The American Infrastructure Guardian

A Publication of InfraGard National Members Alliance

Fall 2022

Water and Wastewater Systems



InfraGard National Members Alliance

Publication Committee

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> Editors: Daniel Honore Rob Walker

Critical Infrastructure Sectors:

Chemical **Commercial Facilities** Communications Critical Manufacturing Dams Defense Industrial Base **Emergency Services** Energy **Financial Services** Food and Agriculture Government Facilities Healthcare and Public Health Information Technology Nuclear Reactors, Materials and Waste Transportation Systems Water and Wastewater Systems

About InfraGard National Members Alliance

InfraGard National Members Alliance (INMA) is an FBI-affiliated independent nonprofit organization dedicated to protecting U.S. critical infrastructure and the American people. Established in 2003, INMA is the private sector component of the FBI's InfraGard program, which is a partnership between the Federal Bureau of Investigation and members of the private sector for the protection of U.S. critical infrastructure. INMA is comprised of 77 InfraGard Member Alliances, nonprofit organizations which represent INMA at the local level across the country. Through these alliances, law enforcement and the American business community can collaborate on educational programs, training events and information-sharing initiatives that strengthen national security and the foundation of American life. For more information, visit www.infragardnational.org.



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The American Infrastructure Guardian

A Publication of the InfraGard National Members Alliance (INMA)

Fall 2022

An Introduction to Water and Wastewater Systems

Cybersecurity and Infrastructure Security Agency (CISA). *The supply of safe drinking water and wastewater treatment services are essential to modern life and our nation's economy.*

Leadership Corner

Ivan Wolkind, Chairman, and Maureen O'Connell, President, InfraGard National Members Alliance. *The duo introduces the inaugural issue of The American Infrastructure Guardian and shares timely news*.

Interview: FBI Office of Private Sector

Eric Velez-Villar, Assistant Director, FBI Office of Private Sector, sits down for an exclusive interview with Colt Chester, InfraGard Program Manager.

Meet the InfraGard National Members Alliance Board and Staff

Upcoming Events and the Patriots Circle

Caroline Schirato, Director of Development and Events, InfraGard National Members Alliance. Join InfraGard National Members Alliance at our upcoming events, and learn more about how you can support our mission by joining the Patriots Circle!

IMA Governance, Support, and Development

Gene Kingsley, Vice President, Learn more about INMA's role in supporting our incredible InfraGard Members Alliances (IMAs) across America.

IMA Governance, Support, and Development

Sandy Moul, Executive Director, InfraGard National Members Alliance. Learn more about RISE.

Education and Training: National Infrastructure Security and Resilience U

Chuck Georgo, Director of Training and Education, InfraGard National Members Alliance Discover the numerous opportunities for continuing education and workforce development available to InfraGard members.

National Sector Security and Resilience Program (NSSRP) Director Dan Honore. An introduction to NSSRP, membership opportunities, and more.

National Cross-Sector Council Program (NCSCP)

Director Mary Lasky. An introduction to NCSCP, membership opportunities, and more.

Critical Sector Defined: Water and Wastewater Sector.

Cybersecurity & Infrastructure Agency.

Water Security is Vital: Water Issues and Affordable, Actionable Water Resilience Solutions

A 2022 Report by the National Disaster Resilience Council

This white paper explores the national security implications of water and issues that create water insecurity and outlines steps that can be taken to improve water security and increase resilience.



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An Introduction to Water and Wastewater Systems Cybersecurity and Infrastructure Security Agency (CISA)

InfraGard[®] connects owners and operators within critical infrastructure to the FBI, to provide education, information sharing, networking, and workshops on new and emerging technologies and threats.

Critical infrastructures are designated as such because their disruption, corruption, or dysfunction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof. The Water and Wastewater sector is one of the sectors that fits that critical need. Safe drinking water is a necessity, crucial to sustaining life on our planet and properly treated wastewater is vital for preventing disease and protecting the environment.

The result of any variety of attack could be large numbers of illnesses or casualties and/or a denial of service that would also impact public health and economic vitality. The sector is also vulnerable to natural disasters.

Fresh water is not readily available to everyone. There are approximately 153,000 public drinking water systems and more than 16,000 publicly owned wastewater treatment systems in the United States. More than 80 percent of the U.S. population receives their potable water from drinking water systems, and about 75 percent of the U.S. population has its sanitary sewerage treated by these wastewater systems.

Safeguarding our water supplies against a variety of attacks, including contamination with deadly agents. Physical attacks, such as the release of toxic gaseous chemicals is another area of concern. Protection from Cyber attacks is a high priority. Critical services, such as firefighting and healthcare (hospitals), and other dependent and interdependent sectors, such as Energy, Food and Agriculture, and Transportation Systems, would suffer negative impacts from a denial of service.

The Water and Wastewater Systems Sector-Specific Plan details how the National Infrastructure Protection Plan risk management framework is implemented within the context of the unique characteristics and risk landscape of the sector. See page 18 for more details.

INSIDE THIS ISSUE:

- Interview: FBI Office of Private Sector
- Water Security is Vital: Water Issues and Affordable, Actionable Water Resilience Solutions
- A Look at National Infrastructure Security and Resilience U
- National Program Updates and Upcoming Events

TYPICAL WATER AND WASTEWATER SYSTEM





InfraGard National Members Alliance Leadership Corner

InfraGard National Members Alliance Chairman Ivan Wolkind and President Maureen O'Connell



I come from a family of police officers and firefighters, and as you know, I spent twenty-five years in the FBI, so protecting others is in my blood. In the aftermath of 9/11, it became more important than ever to protect our country. Every day, motivated by the drive to protect their loved ones or simply to do the right thing, men and women across the nation stepped forward and did what was necessary to protect their country. The nation was truly united under one banner, and for many of us, that banner is InfraGard. I am pleased to have this opportunity to share with our readers the humble gratitude I have to InfraGard for teaching me so much. This year, I'm stepping down as InfraGard National Members Alliance President, but I know I'm leaving you in good hands, with leaders you can count on.

It's been an honor to serve. I'll still be here rooting you on from the sidelines. As I start the next stage of my life and career, know that I will continue to be a cheerleader, a friend and a resource you can count on. I will always be committed to our country and our shared values of freedom and tolerance. I have no doubt that if given the chance, we will meet again. Until then, take care and be safe. I am confident that together you will continue working to keep our economy, infrastructure and lives safe against the threats that face us, whether from within or without. I wish you the best and look forward to working with you in the future. Please stay involved, stay engaged, and stay focused.

