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Advancing U.S. Drinking Water Security and Resiliency

Program Design
for
H.R. 1579 Secure and Resilient Water Systems Act

MPA in Environmental Science and Policy
Fall 2017

H.R. 1579: SECURE & RESILIENT WATER SYSTEMS ACT

Fall Workshop in Applied Earth System Management

Final Report

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November 2017

Executive Summary

Since 1974, public water supplies have been regulated by the EPA under the Safe Drinking Water Act (42 U.S.C. §300f et seq. (1974)). This federal law was passed at a time of increasing environmental awareness and concern around chemical contamination of drinking water. The Safe Drinking Water Act was last amended in 1996, even though there has been growing public and scientific concern about new and emerging threats ever since. Over the past couple of years, disasters have sounded the alarm on the need to assess and address the vulnerabilities of public water systems. The aftermath of Hurricane Sandy, the lead contamination in Flint, Michigan and other recent events have been turning the public's attention toward the effects of climate change, degrading infrastructure, cyber attacks and unregulated chemical contamination from industrial and agricultural activity on drinking water supplies.

H.R. 1579: The Secure and Resilient Water Systems Act was proposed in March 2017 as an amendment to the Safe Drinking Water Act, attempting to bridge the gap between the existing legislation and address emerging environmental concerns that leave community water systems vulnerable. By introducing a structured mechanism for vulnerability identification, mitigation plan production and knowledge sharing across levels of government, H.R. 1579 seeks to improve community water system resiliency and security.

In this report, we outline our recommended program design for implementing the Secure and Resilient Water Systems Act. The Act establishes four main objectives for meeting its goal: developing guidelines, conducting vulnerability assessments, creating protection plans and offering federal technical and financial assistance. To best meet community water system needs and ensure long-term program success, we opted for a bottom-up design approach that incorporates stakeholder feedback. We believe that prioritizing engagement will increase community water system compliance and further reduce community water system vulnerability.

Our program design focuses on the first year of implementation. All operational aspects including budgeting, staffing and performance management are presented in this report.

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Introducing H.R. 1579: Secure and Resilient Water Systems Act

Community Water Systems

Drinking water in the U.S. is primarily delivered through public water systems, which are systems that serve over 25 people. These systems can be of public or private ownership and are all regulated by the EPA to ensure that the U.S. has one of the safest drinking water systems in the world. Public water systems are categorized into community water systems and non-community water systems (composed of transient & non-transient) (Figure 1). A community water system is any public system that provides water to a group of at least 25 people year-round. There are currently more than 52,000 community water systems in the United States, which serve around 88% of the population. This means that the tap water for more than 286 million Americans comes from community water systems (CDC, 2014). Community water system management is inherently full of challenges, as these systems differ considerably in size, staffing and needs. In addition, due to the large number of existing systems, it is often the case that they are underfunded and understaffed. Regulating, monitoring and ensuring the orderly operation of community water systems is an integral part of maintaining human health.

80% of the population
served by community water systems

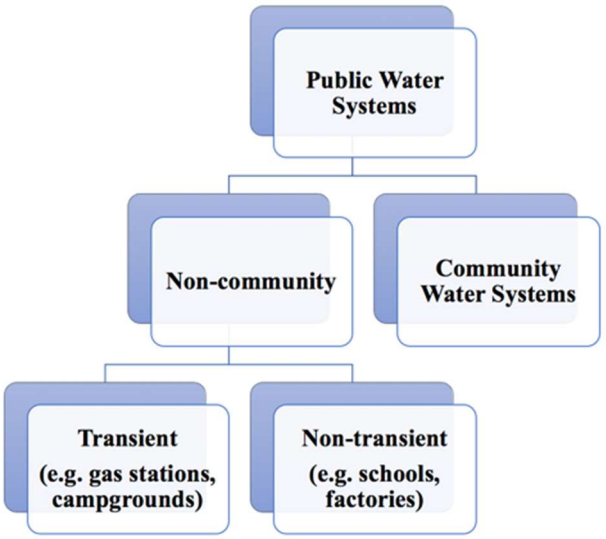


Figure 1. Categorization of Public Water Systems

The Legislation

The Safe Drinking Water Act has been vital for securing our water infrastructure and ensuring that all communities have access to clean drinking water. However, the Safe Drinking Water Act was introduced in 1974 and lacks the power to account for emerging and evolving challenges that threaten America's critical water infrastructure now and in the future. As an amendment to the Safe Drinking Water Act, H.R.1579: The Secure and Resilient Water Systems Act, seeks to address emerging threats in addition to mitigating existing threats to community water systems (Library of Congress, 2017).

H.R.1579: Secure and Resilient Water Systems Act is an amendment to the Safe Drinking Water Act

Key Provisions

HR: 1579: The Secure and Resilient Water Systems Act (SRWSA) seeks to address both human-caused and natural threats to drinking water systems. More specifically, the bill encourages the assessment and mitigation of four key threats:

1. The impacts of industrial pollution and agricultural runoff, including the highly contentious activities of hydraulic fracturing;
2. Intensifying climate change that poses a risk to the resiliency of drinking water systems and the availability of freshwater sources;
3. Intentional acts of sabotage, both physical and cyber-attacks that can compromise the functionality of drinking water infrastructure itself or the safety of the public water supply; and
4. Infrastructure degradation, which refers to the deterioration of the water delivery system and affects the quality and quantity of drinking water.

This bill is unique in that it focuses on both the mitigation of current issues as well as the prevention of future vulnerabilities, with an end goal of achieving long-term solutions. It requires community water systems to submit a Source Water and Distribution System Vulnerability Assessment to the EPA. With 88% of the population depending on community water systems for their drinking water, it is essential that policymakers continue to protect the water infrastructure that so many are dependent upon (EPA, 2004).

Technical Assistance and Grants

The Secure and Resilient Water System Act calls for the allocation of $50 million for each fiscal year of the 5 years outlined in the bill, for a total of $250 million that is subject to appropriation. Our implementation plan reserves most of the $250 million to go towards grants for community water systems with only a small amount being used to cover the costs of implementation of the program. The EPA Administrator is responsible for allocating these grants to community water system owners and operators to assuage implementation costs. However, these grants cannot exceed 50% of any activity's entire cost.

$250 million
the amount of money subject to appropriation over a 5 year period

The bill suggests that the highest priority for grant awards should be given to community water systems that are at the "greatest and most immediate risk". Additionally, the EPA Administrator must give a greater priority to community water systems whose protection plans:

- Improve efficient water usage
- Develop approaches that parallel the natural hydrological cycles
- Reduce runoff and flooding by protecting ecosystem functions
- Replace current community water system infrastructure as a response to changing hydrological conditions
- Improve water quality and/or quantity
- Protect water supply, water quality, and/or natural ecosystems
- Reduce water demand, and/or
- Increase flood protection

H.R. 1579 – Section (3)(A): Water Systems at Greatest and Most Immediate Risk

The bill authorizes the EPA Administrator to prioritize which community water systems will receive funding. The bill does not specifically define the terms. Therefore, it allows the EPA to interpret and evaluate risk based on the combination of threats identified in the bill.

