ordinances, including aquatic buffers, erosion and sediment control, open space development, stormwater control operation and maintenance, illicit discharges and post construction controls.

U.S. EPA Soak Up the Rain - Soak Up the Rain

U.S. EPA Stormwater Retrofit Manual

Massachusetts Stormwater Handbook https://www.mass.gov/guides/massachusetts-stormwater-handbook-and-stormwater-standards

New Hampshire's MS4 Resources Website https://www.nhms4.des.nh.gov/

NHDES Road Salt and Water Quality Factsheet - Road Salt and Water Quality

Low Impact Development (LID) Center –http://www.lowimpactdevelopment.org/

EPA Urban Runoff LID https://www.epa.gov/nps/urban-runoff-low-impact-development

EPA Using Local Codes to Facilitate LID https://www.epa.gov/sites/default/files/2021-06/documents/lid_fact_sheet_codes_june_2021_508.pdf

Model LID Bylaws Massachusetts & Maine DEP Model Ordinance

Green Infrastructure EPA Green Streets Handbook **&** EPA CBP3 Financing Toolkit

Greening In Place: Protecting Communities from Displacement - Appendix: How to Implement

Federal and State UIC Programs

- **U.S.EPA:** https://www.epa.gov/uic
- **U.S. EPA Region 1**: https://www.epa.gov/uic/underground-injection-control-epa-region-1-ct-me-ma-nh-ri-and-vt
- **U.S. EPA Region 2:** https://www.epa.gov/uic/underground-injection-control-epa-region-2-nj-ny-pr-and-vi
- **Massachusetts:** https://www.mass.gov/service-details/description-of-uic-regulations-and-registration-requirements-including-wells-installed-by-public-water-systems
- **Maine:** http://maine.gov/dep/water/wd/uic/index.html
- **Rhode Island:** http://www.dem.ri.gov/programs/water/permits/gwd-uic.php
- **Vermont:** http://dec.vermont.gov/water/underground-injection-control

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