--Maureen O'Connell, INMA President 2017-2022

The InfraGard National Members Alliance Board of Directors is grateful for the leadership of Maureen O'Connell in her role as the InfraGard National Members Alliance President over the past six years. Under Maureen's

leadership, the organization has grown in strength and members' participation, as well as improved the efficiency and value of InfraGard. Her experience at the FBI, her expertise in leadership, and her commitment to the mission of InfraGard have made her a strong advocate for the organization, that will continue well beyond her time with us now. During her term, Maureen has worked tirelessly to advance the role of the private sector in critical infrastructure protection. The Board looks forward to building on her successes as a member of the Executive Committee and contributing to InfraGard's growth and advancement.

Maureen and I would like to welcome you to INMA's new quarterly publication, *The American Infrastructure Guardian*. The new publication will highlight a critical infrastructure sector with each issue. This fall issue focuses on the Water and Wastewater sector. Water is an essential part of our infrastructure, along with power, roads, and bridges. Inside you will learn about education opportunities,



upcoming events, and get to know your INMA board. Each issue will provide the readers with the knowledge they need from subject matter experts that work in the chosen sector. These experts have dedicated their lives to ensuring that we have clean water for consumption and for the plants and animals that live among us. We are very grateful to all the sponsors of InfraGard National Members Alliance, whose support is vital to our work and our mission.

-- Ivan Wolkind, Chair, INMA Board of Directors

Spotlight: FBI Office of Private Sector

InfraGard Program Manager Colt Chester sat down with Assistant Director Eric Velez-Villar, FBI Office of Private Sector, for an exclusive interview.

FBI Director Christopher Wray named Eric Velez-Villar as the Assistant Director (AD) of the Office of Private Sector (OPS) on October 12, 2021. In this role, AD Velez oversees efforts to strengthen FBI partnerships with



Eric Velez-Villar, Assistant Director, FBI Office of Private Sector

the U.S. private sector, and programs such as InfraGard and the Domestic Security Alliance Council (DSAC). I recently had the opportunity to sit down with him to discuss his commitment to private sector engagement and its impact on the FBI's mission, and how his experience has shaped these. As a retired FBI special agent with a distinguished career in the private sector, AD Velez brings a unique skill set to OPS as well as critical insight on building effective, impactful partnerships with private industry. During our meeting, AD Velez also reflected on his time at the Walt Disney Company, where he went to work when he retired from the FBI in 2016, as Vice President of Security for Parks, Products, Experiences, and Sensitive Information Protection. While in that role he was responsible for the security of all Disney parks, resorts, stores, and cruise ships around the world, as well as helping to protect the company's most sensitive intellectual property.

Colt Chester (CC): Congratulations on your appointment this past October — I should say reappointment — to a key leadership role at the FBI.

AD Eric Velez-Villar (EVV): Thanks, Colt. It's really great to be back — it's an exciting time to be innovating in how the FBI engages private industry. I find this is an incredible opportunity. I've always been the kind of person that enjoys building and creating.

CC: Your first FBI career culminated initially as Assistant Director for the Directorate of Intelligence, and you became the Executive Assistant Director for the then-newly formed Intelligence Branch. You often seem to be called to the forefront to lead during times of change. How would you characterize your leadership style?

EVV: It's true, and I'm grateful to have been in many leadership roles that allowed me to be creative. Helping to lead the Bureau's transformation from case-driven to intelligence-driven in our mission to protect the American people was one of the most challenging yet rewarding things I've ever done. In that transformation, communication was key. I remember encountering some resistance to the notion of rewriting the way we approach threats, reactions akin to "that's not the way we do things." This, for me, emphasized that I needed to listen, hear what they were really saying, understand their concerns, and — yes — challenge, them to reimagine where necessary.

The threat required us to take everything that we "can't-don't-never have done" and turn it into a barrier-breaking opportunity, re-examine how we were organized, how we approach the threat, how we engage with local partners, law enforcement partners, other government agencies, and private sector partners. Wholesale reinventing isn't easy, but we were being called to do it — it was clear that the status quo was not working.

Fast forward to now, with the threats we face from cyber actors, foreign adversaries, insider threat, and terrorism. It's an unexpected combination of deja' vu, and simultaneously reacquainting myself with the new and evolving FBI. I can see the progress and change of the last years. I also see that we have to continue to look at how we engage

the private sector, how do we truly behave in partnership. I would say that — in its most practical form — my approach is to build teams and bring right people to the table to transform what we do to improve our outcomes — not because it feels good but because it's an operational necessity.

CC: The FBI has certainly evolved in how it engages with private industry over the past years. How do you see this transformation, in its most basic sense, and how would you move it to the next level?

EVV: We have to continue to work harder to understand our partners — really understand. I remember when I was the Assistant Special Agent in Charge of the Los Angeles Field Office Counterterrorism Branch, I participated in a full field exercise involving many U.S. government agencies, as well as local law enforcement. The fictional scenario involved terror actors targeting the ports of Los Angeles and Long Beach. There were multiple rooms, many tables set up with each participant playing the role of the various entities and communities that would find themselves in that setting. There was a specific chair labeled "private sector." The person sitting there didn't speak up much until the after-action session. In the after-action, he commented that he appreciated all the efforts involved to help protect his company which was doing business at the port but added, "We are not the damsel in distress." He commented on how his company had made significant investments to protect their assets and wished we would have taken advantage of those capabilities. This has always stuck with me and reminds me every day that we need to think more holistically when mitigating threats.

I think the next level is listening and really hearing what the private sector has to say. What I find rewarding about this job is the opportunity to truly integrate the private sector's capabilities into the overall fabric of how we protect our country. Leadership should be willing to challenge the status quo. I want to emphasize transparency in the relationship, bring all stakeholders, get their commitment to stay involved and vested.

CCS: How did your time at Disney influence your perspective on this?

EVV: I place great value in the private sector perspective I gained while at Disney. Working with all the stakeholders that an effective security operation reaches, such as customers, vendors, employees, executive management, and the legal and communications teams — I came to appreciate the very real, on-the-ground challenges the private sector faces and how we can partner to help them. I have been using what I learned at Disney, as well as my prior experience in the FBI, to help further OPS initiatives and partnerships. I would say I'm now a combination of old-school FBI, with a bit of Disney pixie dust sprinkled on top. I am open to new ideas and looking for the creative approaches to problem sets that I learned at Disney — a company consistently at the forefront of finding new and innovative ways of running operations. Thoughtful planning and a focused strategy will lead to success in building meaningful partnerships.