One method the EPA can utilize in their selection process is an aggregate score system. For instance, the term "greatest" may take into consideration the size of the population served, the severity of each identified threat and the system's budget, staffing, and available resources. The term "most immediate" may take into account the nature of the threats, the rate of aggravation and time constraints. For example, a community water system facing lead contamination due to corroding infrastructure will be prioritized against a system that is projected to face freshwater shortages due to climate change in 20 years. Depending on how the EPA decides to define the terms, a process will need to be established through which each criterion will be weighted, and ultimately community water systems with the highest aggregated vulnerability score will be prioritized.

There are other selection methods the EPA may choose to utilize. Ultimately, the procedure they choose should reflect an established terminology and it must be applicable to all community water systems.

The Need for Legislation

The necessity of strengthening the resiliency of community water systems was underlined by the events following Hurricane Katrina in 2005 (Van Leuven, et al., 2011). Failing to identify and address the vulnerabilities of water infrastructure to intensifying climate change and lacking the proper emergency response plans exacerbated the impact of Hurricane Katrina to public water systems, leading to significant damages that could have otherwise been averted or at least attenuated. The EPA estimated that 1,220 water systems in Louisiana (Figure 2), Mississippi and Alabama were unable to operate due to power loss, including water treatment plants and drinking water systems. In New Orleans, water remained unsafe to drink even after power was restored due to contamination and inadequate pressure caused by damage in the water pipelines (Renda-Tanali & Harrald, 2016). New Orleans's water infrastructure was built more than 75 years ago, and despite regular flooding since the city's formal establishment in 1718, emergency response plans and aging infrastructure replacement plans were inadequately implemented (Renda-Tanali & Harrald, 2016). This is only one example that underscores the need for community water systems to identify and proactively address their vulnerabilities, including among others infrastructure maintenance.

Figure 2. Damaged water tower in Louisiana

1,220
the number of water systems impaired from Hurricane Katrina in Louisiana, Mississippi and Alabama

Like many key pieces of federal legislation, SRWSA also faces funding challenges. In 2000, the Water Infrastructure Network (WIN) estimated that drinking water and wastewater systems spend $23 billion per year on average for infrastructure. However, this amount represents only half of the amount needed since they require another $23 billion to replace aging facilities and comply with existing and future water regulations (Gasteyer, 2010). Small community water systems may be more disadvantaged than larger systems because they lack the economies of scale of larger systems and are more strained to meet requirements such as enforcing stricter maximum contaminant levels. In essence, these community water systems have fewer financial options due to a lack of a commercial revenue stream, and this situation is exacerbated by their lack of the necessary technical capacity to address new regulatory changes (Gasteyer, 2010). Thus, this bill also seeks to bridge this gap by not only identifying the most vulnerable community water systems, but also providing the technical guidance and financial assistance for the most challenged communities. Although this bill has a strong foundation, it does come with significant challenges.

48,020
the number of very small, small and medium community water system

53 million
the number of the people in the U.S. served by very small, small and medium community water systems

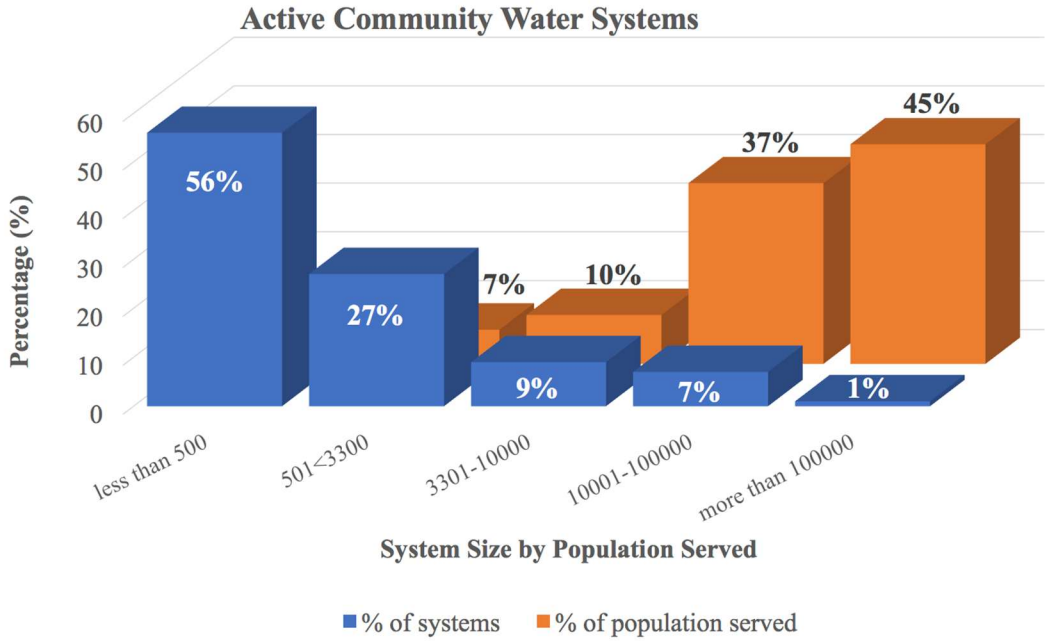


Figure 3. ***Although serving only 19% of the U.S. population, 92% of community water systems are very small, small and medium in size*** *(each serves less than 10,000 people). These systems often face underfunding and understaffing, leaving them unable to meet EPA drinking water quality requirements.*

Impacts of Hurricane Katrina on New Orleans's Water Infrastructure

Inundation of the city of New Orleans in the aftermath of Hurricane Katrina in 2005 (Credits: Marty Bahamonde/FEMA)

Although some parts of New Orleans's water systems did not experience interrupted service during Hurricane Katrina, other parts were severely affected, especially the central portion of the city. In addition to electrical impairments which deactivated the pumping systems, both drinking water facilities and water treatment plants experienced flooding and disconnection to distribution lines (Copeland, 2005). Even after power was restored, water remained unsafe to drink due to contamination and delivery issues persisted because of inadequate pressure in the damaged pipelines (Renda-Tanali & Harrald, 2016). The city's two largest drinking water plants were located in the areas that experienced the worst flooding. As a result, the plants remained completely underwater for almost two weeks. After two weeks of immediate repairs, only 30% of the affected drinking water was restored (Renda-Tanali & Harrald, 2016). Overall, the estimated cost of repairing and replacing the damaged water infrastructure amounts to $2.25 billion (Copeland, 2005).

The levee system played a critical role in exacerbating the disaster, and it should have warranted more attention due to two factors. First, much of the city is located below sea level. Second, Louisiana's wetlands have been eroding at more than 25 square miles a year due to settlement and poor land management practices, which increasingly weakens this natural flood buffer (Renda-Tanali & Harrald, 2016). This combination of insufficient preparedness and overreliance on the levee system contributed to a catastrophe that could have been mitigated though proper planning.

As mentioned, the main goal of the SRWSA is to encourage community water systems to assess and address vulnerabilities across emerging threats. However, if not implemented correctly, it could have the opposite effect. Out of the more than 52,000 community water systems across the country, 48,020 are medium to very small community water systems that serve communities with fewer than 10,000 people, totaling almost 53 million people annually across the U.S. (EPA, 2008). While that accounts for only 19% of the population, these community water systems are often the ones with the fewest staff and the smallest tax bases. Since many small-town budgets are already struggling, yet another regulation could be seen as burdensome, not helpful.