CC: What do you tell your team about how you approach the mission?

EVV: During a OPS all-hands meeting when I first arrived, I shared with our team the need for "excellence in everything we do," and I thanked them for continuing to work with integrity, and a positive, "can-do" outlook. I encouraged them to always work towards "Yes." I see their enthusiasm for the mission and I'm very excited to be here in the FBI and greatly enjoy my role in supporting private industry, through InfraGard, DSAC, academia, and our other programs.

CC: You've been very generous with your time—thank you. Is there anything you'd like to add?

EVV: Thanks very much, Colt. It's an exciting opportunity to move forward the work the FBI is doing with the private sector. After almost thirty-seven years in various jobs in government and private industry, I have witnessed first-hand examples of the benefit of establishing and cultivating relationships between the private sector and the

FBI. We cannot address the threats we face without the private sector's partnership, knowledge, experience, and wisdom. It's that simple.

Also, in conclusion I just want to thank the members of InfraGard across the United States. InfraGard members have done so much to support the FBI's operations, investigations, and mission over these last 26 years, and I want to acknowledge all of your efforts.



InfraGard is a unique partnership between the Federal Bureau of Investigation (FBI) and individuals in the private sector for the protection of U.S. critical infrastructure and the American people. As one of the nation's largest public/private partnerships, InfraGard connects critical infrastructure owners, operators, and stakeholders with the FBI to provide education, networking, and information-sharing on security threats and risks.

InfraGard's membership includes: corporate security managers, directors and C-suite executives, cybersecurity and IT professionals, chief information security officers, financial services executives, healthcare professionals, emergency managers, military and government officials, academia, state and local law enforcement, and more — all dedicated to contributing industry-specific insight to advance national security. Today, there are members in more than 77 local InfraGard Member Alliances (IMAs), represented nationally by the InfraGard National Members Alliance (INMA). Each IMA is affiliated with the FBI Field Office in its region.



Tens of thousands of members, one mission: protecting critical infrastructure, the foundation of American life.

Mission:

The mission of the InfraGard program is to enhance our nation's collective ability to address and mitigate threats to United States critical infrastructure by fostering collaboration, education, and information-sharing through a robust private sector/government partnership.

To accomplish this mission, InfraGard promotes ongoing dialogue and timely communication between its members and the FBI through local, regional, and national programs. This two-way exchange of information equips InfraGard members with the knowledge, information, and resources to protect their respective organizations, while the FBI benefits from private sector engagement, insight, and expertise that can help prevent terrorism, cybercrime, espionage, and more.

Benefits:

- FBI and other government agency threat advisories, intelligence bulletins, analytical reports, and vulnerability assessments.
- Presentations and trainings by the FBI, or other government agencies.
- Direct engagement with the FBI, other government agencies, and private sector experts at the local level.
- Access to a members-only web portal featuring the latest FBI intelligence and the ability to view and share critical infrastructure protection information and collaborate with peers.
- Access to thousands of subject matter experts within each critical infrastructure sector, who share threat information as part of the INMA-led National Sector Security and Resiliency Program (NSSRP) and Cross-Sector Councils (CSC) Program.
- · Invitations to regional and national InfraGard events.

InfraGard National Members Alliance Board of Directors



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Stacey Moy Special Agent in Charge, FBI San Diego **Fx-Officio** Member



InfraGard National Members Alliance Events

Caroline Schirato, Director of Development & Events.

InfraGard National Members Alliance @ GSX 2022

InfraGard National Members Alliance (INMA) has partnered with ASIS again this year to offer our members a special discount for the 2022 Global Security Exchange (GSX) Expo & Conference. GSX will take place in Atlanta from September 12-14 at the Georgia World Congress Center.

InfraGard National Members Alliance will have a booth in the GSX Exhibit Hall, so please come visit us, along with our amazing corporate sponsors, at booth #1029. As an InfraGard member, you can also get member pricing on all-access passes with the following discount code: GSX22IG

InfraGard National Members Alliance @ InfoSec World 2022

InfraGard National Members Alliance has partnered with InfoSec World to offer an exclusive workshop on September 29 during the event in Orlando, Florida! Please see below for event details!

Date: September 29 @ 9:00am - 5:00 pm EST

Workshop: Fundamentals of Critical Infrastructure Protection for Cybersecurity Professionals Location: InfoSec World 2022, Disney Coronado Springs Resort, Orlando, FL Description:

This one-day workshop will provide cybersecurity professionals the knowledge and skills needed to understand what critical infrastructure protection is, the nature of the physical, cyber, and human (insider) threats, who the stakeholders are, what their roles and responsibilities are, and the tools and resources available to help them better protect our nation's critical Infrastructure.

Specific topics to be addressed include:

- What is critical infrastructure?
- What are the threats to critical infrastructure? (physical, cyber, human)
- How did homeland security come about and what is critical infrastructure protection?
- Who is involved in critical infrastructure protection?
- Who should I have partnerships with to protect the infrastructure(s) I am responsible for?
- What tools and resources are available to me to help me better protect the infrastructures I am responsible for?

• Cost: InfraGard Members \$675.00; all others \$895. Note: For Patriots Circle members, pay the \$675.00 price, then email cgeorgo@infragardnational.org to receive a 10% rebate from INMA.

- Information: https://www.infosecworldusa.com/workshops/
- Contact: Chuck Georgo, Director of Education and Training, InfraGard National Members Alliance; cgeorgo@infragardnational.org



Join Patriots Circle!

As a nonprofit 501(c)3 organization, InfraGard National Members Alliance appreciates the generosity of our individual members in helping to defray the costs of programs that strengthen national security and resilience. The Patriots Circle harnesses our collective contributions and commitment to safeguarding national interests. Please consider making a tax-deductible gift that will serve as a force multiplier in this worthwhile endeavor.



With a \$100 contribution, Patriots Circle members will enjoy special benefits, including:

1. An exclusive Patriots Circle lapel pin and coin.

fund their activities.

2. The distinction of being a supporter of InfraGard National Members Alliance's national educational programs.

3. Additionally, you will be a supporter of your local InfraGard Members Alliance, as \$25 of your donation is returned to your local chapter to fund their activities.

4. Enjoy an additional 10 percent discount off the regular InfraGard member rate for all National Infrastructure Security and Resilience U (NISRU) workshops, webinars, and eLearning courses (where a fee is charged).

5. Also enjoy an additional 10 percent discount off the regular InfraGard member rate for InfraGard National Members Alliance conferences, summits, and symposia (where a fee is charged).

6. Finally, the most important benefit is knowing that your IMA). valued gift will strengthen InfraGard National Members Alliance, helping to make our nation safer and more resilient for your family, business, and community!

With a \$250 contribution, Patriots Circle members will also receive an exclusive lapel pin and challenge coin (pictured below), coin holder, Patriots Circle decal and an embroidered hat. Additionally, you will be a supporter of your local InfraGard Members Alliance, as \$50 of your donation is returned to your local chapter to fund their activities.

With a \$500 contribution, Patriots Circle members will also receive an exclusive lapel pin and challenge coin (pictured below), coin holder, Patriots Circle decal and logo insulated coffee tumbler. Additionally, you will be a supporter of your local InfraGard Members Alliance, as \$75 of your donation is returned to your local chapter to

With a \$1000 contribution, Patriots Circle members will also receive an exclusive lapel pin and challenge coin, coin holder, Patriots Circle Decal, logo insulated coffee tumbler and embroidered InfraGard logo backpack cooler (\$100 back to your InfraGard Members Alliance (IMA) chapter.

With a \$2500 contribution, a corporate membership will also receive an exclusive lapel pin and challenge coin, coin holder, Patriots Circle Decal, logo insulated coffee tumbler and embroidered InfraGard logo hats, a "Proud Corporate Patriots Circle Supporter" plaque and access for five people to receive discounts at NISRU and certified training programs plus free access to the InfraGard National Members Alliance webinars. The company listed as Corporate Patriots Circle Member on the InfraGard National Members Alliance website with link and contact info for one year (\$250 back to your IMA).



InfraGard Members Alliance Governance, Support and Development

Vice President Gene Kingsley



Welcome to the inaugural issue of *The American Infrastructure Guardian*. Many of you that have served on the local IMA boards know me through our interactions over the 16 years I've volunteered with InfraGard, from my days as a fellow IMA leader with InfraGard Boston, where I served in roles as Secretary and President, to where I have risen today serving on the national level as Vice President. More recently, we have probably been exchanging thoughts and ideas on recertification efforts or projects that would help local IMA leaders become more successful.

As the Vice President serving on the INMA Board, my role as an officer is to assist and guide local IMA leaders in effectively managing their chapters. I respond to questions 24/7 about issues surrounding bylaw interpretations and roles and responsibilities of the local IMAs. Anything to do with internal controls, audits, and financial reporting, I try to lend our best practices approach and help all who support our mission succeed in their endeavor.

We just wrapped up recertification for 2021-2022. It has been streamlined to make things easier than in years past and helps to cut down on the time and effort to sustain your IMA in good order. It's our hope that you find this process less painful and more helpful than in years past as we take an iterative approach and make improvements where and when we are able. Our recertification process, if leveraged throughout the year, helps us to have better resiliency and take on less risk as an organization in a partnership with the FBI. As part of the risk assessment, we all contribute to Directors and Officers liability insurance. Some chapters have had extraordinarily difficult times contributing in that manner, as required, so we developed a grant application form to assist those struggling. In addition, your fellow IMAs have stood up year over year to help offset the costs for those neighboring IMAs who are struggling. I would like to personally thank the IMAs who have so graciously offered to help in this regard, Denver and St. Louis. Your efforts are truly appreciated. To you all reading this publication, I thank you. Your service to your country, region, and IMA is truly a patriotic voluntary mission, and its a pleasure to work with you all.

--Gene Kingsley, Vice President INMA Board

INFRAGARD STRUCTURE AND MEMBERSHIP

Membership Requirements:

The InfraGard program is managed through a partnership between the FBI-Office of Private Sector and INMA, an independent 501(c)(3) nonprofit organization, which manages the local IMAs.

The IMAs are also incorporated as nonprofit 501(c)(3) organizations and work with their respective FBI field office to hold chapter meetings, host events, educate, and serve their communities. Each IMA has a board of directors to manage its activities and operations. When applying to InfraGard, one is affiliated with their local IMA.

- Employed or formerly employed in a critical infrastructure sector for at least three years.
- At least 18 years of age on the date of application completion.
- U.S. Citizen (U.S. Citizen by birth as defined by 8 USC 1401-1409 or a U.S. Citizen by Naturalization as defined by 8 USC 1421-1459).
- Complete the InfraGard membership application form in its entirety.
- Agree to the following items: InfraGard Information-Sharing Policy, Privacy Act Statement, Agreements to Hold Harmless, and Code of Ethics.
- Consent to a FBI-conducted security risk assessment and to periodic re-confirmation of the security risk assessment. The risk assessment is a process completed by the FBI which includes local, state, and federal criminal history, and other security-related database checks.
- **Successful completion of the security risk assessment does not equate to a security clearance. InfraGard members are not given security clearances by the FBI.

How to Join:

Visit our website: www.infragard.org

Introducing R.I.S.E. (Raising InfraGard Success & Excellence) Executive Director Sandy Moul

Greetings fellow InfraGard members,

It is a privilege to serve as your Executive Director for InfraGard National Members Alliance and your ally in protecting U.S. critical infrastructure and the American people. Upon assuming

this role in November 2021, I could not imagine a more meaningful calling. After completing a six-year tenure as president of the InfraGard San Diego chapter, the opportunity to serve nationally has blessed me with incredible opportunities and continues to be one of the greatest honors of my life.

I have a tremendous appreciation for the United States and the principles it represents; in my eyes, they are worthy of the highest levels of preservation. In protecting the American people and these ideals, InfraGard National Members Alliance, our seventy-seven InfraGard Members Alliances (IMAs), and our 80,000+ members have the highest sense of mission. We understand not only what we do, but why we do it: to safeguard the foundation of American life. That is the heart and soul of our story.

For this issue, I'd like to brief you on a new passion project: R.I.S.E., an acronym for Raising InfraGard Success and Excellence. "Rise" is a special word because it encourages us to think aspirationally, imagining an idealized state in which we fulfill our full potential. Our seventy-seven IMAs throughout the nation represent the single greatest force multiplier in mission achievement for InfraGard National Members Alliance and the InfraGard program. Entrenched in hometowns across America, IMAs are the boots on the ground, on the front lines of protecting their communities, and represent a vital piece of the larger national security picture.

The nation's safety, security and resilience are best served by creating a rising tide of IMAs that attain standards of excellence in all they do. Our board of directors and senior leadership are deeply invested in fostering their success, and in May 2022, we announced a new national strategy to achieve that success. R.I.S.E. is a multi-year initiative that formalizes, refines and expands our IMA development programs. It is a commitment to resource prioritization in this crucial area, and a nod to the importance of local and regional security landscapes within the national context.