52,000
the number of community water systems

During implementation it will be important, though complex, to incorporate input from community water systems and stakeholders. Through communication with community water system operators or experts in the field, EPA staff will have to effectively balance the needs of diverse and geographically diffused systems in order to effectively implement the SRWSA. This runs the risk of catering to some community water systems over others or being too broad so that it is inapplicable to most systems. One of the most important goals of the SRWSA is the implementation of vulnerability assessments, which will require technical assistance to the most under-resourced and under-staffed community water systems. The EPA's challenge will lie in the dissemination of technical assistance appropriate for the challenges, varied regions and capacities of each system, likely with the help of the EPA Regional Offices. This will be a technical and managerial challenge for the EPA: assessing who needs what, where and how to get it to them.

Diverse & geographically diffused systems
present a significant challenge to implementation

It will be up to the EPA and its staff to seek the input of community water systems and other stakeholders, garner buy-in for the process, and ensure that this bill truly addresses the needs and threats facing drinking water in the U.S. today.

Challenge Accepted – A Participatory Program Design

The sheer number of people served by community water systems underlines their centrality to safeguarding public health. However as discussed above, implementing a federal program to reduce their vulnerabilities will be a challenge because of the heterogeneity of these systems in size, organizational structure and financial capacity.

The proposed program design was created with these challenges in mind. It has been constructed in a way that seeks to assist the most vulnerable community water systems and include them in the process. The program design provides an iterative development process, focused on stakeholder engagement and participation, to incorporate feedback and create a program that is responsive to the specific needs of the respective community water system. Increased stakeholder engagement will enable the aggregation and dissemination of best practices, improve compliance and allow for efficient communication between federal, state and local governments. The program design is also flexible, so that it can be adhered to diverse community water systems.

The bill outlines four phases of the program that will span over five years (Figure 4). The first phase, guidelines and outreach, needs to be completed within 12 months of the bill's enactment and includes publishing guidelines to inform community water systems about the vulnerability assessment and protection plan criteria. The second phase, vulnerability assessments, needs to be completed within 24 months, focused on the four threats outlined in the bill. Next, the protection plans will be submitted to the EPA within 4 years. The fourth and final phase includes grants and financial planning and must be completed within 5 years. The prioritization of funding will be key in this milestone. The process will restart every five years when the EPA will review and make modifications to the guidelines to update (see Appendix 1 for more details).

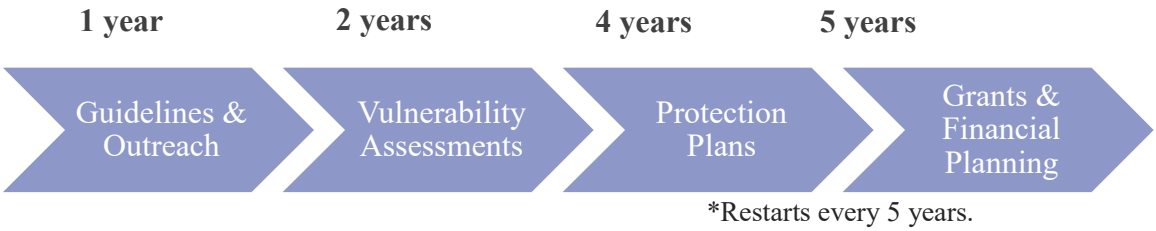


Figure 4. Five-year plan and timeline

Challenge of the Program Design

As shown in Figure 3, 56% of community water systems are small systems serving less than 500 people. These are oftentimes the systems that have been facing severe financial restrains and have been neglected over long periods of time. Although the small community water systems serve a mere fraction of the total U.S. population, it is a matter of equity and fairness to ensure that they are functioning properly, since many of the communities served by these systems are already under financial pressure. Therefore, one of the primary challenges in this bill is the fact that a significant number of community water systems are underfunded and lack both the technical expertise and infrastructural capacity to have a secure and resilient system. For this reason, the program design that we have developed adheres to community water systems of all sizes, focusing on smaller systems which tend to be overlooked because they do not serve as many people. In this program design, prioritization of the vulnerability assessments and protection plans will determine which system gets access to the grants, irrespective of their size.

A challenge of the program design is the number of community water systems that need to undergo implementation. In addition, this entire process of creating guidelines, protection plans, and obtaining grants, is very time-consuming and costly. Maximizing stakeholder outreach and ensuring that every stakeholder's voice is being heard, providing access to technical assistance tools, processing vulnerability assessment data in a productive manner and prioritizing grant allocation to the most vulnerable systems in a just, transparent way are all additional challenges of the program design. Nonetheless, this program design is one that involves stakeholders, increases compliance, and reduces management needs on a greater scale due to outreach.

Case study – Georgia drinking water supply threatened by climate change

A case study in the Apalachicola-Chattahoochee-Flint River Basin in Georgia shows the importance of planning for water availability, as increasing annual temperatures are leading to a decrease in the available freshwater supply (Carter, et al., 2014). The basin provides drinking water for thousands of people and extends 19,600 square miles across three states – Georgia, Alabama and Florida. It is predicted that the basin's hydrologic conditions will change due to increased evapotranspiration[1] rates, declining soil moisture storage and declining river flow, induced by climate change (Zhang & Georgakakos, 2011). Coupled with poor infrastructure, insufficient facilities, and lack of technical expertise this case demonstrates how a combination of different factors including climate change and infrastructure degradation may be threatening the community water systems who depend on the river basin for their freshwater supply.

The program design would approach this in a way that would maximize efficiency and ensure stakeholder involvement. The goal is to include all relevant stakeholders in this process, especially the community water systems operators and technicians. The vulnerability assessment would include all of the issues relating to each specific community water system in the three states and the tools and technical expertise needed to draft the vulnerability assessments would be supported by the EPA through online workshops and webinars. The protection plan that would be submitted to the EPA would also be personalized, perhaps by each individual state, to highlight the many issues the specific water system may be threatened by. For example, while Georgia might claim that diminishing water supply due to climate change is their primary concern, Alabama may claim that their biggest issue is relating to aging, outdated infrastructure. Based on this, the EPA would prioritize funding and potentially provide grants to the community water systems in the Apalachicola-Chattahoochee-Flint River Basin.

Program Design – Steps towards an effective solution

The Office of Water within the EPA is responsible for overseeing the development of the five-year plan, and the agency will hire private contractors to perform on the ground work for the first year of the program. In the long run, the EPA will have the expertise to independently manage the resubmission process for the new cycles.

This report focuses only on the implementation of the first year after the bill's enactment. The implementation plan utilizes a bottom-up approach focused on stakeholder engagement to incorporate feedback and create a program that is responsive to the needs of the community water systems. Increased stakeholder engagement will enable the dissemination of best practices, improve compliance and allow direct communication between federal, state and local governments. Although adopting this approach will be expensive and time-consuming, it will provide a more solid program design in the long-run. Involving different stakeholders can increase compliance and reduce community water systems vulnerabilities. This is of great importance to not only guarantee success of the first year, but also to create continuity for the program into the future.