R.I.S.E. is comprised of five pillars:

- The R.I.S.E. Leadership Academy
- InfraGard Regional Presidents' Summits
- The R.I.S.E. Exchange, an IMA Mentorship Program
- The InfraGard Presidents & Private Sector Coordinators (PSCs) Summit
- The R.I.S.E. Resource Library

R.I.S.E. is off to a strong start, and our team is incredibly excited about what we can accomplish together as we rely upon our shared interests, Patriotsism and service orientation. To the men and women of the FBI, the leaders of our InfraGard Members Alliances, and my InfraGard National Members Alliance colleagues, I thank you for taking up the fight every day. We are successful because of you. There is no limit to what we can accomplish for the greater good with a vision, execution, and a lot of heart.



Yours in Service,

Sandy Moul Executive Director InfraGard National Members Alliance



InfraGard Members Alliance Education and Training

INMA Director of Education and Training, Chuck Georgo

About National Infrastructure Security and Resilience U (NISRU)

National Infrastructure Security and Resilience U (NISRU) is the flagship eLearning program of InfraGard National Members Alliance, an FBI-affiliated independent nonprofit

organization dedicated to protecting U.S. critical infrastructure and the American people. The mission of NISRU is to develop and deliver education, training and workforce development programs - including webinars, workshops, conference events, and other learning opportunities - for InfraGard members and other security stakeholders to advance their knowledge and skills in critical infrastructure protection.

World-Class and Affordable Workforce Training

Sourced from the U.S. national security and critical infrastructure protection community and vetted by InfraGard National Members Alliance subject matter experts, our instructors present workplace and industry-relevant workshops and courses that can be completed individually or organized into one of our certification programs. We offer the following:

- 1-hour webinars short, less formal briefings on specific threat or technology matters
- 2 or 4-hour workshops more structured training, specific learning objectives, with certificate and CPEs
- 8-hour eLearning courses academically structured learning, with certificate and CPEs
- 32-hour certificates groups of 8-hour eLearning courses covering a topic or sector, with certificate and CPEs

Current Online Catalog Offerings

Individual courses are available across the following focus areas:

- Homeland Security
- Intelligence Community
- Critical Infrastructure Protection
- Emergency Management
- Blockchain for Critical Infrastructure
- Critical Infrastructure Cybersecurity
- Assessing Threats and Hazards

Self-Paced Certifications

Our online, industry-relevant certification programs are offered in Fundamentals of Homeland Security, Cybercrime Prevention, Critical Infrastructure Cybersecurity, Practical Application of Risk Assessment for Critical Infrastructure, and Blockchain for Critical Infrastructure Protection, among others. Certifications generally include at least four courses.



Here are some examples:



COMING SOON! – Critical Infrastructure Protection (CIP) Certification Program

In 2023, InfraGard National Members Alliance will proudly introduce the Critical Infrastructure Protection (CIP) certification program. This groundbreaking national program will be unique in providing education and certification specific to U.S. critical infrastructure protection. Similarly to other industry certification programs, we will offer certification at three levels of CIP: Infrastructure Protection Representative (IPR); Infrastructure Protection Specialist (IPS); and Infrastructure Protection Executive (IPE). Each of these levels will include 10 eLearning courses and a capstone certification examination.

	Curated Courses for Your Audience We can put the NISRU platform to work for your organization or agency! Ask us how we can host your current training or develop new training that NISRU can deliver to your employees and partners.
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courses.nisru.org	for your organization by contacting info@nisru.org

InfraGard Membership

Today, there are over 86,000 InfraGard members in more than 77 local InfraGard Members Alliances (IMAs), epresented nationally by the InfraGard National Members Alliance (INMA). InfraGard's membership includes: corporate security managers, directors and C-suite executives, cybersecurity and IT professionals, chief information security officers, financial services executives, healthcare professionals, emergency managers, military and government officials, academia, state and local law enforcement, and more - all dedicated to contributing industryspecific insight to advance national security.

National Program Updates National Sector Security and Resilience Program (NSSRP) Director Daniel Honore

Conceived in 2003 as the Sector Chief Program in the Kentucky IMA, the program was renamed the National Sector Security and Resilience Program (NSSRP) in 2019, when it became a national program.



The purpose of the NSSRP is to protect, secure and ensure operational resilience of the nation's

interdependent, global and internet reliant Critical Infrastructure through the timely, accurate and effective dissemination and exchange of sector and cross-sector specific information. One of the four life-line sectors identified by the Department of Homeland Security is the Water and Wastewater sector. There are over 150,000 public drinking water systems and more than 16,000 publicly owned wastewater treatment systems in the United States.

Approximately 84% of the U.S. population receives their potable water from these drinking water systems, and more than 75% of the U.S. population has its sanitary sewerage treated by these wastewater systems.

The Water and Wastewater Systems Sector is vulnerable to a variety of attacks, including contamination with deadly agents, physical attacks such as the release of toxic gaseous chemicals and cyberattacks. If these attacks were realized, the result could be large numbers of illnesses or casualties and/or a denial of service that would also impact public health and economic vitality. Critical services such as firefighting and healthcare (hospitals), and other dependent and interdependent sectors, such as Energy, Food and Agriculture, and Transportation Systems, would suffer negative impacts from a denial of service in the Water and Wastewater Systems Sector.

If your employer's primary sector is water and/or wastewater, or if you have interest in this sector, then we encourage you to participate. There are multiple ways for you to participate in this or any national critical infrastructure sector.

- 1. The first step is to log into the FBI InfraGard portal.
- 2. Select COLLABORATION from the menu.
- 3. Next, select NATIONAL SECTOR SECURITY AND RESILIENCE PROGRAM.
 - A list of the sixteen critical infrastructures will be displayed.
- 4. Select the Water and Wastewater sector. From here you will have two opportunities to participate.
 - First, click the checkbox so that you will receive broadcast messages from the Water and Wastewater National Sector Chief.
 - Second, click FORUM in the left menu. Select FOLLOW so that you will receive updates when information is posted to the forum.

You also may post to the forum which will in turn update your fellow InfraGard members who follow the forum. You can contact the Water and Wastewater National Sector Chief via email at *NSC-WTR@infragardnational.org* or the NSSRP program manager at *pm-nssrp@infragardnational.org*.



--Daniel Honore, Chair NSSRP

National Program Updates National Cross-Sector Council Program (NCSC) Director Mary Lasky

Why a National Cross Sector Council Program?