The specific objectives of the first year include meeting the first-year milestone and creating the conditions that will allow a continued implementation in the subsequent years. The three main goals of the first year will be described in more detail in the following sections of the report (Figure 5).

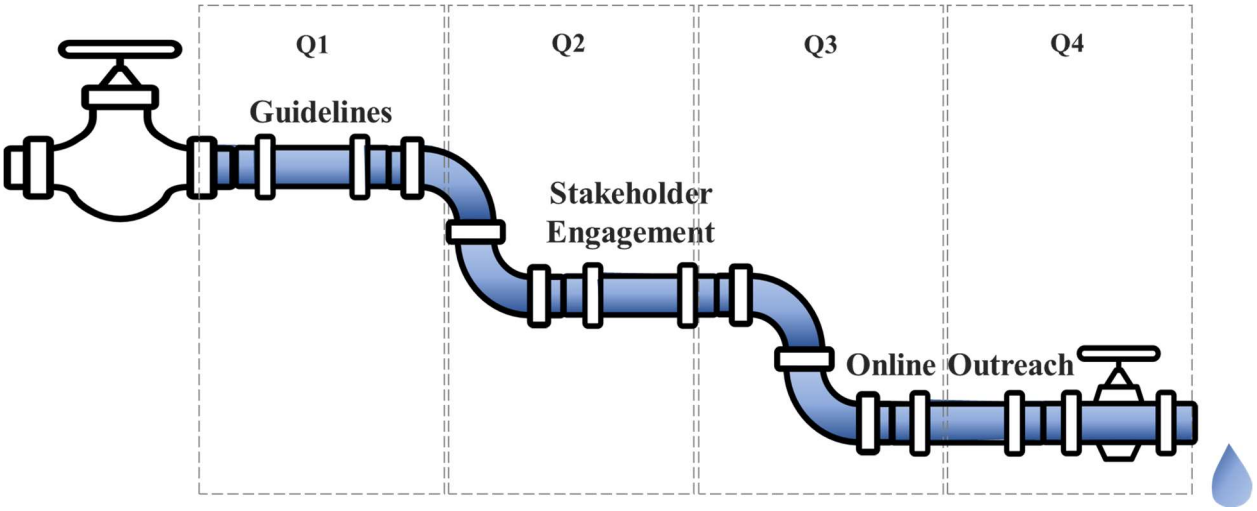


Figure 5. First Year Activities by Fiscal Quarter

A master calendar (see Appendix 2) describes a timeline with detailed tasks that will be completed during the first year of implementation. The first year SRWSA mandates have been separated into quarters and will present key tasks and respective objectives to stakeholders and internal managers. The Office of Groundwater and Drinking Water (OGWDW), under the Office of Water, will oversee the first-year steps for the implementation of SRWSA. This office is responsible for developing national drinking water standards and helping water systems implement said standards. Within this Office, departments such as the Divisions of Standards and Risk Management, Drinking Water Protection, and Water Security, will coordinate efforts to manage and advise the preliminary draft and revise the final version of the guidelines. Four full-time General Schedule (GS) EPA staff will manage and advise the outside contractor responsible for the first year's tasks. There will be a manager responsible in overseeing the entire implementation process, and three other managers that deal specifically with each objective, as shown in Figure 6 (see Appendix 4 for full staffing).

Figure 6. EPA Project Managing Staff

Most of the bill's budget is expected to be spent during the fifth year towards grants. Budgeting for the first four years was reduced as much as possible in order to be able to provide the maximum amount of grants to community water systems, as they will require financial assistance for the implementation of their protection plans. Figure 7 summarizes the budget for the five-year plan. During the first year, around 1% of the total budget will be spent, which represents approximately $2,407,720. For this year, the budget was divided between Personal Services ($655,720) and Other than Personal Services ($1,752,000). See Appendix 3 for further details on the first-year budget.

Figure 7. Five Year Financial Outlook

Guidelines Development

To ensure program success, it is essential to provide community water systems with integrated guidelines for vulnerability assessments. The guidelines should contain:

- Information about the timeline
- Information about the threats (e.g. industrial pollution/agricultural runoff, climate change, sabotage and infrastructure degradation)
- A user's guide for the vulnerability assessment software (VSAT)
- Threat prioritization criteria
- Areas of responsibility among different stakeholders
- Information on financial support for community water systems to submit the aforementioned report every five-years

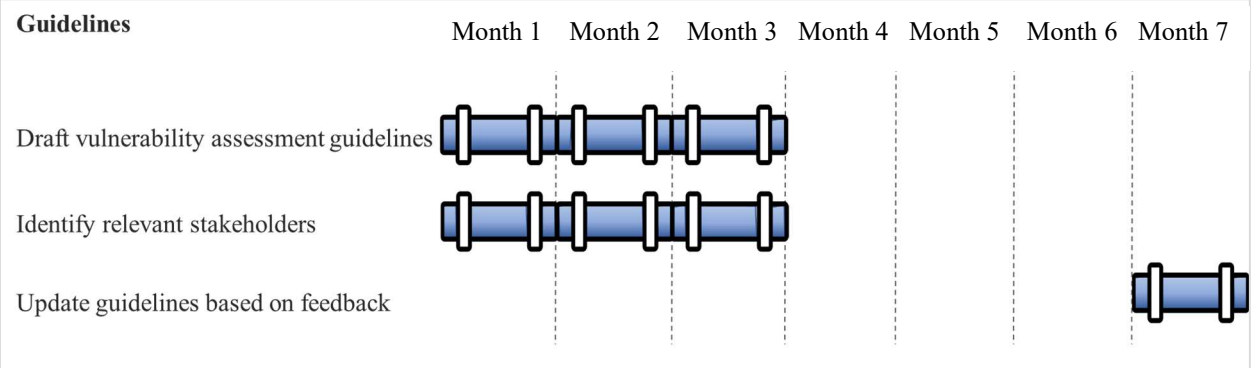


Figure 8. Guidelines Development Outcomes and Processes

The guidelines team has three months to deliver a draft version for their manager's approval. Then identified stakeholders will receive the draft and respond with their comments (see stakeholder engagement for more information). The guidelines team will review the feedback and make appropriate revisions. The final version of the vulnerability guidelines is expected to be published within nine months from the bill's enactment.

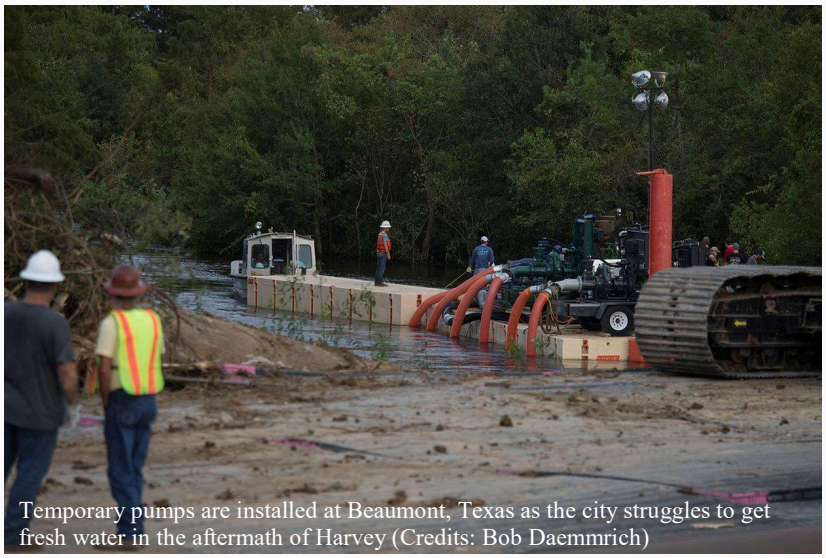
Since these guidelines will serve as the foundation for the program, their development is critical. The guidelines manager will be selected from existing EPA staff of level GS-11 in the Standards and Risk Management Division from the Office of Water. The guidelines manager will coordinate and oversee all EPA staff and contractors. A reliable contractor team with prior experience in drinking water systems will be responsible for creating and revising the guidelines. An ideal contractor team is expected to have at least one specialist and two analysts, however, the contractor will have the ability to reorganize the team according to the budget (Falk, 2012).

Major expenditures for this portion of the program are concentrated in the area of personnel and contracting fees (see Appendix 3). We estimate that EPA staff salary will be $175,000 with fringe benefits in the first year. The budget for contracted support is estimated at $1.4 million for the first year, based on past cases and published price lists (US Office of Personnel Management, 2017) (US EPA, 2017) (Abt Associates, 2013). As mentioned, the contractor is free to select qualified

members for the guideline team beyond what's suggested (see Appendix 3). Potential operational expenditures are included in "other than personal expenses" (see Appendix 3).

The first three to four months are crucial regarding the following three tasks: completion of the bidding process for a contractor, finalizing cooperation details and delivering the draft of guidelines. Overall, the most important indicator for performance is to publish the finalized guidelines so that community water systems can begin to test systems for vulnerabilities using the updated VSAT tool.

Hurricane Harvey: Beaumont's water supply failed



Temporary pumps are installed at Beaumont, Texas as the city struggles to get fresh water in the aftermath of Harvey (Credits: Bob Daemmrich)

In late August, tropical Storm Harvey caused severe flooding throughout the city of Beaumont, Texas. Approximately 118,000 people were left without drinking water after floods disabled the city's system. For most of them, there was no easy way out of a town that now felt like more of an island (Frankel, et al., 2017). Rising water in the Neches River took out the city's main water pumps, and the mayor couldn't give a timetable for when officials expect the water system to be back in service (Chang & Herrera, 2017). As a result, the citizens could not access clean drinking water, and were exposed to floodwaters containing E. coli, chemicals and other contaminants.

After the crisis, local and state governments focused on getting interim financing to restore water treatment facilities. While the expedited loan funding for Harvey-related water projects could be used for long-term stormwater resiliency projects, most of the funding will be used on near-term restoration. Trump's proposed budget called for a $667 million cut to state and local Federal Emergency Management Agency grant programs that focus on long-term disaster preparation, reducing the ability of community water systems to mitigate the impacts of natural disasters.

After SRWSA is enacted, communities would have access to grant funding during times when there is not a disaster or crisis, enabling long-term planning and prevention. Using the SRWSA guidelines would better prepare community water systems like Beaumont to plan for future weather events of this scale and better protect their drinking water systems. Beaumont would be able to use SRWSA funding for large-scale infrastructure projects (Riordan, 2017) to mitigate future vulnerability to hurricanes.

Stakeholder Engagement

The linchpin holding together the intentions of the vulnerability assessment guidelines and their successful implementation is stakeholder engagement. Stakeholders, including EPA Regional Administrators, private water utility managers, and state water board agents understand the vulnerabilities that their respective community water systems are subject to and how to best apply vulnerability assessment guidelines to their community water systems. Stakeholders have the knowledge to identify gaps between the proposed guidelines and application of those guidelines. That is why stakeholder involvement in formulation of the guidelines via questionnaires on the preliminary version and stakeholder education of the final guidelines via webinars are vital to the first-year plan of the bill.

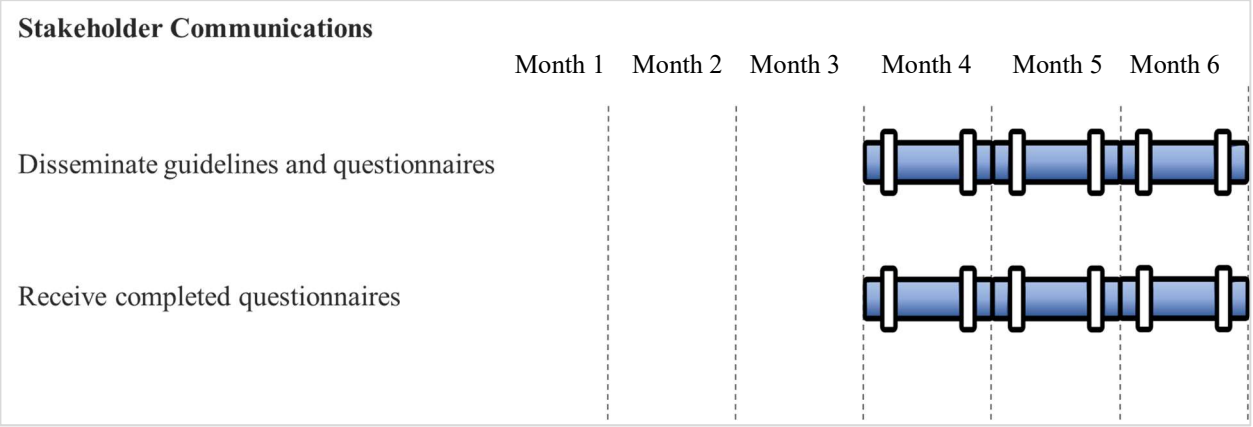


Figure 9. Stakeholder Communications Outcomes and Processes

Stakeholder engagement will be managed by the EPA Communications Manager, likely at the GS-11 level, who oversees a contractor team that specializes in stakeholder communications and education (Appendix 4). The Communications team will be responsible for working with the Communications Manager to identify relevant stakeholders, draft questionnaires that will elicit stakeholder feedback, send out questionnaires and receive completed ones, and create effective education tools in coordination with contracting staff that stakeholders can use to understand the updated guidelines (see Appendix 2 for more detail on tasks).

Performance management metrics will ensure that the guidelines are designed with community water system input. Performance management metrics within the second quarter

of the program include sending out at least 40 guideline questionnaires, working to have 80% response rate to questionnaires by community water systems, and processing the questionnaire feedback as a comprehensive deliverable that the Guidelines Team can utilize to update the guidelines (see Appendix 5.1 for more detail).