We now have eight Cross Sector Councils (CSC) for you to choose to join and work with them to share information and help make a difference. The CSCs or Councils include: Blockchain, Electronic Safety Industry, CISO, Legal Industry, Business Continuity, Countering Human Trafficking and Forced Labor, Insider Threat Mitigation and National Disaster Resilience.

The Blockchain for the Protection of Critical Infrastructure Cross Sector Council covers topics that are also important and also critical to our newly formed Council on Countering Human Trafficking and Forced Labor. These Councils are tied to the Legal Industry Council and the three are working together to help protect all of the Critical Infrastructure (CI).

The National Disaster Resilience Council (NDRC), is concerned with all CI that might be unavailable for a a month or more, in case of an attack, and the cascading consequences involved. and the cascading consequences involved. What would you do if there was no electrical power for 45 days caused by a cyberattack? Would you be prepared? Your family? Your organization? Do you think the government is prepared? What about your local government? The NDRC is concerned and has working groups on Water Security, Predictive Modeling, Cyber, Testing and forming a new one on being prepared. Please join us.

The Insider Threat CSC is concentrating on insider threats in each of the CIs. The "Made in Beijing" FBI film features four insiders who focused on stealing critical US technologies (*https://www.youtube.com/watch?v=GdapE82GceA*).

The NDRC partnered with Insider Threat, Blockchain, and CISO Councils. Together they been following up on the movie and investigating how the Chinese Communist Party (CCP) has been using the ancient Chinese proverbs known as the 36 Stratagems, which fundamentally promotes deceit in business and messaging as a virtue. Please come join the work and learn and share information. This growing team will help you orient to and understand the 36 Stratagems, help others see how the CCP is using them against us with great effect, and how we can make the U.S. stronger.

Blockchain, CISO and Electronic Security Industry CSCs hold regular virtual meeting. The Business Continuity Cross Sector Council is focused on operational resilience in the face of crisis events impacting an organization's ability to continue business as usual and is hosting a series of quarterly webinars.

We invite you to explore any or all Cross Sector Councils, and hope you are inspired to be involved! Lastly, please

attend the NDRC Summit on October 18 and 19, 2022 – virtual and in person.





--Mary Lasky, Chair NCSCP

InfraGard NDRC Virtual Summit Critical Infrastructure Resilience: Setting Priorities/Getting Results

Water and Wastewater Sector

This is the National Infrastructure Protection Plan (NIPP) 2015

Executive Summary Specific to the Water and Wastewater Sector

(Source: 2015 Water and Wastewater Systems Sector-Specific Plan 2015)

Executive Summary

Drinking water and wastewater treatment are essential to modern life and the Nation's economy. Therefore, it is critical that we enhance the security and resilience of the Nation's drinking water and wastewater infrastructures, collectively known as the Water and Wastewater Sector (Sector). The purpose of this 2015 Water and Wastewater Sector-Specific Plan (Water SSP) is to guide and integrate the efforts intended to secure and strengthen the resilience of the Sector's infrastructure. This Water SSP tailors the strategic guidance provided in the National Infrastructure.

Protection Plan (NIPP) 2013 to the unique operating conditions and risk landscape of the Sector.

The Water SSP describes the complexity of the Sector:

- The entities that compose the drinking water and wastewater infrastructures
- The matrix of policy authority pertaining to the Sector
- The components in the value chains of the drinking water and wastewater infrastructures
- The partnership mechanisms that represent the myriad stakeholder segments within the Sector
- The federal, state, and local government entities that interact with those partnership mechanisms and their respective roles in contributing to the security and resilience of the Sector
- The risk scenarios that could drive Sector security and resilience activities over the next 5 years

The Water SSP also describes how the Sector, through its voluntary partnership mechanisms, has developed a strategy – the Vision, Mission, Goals, Objectives, and Milestones – to manage the complexity within the Sector in a way that moves it toward realizing its security and resilience goals.

This strategic development process is aligned with and relies heavily on the 2013 Roadmap to a Secure and Resilient Water and Wastewater Sector. The Roadmap creates a framework that prioritizes the holistic set of activities necessary for the Sector to realize its Vision. The Water SSP describes these priorities and activities.

Finally, the Water SSP describes how the Sector measures the performance of its activities so that progress can be measured and continuously improved. The Water SSP is designed to be a "living document" that not only establishes the strategic framework for achieving the Sector's security and resilience ends, but also encourages tactical flexibility with respect to the means.

Only 1% (968) of the InfraGard members work in Water and Wastewater Systems. These companies provide drinking water and treatment for communities throughout the country. Every day, the Water and Wastewater Sector of InfraGard works hard to make sure that you have safe drinking water and that your wastewater is properly treated. The sector has provided security measures to protect against cyber-attacks, and ensures that pipes that bring water to your home or business are not vulnerable to terrorist attacks. The sector supports public safety by providing the tools necessary to track and detect illegal activities.



Most Significant Risks

- Natural disasters (such as impacts on water quality and quantity from floods, hurricanes, earthquakes, ice storms, pandemic flu and other geographic catastrophes)
- Economic implications of aging infrastructure
- Cyber events
- Capability in managing an area-wide loss of water
- Although the Water Sector has been defined as a lifeline sector, this is not commonly recognized among all relevant stakeholders, a situation that can escalate consequences during area-wide events

High Risks

- Economic costs of preparation and response: The Water Sector can create a large economic risk in a disaster, but there are insufficient funds to prepare for and address risks ahead of time
- Ignorance about the consequences of inaction and apathy from some stakeholders in utilities, the customer base, state/local government and Federal Government/Congress
- Inadequate coordination and information sharing during preparation, response and recovery
- Intentionally malicious acts
- Limited resource availability: Many utilities are faced with competing needs (e.g., regulatory, aging infrastructure, environmental and public health protection, and workforce succession requirements) that are immediate, concrete and can limit resource availability for implementing preparedness and resiliency improvements
- Unenforced and outdated requirements that do not address evolving threats

Medium Risks

- Lack of mutual aid agreements, effective education and outreach to emergency management, and lack of best practices for emergency response planning
- Technology interoperability issues that create information-sharing challenges during response
- Insufficient communication to water utility boards of the definition, management and prioritization of critical assets and needs

Source: Adapted from the 2013 Roadmap to a Secure and Resilient Water and Wastewater Sector



Water Security Is Vital

Water Issues and Affordable, Actionable Water Resilience Solutions

A Report by the InfraGard National Disaster Resilience Council 2022

Acknowledgements

The National Disaster Resilience Council (NDRC) Mission is to inform communities how to mitigate the highimpact threat of long-term power, communications, and water failure (greater than 30 days) that could lead to catastrophic, cascading losses of life-sustaining infrastructures and resources for recovery.