Stakeholder Engagement in the San Joaquin Valley

Stakeholder input is critical, particularly for small community water systems that do not have the financial infrastructure to overcome their vulnerabilities. In the midst of California overcoming a drought there were many vulnerable community water systems due to contaminants like arsenic, uranium and nitrate in the San Joaquin Valley where 58 small and rural counties are impacted (Leslie, 2017). It is estimated that up to 1 million Californians are drinking water that is not properly treated. In this case, stakeholder input is critical because when community water boards become involved, as in the case of the San Joaquin Valley, pressure can be applied to other stakeholders such as the state government. This manifested itself in California when Latino activists campaigned for increased water rights throughout the state, and Governor Jerry Brown ultimately signed legislation to make the state of California officially recognize clean, affordable and accessible water as a right (Leslie, 2017). Additionally, the state passed Senate Bill 88 in 2015 that allowed the State Water Resources Control Board to consolidate bad water systems for more resources in order to provide more adequate drinking water (Leslie, 2017). Although the engagement process is different, this combination of stakeholders including citizens, water boards and state actors is exactly the dynamic action that is envisioned in garnering stakeholder participation in the first year of the program design.

Online outreach

One of the most significant challenges in discussing community water system engagement is creating greater public awareness of the interdependence between the environment, the economy and community life. Cooperation between public agencies, non-profit organizations and the private sector can create compelling messages and materials to improve public understanding of the drinking water related issues and the planning process. These materials facilitate conversations between stakeholders and encourage them to share common ideas or different perspectives, so the contents are specific to each community water system and are based on the actual experiences of local people, organizations and the government.

The information technology (IT) department of the EPA plans, operates and supports the organization's IT infrastructure which enables the staff to carry out their roles in an efficient and secure manner. In addition to the internal network support and information security management, the IT department also oversees

the contracted IT developers and is responsible for updating the VSAT software.

The first stage of the program requires the IT department to review the report which summarizes the areas for improvement from the Guidelines department. Then, the IT Department communicates with the contracted IT developers to design and replace the old features of the VSAT software with updated features based on the outline vulnerabilities and feedback from the stakeholders.

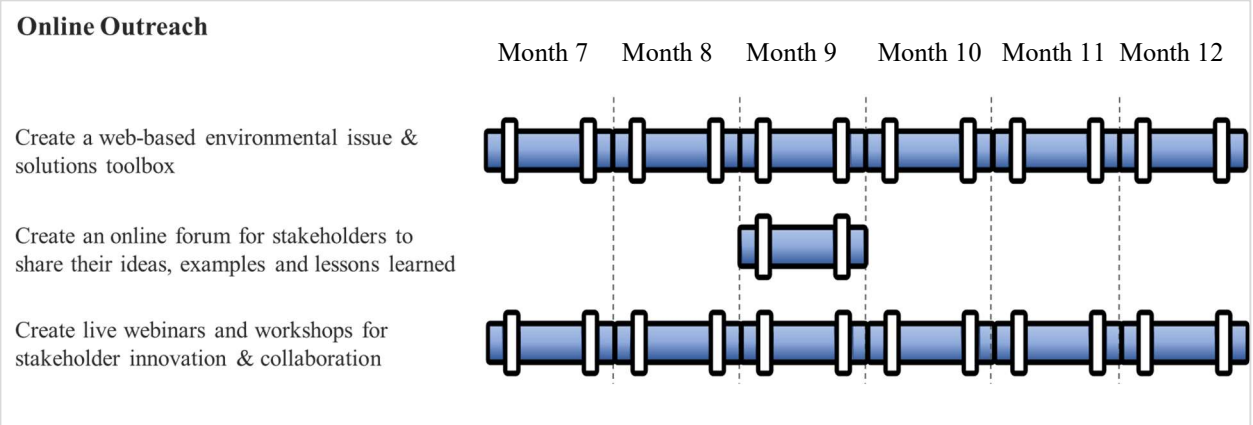


Figure 10. Online Outreach Outcomes and Processes

After receiving the updated software, the IT department will test the new software system and assess areas for further improvement or adjustment. The IT Manager is in charge of reviewing and approving the updated VSAT software following completion of updates. This process is expected to be finished in six months and total budget for contracting is estimated through price lists provided by GSA while the program manager is flexible to alter the team structure to generate the best outcome within the assigned budget (see Appendix 2 for additional information).

In addition to modifying the VSAT program, the IT department will collaborate with the contracted staff to ensure that the online outreach materials are functional and accessible. To promote stakeholder participation, the EPA will create outreach materials to educate community water system operators on how to comply with the bill. These materials will include tutorial videos and online webinars to be accessed by stakeholders and community water systems at large. These will be accessible by the tenth month of the program. These costs fall under "Other than Personal Services" in the project budget (Appendix 3). Associated costs include webinar development, a platform fee and technical support. Platform fees vary depending on the size of the audience but most online conferencing services provide the option of a monthly or annual charge (ConferTel, 2010) which allows for unlimited sessions. Since the EPA hosts webinars regularly, annual webinar fees are already included in their overall budget. However, additional tech support and bandwidth are likely to be needed. For this reason, an

additional $1,000 fee for every event is included in the budget. Most platforms underperform when the audience exceeds 1,000 individuals, (Hanks, 2016) so we recommend the EPA holds 54 webinars with a maximum of 1,000 participants per webinar. The initial construction fee for a webinar is estimated to be $6,000 (Bandy, 2014).

The VSAT Explained

The Vulnerability Self-Assessment Tool, known as the VSAT system, was created by the US EPA in 2003 to help community water system conduct risk assessments for drinking water (or wastewater) utility of all sizes to improve their resiliency and security. It is a web-based tool that is designed for mobile devices, which is very convenient for community water system staff to gather data when they are in the field (US EPA, n.d.).

The VSAT tool is helpful for community water systems for the following reasons:

- It's easy to gather, import and analyze data.
- All community water systems servicing over 3,300 people have a version of VSAT, but it doesn't include industrial pollution and agricultural runoff, climate change, and infrastructure degradation as threats.
- Contains comprehensive lists and categories of risk assessment, government regulations and emergency response requirements.

Utilizing the VSAT online tool will enable community water systems to have a standardized approach for evaluating their respective vulnerabilities. This will enable comparisons both between community water systems throughout the US and in each community water system over time. Additionally, the VSAT tool will help community water systems ultimately create protection plans that are based on data, increasing their likelihood of addressing critical community water system threats.

Conclusion

Community water systems all around the U.S. are exposed to diverse and changing threats. Their ability to cope, plan and protect their operations well into the future largely depends on the size of community water system staff as well as their financial and technical resources. HR 1579: The Secure and Resilient Water Systems Act ventures to address these vulnerabilities and provide a framework for regulating, monitoring and assisting community water systems of all sizes to face current challenges and prepare for future ones. We hope that by forcing EPA Administrators, community water system operators and all involved actors to have a hard look at the existing vulnerabilities, the impact of this legislation will extend out of the four threats outlined in the bill. That is precisely why communication, information sharing and cooperation are the central components of our proposed program design. Does the bill provide a complete solution? It would be naive to claim so. However, the Secure and Resilient Water Systems Act is integral in driving federal attention on the issues surrounding the safety and security of the most precious public good, drinking water.

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Appendix 1 – Five Year Program Stages

The following table presents the four main milestones described by H.R. 1579: Secure and Resilient Water System Act.

Milestones	H.R.1579 Proposal	Years from Enactment
Technical Assistance	The EPA shall establish guidelines for the development of vulnerability assessments and protection plans by each community water system (CWS).	1
Vulnerability Assessments	Each CWS shall submit to the EPA a source water and distribution system vulnerability assessment. A review and resubmittal is required every 5 years.	2
Protection Plans	Each CWS shall submit to the EPA a source water and distribution system protection plan. A review and resubmittal is required every 5 years.	4
Grants	The EPA will implement the "Drinking Water Infrastructure Resiliency and Sustainability Program" to award grants in each fiscal year (2018-2022) to CWS. The EPA shall submit to Congress, every 3 years, a report on the progress of this section, including information on applications received and funded.	5

Appendix 2 – Master Calendar

Tasks	Status	1st Quarter		
		Jan	Feb	March
Identify existing applicable vulnerability assessment guidelines	Completed			
Establish areas of responsibility	Completed			
Assess gaps in existing guidelines	Completed			
Revise existing guidelines	In Progress			
Determine areas for CWS feedback	Overdue			
Deliver draft guidelines to Guidelines Manager	Overdue			
Compile list of CWS administrators	In Progress			
Identify relevant private entities	In Progress			

Tasks	Status	2nd Quarter		
		Apr	May	Jun
Create questionnaire for CWS feedback	Not Started			
Create material to explain guidelines to CWS for questionnaire	Not Started			
Send out questionnaires	Not Started			
Send out reminders for questionnaires	Not Started			
Review questionnaires feedback	Not Started			
Deliver actionable feedback	Not Started			

Tasks	Status	3rd Quarter			4th Quarter		
		Jul	Aug	Sept	Oct	Nov	Dec
Analyze questionnaire responses	Not Started						
Summarize the results	Not Started						
Revise the guidelines	Not Started						
Deliver updated guidelines for approval	Not Started						
Deliver areas of improvement for existing assessments to IT	Not Started						
Replace old VSAT features	Not Started						
Test software for improvements	Not Started						
Get software approval from IT manager	Not Started						

Tasks	Status	3rd Quarter			4th Quarter		
		Jul	Aug	Sept	Oct	Nov	Dec
Create an online toolbox for CWS	Not Started						
Create series of tutorial videos for water source protection	Not Started						
Create an online forum for stakeholders to communicate and share ideas	Not Started						
Create live webinars and workshops for stakeholders	Not Started						

Appendix 3 – First Year Budget and Tasks

The following table presents the budget for the first year plan.

FY 2018	Q1	Q2	Q3	Q4	Total
Personal Services					
EPA staff (1.5 FTE)	$ 130,000.00	$ 130,000.00	$ 130,000.00	$ 130,000.00	$ 520,000.00
Fringe benefits	$ 33,930.00	$ 33,930.00	$ 33,930.00	$ 33,930.00	$ 135,720.00
Total	**$ 163,930.00**	**$ 163,930.00**	**$ 163,930.00**	**$ 163,930.00**	**$ 655,720.00**
Other Than Personal Services					
Technology	$ 6,000.00	$ -	$ 27,000.00	$ 27,000.00	$ 60,000.00
Consulting fees	$ 300,000.00	$ 300,000.00	$ 450,000.00	$ 450,000.00	$ 1,500,000.00
Miscellaneous	$ 48,000.00	$ 48,000.00	$ 48,000.00	$ 48,000.00	$ 192,000.00
Total	**$ 354,000.00**	**$ 348,000.00**	**$ 525,000.00**	**$ 525,000.00**	**$ 1,752,000.00**
Total	**$ 517,930.00**	**$ 511,930.00**	**$ 688,930.00**	**$ 688,930.00**	**$ 2,407,720.00**

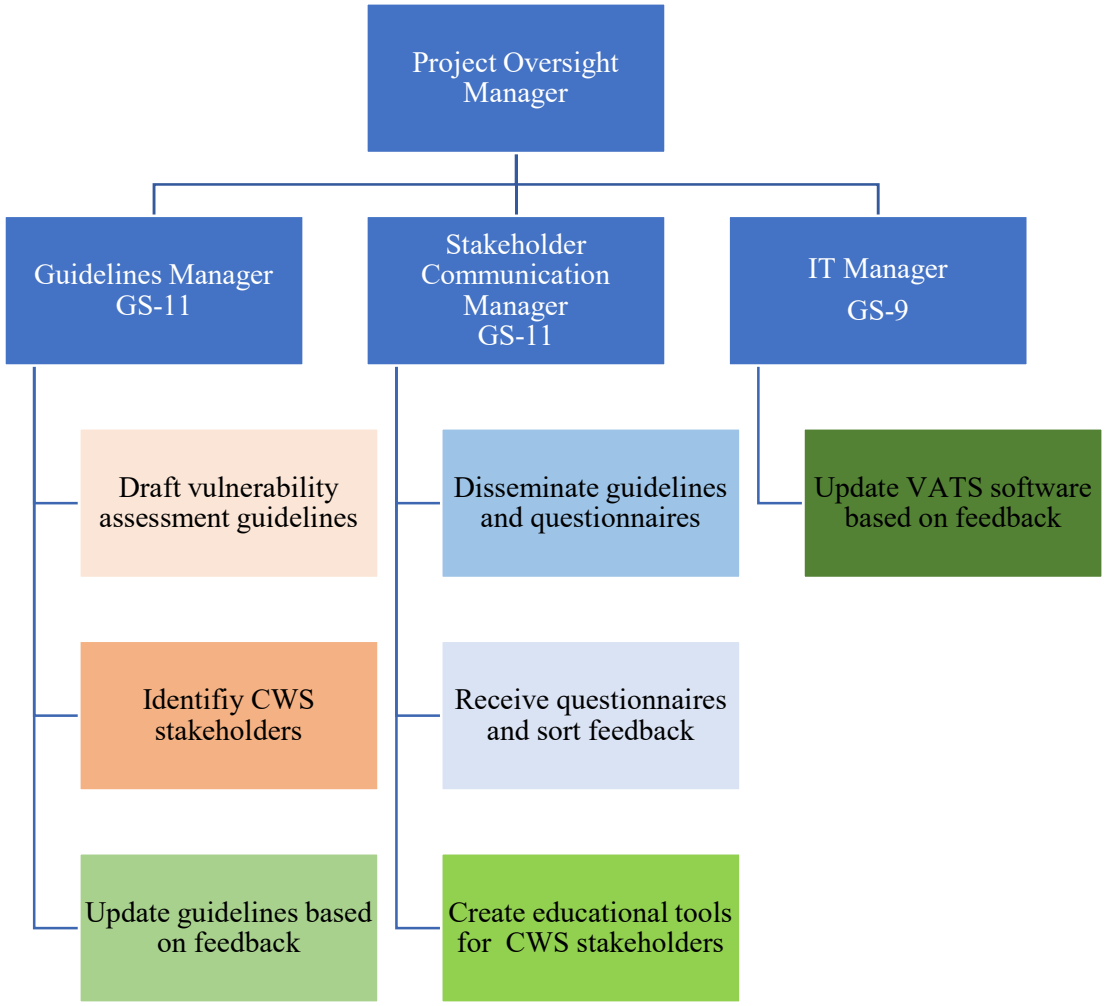
Appendix 3.1 Contracting team staffing estimate