The InfraGard NDRC started a Water Security Working Group after a presentation at the NDRC Virtual 2020 Summit on water by Lt. General (Ret.) Steven Kwast, which was a national "Call to Action."

Working Group members are:

Vincent Tidwell, Donald Schumacher, Michael Lambert, Mike Carpenter, Stephanie Lokmer, John Organek, Bjorn Simundson, Jerry Brown, General Steven Kwast and Gary Reams.

Mae Stevens joined after being a member of the Working Group's panel on Water Security at the NDRC 2021 Virtual Summit and took on the responsibility of rewriting an initial version of a whitepaper. Mae included Henry Pitts and Ted Mondloch.

Special thanks to Dr. David Stuckenberg for being a Co-chair and for his leadership, writing, and encouragement emphasizing how vital this issue is to the United States and the world. Also thanks to Mary Lasky, Chair of the NDRC, and was previously the Co-chair.

Executive Summary

Modern societies consider many services like electricity, telecommunications, food, sanitation, health care, transportation, and internet access essential. Next to oxygen, no service or resource is more essential to human life, health, economic well-being, social stability, the environment, and both national and international security than water. After three days without water, most people would be near death. Three days is the maximum time a society without water can exist before breaking down.

Water is the economic potential energy of a nation's economy. Economic well-being, social stability, the environment, national and international security are therefore entirely dependent upon clean air and clean water without exception. It is part of every supply chain and is essential to all services. As such, water is a key resource in the power competition between the Russian Federation, the Chinese Communist Party, the United States, and other powers . Water is the key to an implementable National Disaster Resilience Strategy.

Water scarcity is a lack of available water to support robust economic activities and human development. Local and regional water sources are increasingly strained around the globe. The most extreme level of water insecurity is water bankruptcy (no water). Some second- and third-order effects of water scarcity and water bankruptcy are explored in this work along with recommendations for how to begin addressing these complex challenges.

In 2018, The Center for Naval Analysis published: The Role of Water Stress in Instability and Conflict. This benchmark study helped inform and inspire the establishment of this InfraGard Water Security working group and other critical research efforts including those underway in the Department of Defense relating to water resilience.

The purpose of this whitepaper is to make the infrastructure community aware of the issues facing the water sector and to provide some steps that each of us can take. The paper highlights water security by alerting readers to the vulnerabilities of our United States water with regards to national security issues. It highlights water resilience by pointing to actions that can be taken to mitigate risk and minimize the extent and duration of reduced service.

This whitepaper starts with a discussion of why water is vital, explains the national security implications of water, and then examines water as a critical infrastructure. The paper provides a look at issues that create water insecurity or that reduce resilience: insufficient water supply; flooding and other hazards; water quality degradation; vulnerable physical infrastructure; security issues; and lack of financial resources. A Call to Action is then issued for individuals, communities, industry, and utilities to join an effort to address these issues. Supporting this Call to Action are steps each of us can take to improve our water security and increase resilience. New technologies to help provide water security are encouraged.

Water is vital! Water is a complex topic. It is imperative for societies to recognize the existential nature of water and to look for and prioritize the implementation of all-hazards solutions to prevent water bankruptcy.

Value of Water

Imagine a day without water — that is what the United States (U.S.) Water Alliance asks the public to do in their national campaign emphasizing the value of water.

- You awaken. You cannot use water to refresh your mouth.
- You cannot bathe or flush the toilet.
- You cannot prepare any food requiring water.
- Thirst will begin in a few hours and become extreme after 8-12 hours.
- Fatigue and discomfort from dry skin will begin after 16-24 hours.

Beyond directly sustaining life, water is also vital to maintaining public health, growing food, fighting fires, heating, and cooling. Water helps to create societies and civilizations while lack of water can cause them to break down.

The average American uses 82 gallons of water per day, according to the EPA on May 11, 2022.¹ Roughly 70 percent of the American family use occurs indoors.² Nationally, outdoor water use accounts for 30 percent of household use but can be much higher in drier parts of the country and more water-intensive landscapes. For example, the arid West has some of the highest per capita residential water use due to landscape irrigation.

From irrigation to processing to food production, water underpins the agricultural industry. 40 percent of water consumption in the U.S. is used to produce food and beverages.³ SOURCE: The Water Footprint Network

Beyond individual water consumption, the U.S. is estimated to withdraw as much as 350 billion gallons of freshwater daily.4

Globally:

• About 70 percent of the world's fresh water is devoted to irrigation.⁵

• Textile production (including cotton farming) uses around 93 billion cubic meters (2.5 trillion gallons) of water annually, representing 4 percent of global freshwater withdrawal. Beyond production, washing clothing with washing machines is estimated to require an additional 20 billion cubic meters of water per year globally.⁶

In the U.S.

• Direct water consumption of US data centers in 2020 is estimated at 1.30×10^8 m³ (34 billion gallons). According to Dr. Arman Shehabi, of the Lawrence Berkely National Laboratory data centers, are collectively "among the top-ten water-consuming industrial or commercial industries in the U.S."7

"When the well's dry, we know the worth of water." - Benjamin Franklin

¹ https://www.epa.gov/watersense/statistics-and-facts 2

https://www.epa.gov/watersense/how-we-use-water

³ http://thevalueofwater.org/the-facts/waters-value#:~:text=The percent20average percent20American percent20176,and percent20the percent20the percent20average percent20American percent20176,and percent20the percent2 20beverages percent20we percent20drink.

⁴ http://thevalueofwater.org/the-facts/waters-value

⁵ http://thevalueofwater.org/the-facts/waters-value#:~:text=The percent20average percent20American percent20176,and percent20the percent20the percent20average percent20American percent20176,and percent20the percent2 20beverages percent20we percent20drink.

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http://thevalueofwater.org/the-facts/waters-value#:~:text=The percent20average percent20American percent201r6,and percent20the percent-20beverages percent20we percent20drink.

Radhika Fox, former CEO of the U.S. Water Alliance and current Assistant Administrator at the U.S. Environmental Protection Agency Office of Water, believes "investing in our water infrastructure as a nation [allows] communities to flourish...dramatically [improves] public health and [sets] our economy up for success." Also, "at a time when so much is at stake, we cannot continue to ignore the urgency of the situation."⁸

The preceding is historically correct. It falls to us to make it strategically true for the future.