Staff Expenditure	Quantity (#)	Labor rate ($/h)	Hours (h)	Subtotal ($)
Environmental Specialist	1	$307.79	1440	$443,217.60
Environmental Analysts	2	$138.30	2400	$331,920.00
Research Assistant	2	$73.23	2080	$152,318.40
Interns	8	$7.25	14080	$102,080.00
Environmental Programmer	1	$129.44	320	$41,420.80
IT Developer	2	$126.54	2400	$303,696.00
Total				**$1,374,652.80**

Appendix 3.2 Contracting team task details

Task	Months	Hours	Specialist	Analysts	Assistants	Programmer	IT Developers	Interns
Draft preliminary vulnerability assessment guidelines	4	640	0.5	0.5	0.5			1
Identify relevant CWS stakeholders to engage	4	640		0.5				1
Disseminate guidelines and questionnaire to identified CWS stakeholders to get feedback on guidelines	2	320		0.5	0.5			1
Receive questionnaires and sorts for feedback	2	320			0.5			2
Incorporate questionnaire feedback and update guidelines	5	800	0.5	0.5	0.5			1
Update VSAT software to accommodate feedback	5	800					1	1
Create educational tools for roll-out and schedule webinars and workshops for CWS stakeholders	5	800				1	1	1
Total FTE			**1**	**2**	**2**	**1**	**2**	**8**

Appendix 4 – EPA Project Managing Staff



Appendix 5 – Performance Management

Appendix 5.1 EPA Guidelines performance management indicators

Indicator of success	Measurement and collection	Reporting and feedback
At least 40 relevant CWS stakeholders identified, including 2 from every EPA region in the first four months.	EPA and contractors will identify CWS stakeholders from all EPA regions and contact them at the start of the process. This contact list will be used for the rest of the process.	The reporting will be done to the Guidelines Manager, who will provide feedback.
40 questionnaires sent out to CWS and other stakeholders between the fifth and sixth months.	Online questionnaires will be sent out by the contractor to stakeholders with a time limit of 3 weeks to answer them. Reminders will be sent out every week.	The questionnaires will be collected and then sent to the Stakeholder Communication Manager who will provide feedback.
80% of questionnaires returned from stakeholders by the seventh month.	The answers will be received online by the contractors, which will then be combined into relevant topics for their inclusion in the guidelines by the contractor.	The Stakeholder Communication Manager will oversee this process.
100% of the feedback processed during the first year of implementation.	Final version of the guidelines will include the feedback given by the stakeholders. A list including the feedback from the questionnaire will explain how it was incorporated into the guidelines or why it was not included.	The Stakeholder Communication Manager will ensure that the list is comprehensive and will sort the feedback.

Appendix 5.2 Prioritization of vulnerability assessments performance management indicators

Indicator of success	Measurement and collection	Reporting and feedback
Inclusion of the 4 threats in the Vulnerability Self-Assessment Tool (VSAT) by the end of the first year.	The contractor will update the VSAT including the 4 threats identified by the bill, as well as the feedback given by the questionnaires.	The Guidelines Manager will oversee feedback on VSAT inclusion. The IT Manager will update VSAT software based on the feedback.

Appendix 5.3 Outreach performance management indicators

Indicator of success	Measurement and collection	Reporting and feedback
100% of CWS relevant contacts identified by the fourth month of implementation.	The relevant contact that will be in charge of the assessments will need to be identified and included in the stakeholders list. Each CWS will be assigned a code.	The Guidelines Manager will oversee this, as they are responsible for identifying CWS stakeholders.
Development and recording of one webinar available on the EPA website by the end of the tenth month.	The webinar will be available on the EPA website for the relevant contacts to access it at any time. Each participant will be asked for their name and code so they can be marked as attended in the stakeholder list.	The Stakeholder Communication Manager will develop the webinar for the stakeholders.
Ten workshops developed, one in each region of the EPA[1] by the end of the tenth month.	Ten workshops will have to be conducted by the contractor. Each workshop will have to be done in an accessible city in each of the EPA regions.	The Stakeholder Communication Manager will be in charge of the reporting and feedback for the workshop development.
100% of CWS participating in workshops or webinars by the end of the first year.	After the conclusion of the webinars and workshops there should be more than 100% of CWS marked in the stakeholder list.	The Guidelines Manager will be responsible for tracking CWS participation in workshops or webinars.

[1] EPA (2017). *Visiting a Regional Office*. About EPA. Retrieved from: https://www.epa.gov/aboutepa/visiting-regional-office

Appendix 6 – Reality Check: The current political context of the bill

The SRWSA faces two main political challenges concerning both its passing and implementation. In order to pass, this bill[2] must win the majority of a House that is currently 55% Republican, a Senate that is 52% Republican and be approved by a Republican President (U.S. House of Representatives, 2017). To be successfully implemented, EPA staff must work to prioritize the needs of the community water systems and operators from offices often thousands of miles away. While not insurmountable, the politics surrounding the SRWSA are complex and require strategic approaches by legislators and EPA staff.

Since the Safe Drinking Water Act was passed 43 years ago with the purpose of addressing vulnerabilities to drinking water systems, some threats to drinking water systems omitted by the Safe Drinking Water Act have now emerged as politically contentious, namely hydraulic fracturing and climate change. Hydraulic fracturing is a technique developed decades ago which has only recently become economically feasible to employ at scale. It pumps sand, chemicals and water at high pressure to extract natural gas and oil that are trapped in rock deep underground. This technique has provided the U.S. with greater energy independence which has helped to boost the overall economy. However, there are remaining health and environmental concerns and hydraulic fracturing continues to be a political hot-button issue. More specifically, hydraulic fracturing has raised concerns of contamination of drinking water supplies. Hydraulic fracturing can potentially contaminate drinking water supplies either by introducing chemicals into the groundwater aquifers through fissures or due to improper disposal of the wastewater produced by the fracturing activity. The Safe Drinking Water Act does not currently regulate the disposal of the wastewater produced by hydraulic fracturing. In fact, hydraulic fracturing was omitted from the Safe Drinking Water Act regulation as a part of the Energy Policy Act of 2005 (109th Congress, 2005), following strong lobbying from the energy industry (Center for Responsive Politics, 2017). While more research must be conducted to conclusively prove the connection between hydraulic fracturing and drinking water contamination, enough evidence has surfaced to make some U.S. elected officials and regulators cite the precautionary principle in banning the process (Kaplan, 2014).
As for climate change, while the human causes of a changing climate have been proven by the majority of climate scientists (Hansen & Stone, 2016), climate change is highly politicized in the U.S., often divided along party lines (Funk & Kennedy, 2017). According to a 2016 study conducted by the Pew Research Center, Republicans are much less likely than Democrats to say

[2] The bill was introduced by three House Democrats in March 2017 and is currently sitting in the Subcommittee on Environment and the Economy (Library of Congress, 2017).

that the climate is warming due to human activity. And while the EPA has addressed climate change and its impact on drinking water sources on numerous occasions, the ability to garner support for legislative action on climate change issues remains an uphill battle (EPA, 2017).