Water service disruptions due to crumbling infrastructure are predicted to increase personal household water bills to seven times their current rates by 2039,⁹ and American businesses may spend \$250 billion on disruptions in 2039 alone.¹⁰

Though vulnerable physical infrastructure¹¹ is just one of the six key issue areas outlined in this paper, it is emphasized here since its effects can be easily quantified to highlight the value of water across the nation.



Figure 1: Water Use https://ensia.com/articles/water-use/

Every \$1 spent on infrastructure improvements in the US generates as much as \$6 in returns.¹²

Investment in our infrastructure now not only helps avoid costly disruptions in the future, but also supports the economy at a 6:1 return on investment. Fortunately most Americans realize the importance of water and support water infrastructure investment (Figure 2). For 90 percent¹³ of Americans, water comes to homes, offices, and industry from a water utility that ensures the water is cleansed to meet stringent state and federal standards and delivered via a series of pipes and pumps that have some amount of leakage, intrusion, and infiltration. In many cases, particularly for small water systems, water is priced at what it takes to deliver the water but fails to fully account for adequate maintenance, environmental impact, and *societal and scarcity value* (the differential value assigned to an increasingly scarce resource).

The Water Sector has made great progress with adopting and encouraging others to adopt asset management programs as well as to extend planning horizons out to 50 or 100 years. This practice helps to factor into the price, the long-term costs of pipe replacement and adapting to climate change.

http://uswateralliance.org/news/value-water-campaign-releases-new-economic-report
 https://www.mswmag.com/online
 exclusives/2020/09/underinvestment-in-americas-w

https://www.mswmag.com/online_exclusives/2020/09/underinvestment-in-americas-water-infrastructure-puts-the-economy-at-risk-says-report

¹⁰ https://waterfm.com/new-report-offers-grim-details-on-underinvestment-in-u-s-water-infrastructure/

¹¹ https://www.cfr.org/backgrounder/state-us-infrastructure

¹² https://www.uschamber.com/infrastructure/why-water-infrastructure-investments-would-make-big-splash#:~:text=Indeed percent2C percent20every percent20 percent241 percent20spent percent20on,infrastructure percent20and percent20every percent20economy percent20stronger.

¹³ https://www.epa.gov/dwreginfo/information-about-public-water-systems

Cost of Water Bills by State

A water utility bill may be smaller than electricity, gas, cable, and internet. The typical U.S. family of four used about 100 gallons per person per day and paid about \$72.93 for water every month in 2019.¹⁴ Water is rarely priced at its true value.¹⁵ The public often does not understan the true cost or value of drinking water.

Across all demographics, Americans strongly support water infrastructure investment.



As a result: Most water utilities have difficulty in maintaining their Figure 2: US Water Alliance. "2021 VOW Poll Fact Sheet." systems, adopting new technologies, expanding capacity to new Value of Water Campaign. sources, adequately cleaning available supply, and protecting aquifers

from depletion and the attendant subsidence and scarcity side-effects. Many small water utilities may only have parttime operators.^{16,17}

Public Utility Commissioners are faced with an increased need to provide financial assistance to disadvantaged populations.¹⁸ At a time when drought and flooding are both becoming more severe, other threats to water, such as cyberattacks, are also increasing, as the Issues sections describe.

National Security Implications of Water

The strength of a democracy is underwritten by the health of its economy. Underpinning all economic activities lies one fundamental resource — water. Freshwater is the key enabler in every supply-chain and service globally. Without water, all economic activity stops. And when economic activity stops, in situ local, state, and national governments become insolvent due to an inability to raise tax revenue(s) or support the population's health and needs.

Economically, water is an essential natural resource. In his 2011 lecture to investors, Citi's Chief Economist, Willem Buiter noted, "Water as an asset class will, in my view, become eventually the single most important physical-commodity based asset class, dwarfing oil, copper, agricultural commodities and precious metals."19 Water is fundamental to all processes; the primary working medium or tool required to access all elements whether liquid, gas, or metal and aggregates. Everything requires water.

The water needed to manufacture a good or provide a service is called a *water footprint*.²⁰ This footprint means all goods and services can be measured in the amount of water used to produce them. For example, a Chilean-grown avocado takes about 16 gallons of water to grow, whereas an automobile made in Detroit, Michigan uses about 20,000 gallons. The water footprints for other important commodities are given in Table 1.

Food Item	Serving Size	Water Footprint	
Steak (beef)	6 ounces	674 gallons	
Hamburger	1 (includes bread, meat, lettuce, tomato)	660 gallons	
Ham (pork)	3 ounces	135 gallons	
Eggs	1 egg	52 gallons	

Table 1. Water Footprint of Eight Common Food Items

¹⁴ https://worldpopulationreview.com/state-rankings/water-prices-by-state

¹⁵ https://academic.oup.com/oxrep/article/36/1/86/5696684

¹⁶ https://efc.web.unc.edu/2019/12/12/operating-at-a-deficit-solutions-to-a-water-and-wastewater-operator-shortage/

¹⁷ https://apnews.com/article/956c4d0fa1c94472acebdba5ce3ff1e5

¹⁸ https://www.ioes.ucla.edu/project/the-human-right-to-water-in-poor-communities-of-color-southern-los-angeles-county/

¹⁹ Business Insider: https://www.businessinsider.com/willem-buiter-water-2011-7

²⁰ https://waterfootprint.org/en/water-footprint/

A Publication of the InfraGard National Members Alliance (INMA)

Soda	17 ounces	46 gallons
Coffee	1 cup	34 gallons
Wine	1 glass	34 gallons
Salad	1 (includes tomato, lettuce, cucumbers)	21 gallons

Water security, defined here as sustainable access to adequate quantity and quality of water, is vital to a nation's future and stability. In 2018, Moody's, Fitch, and S&P began to evaluate the solvency of nations and credit rating among other elements, by a state's ability to assure its water supplies.

According to Fitch:

Water risks are likely to become a more important sovereign rating driver over the medium to long term, particularly in the event of severe climate change. We find that countries in the Middle East and Mediterranean basin are particularly exposed to droughts and water stress while several south Asian and African countries are especially exposed to flood risks. Each sovereign's vulnerability to water risks will depend on its ability to devise and implement mitigating policies.

- Competition for rare earth elements.
- Microchip manufacturing capacity.Advancements in quantum technology.
- Artificial Intelligence.
- Space-based systems.

These issues receive necessary and robust attention. The foundation of these critical areas, water, is alarmingly underappreciated and disproportionately underfunded. Without water, all activities and advancements cease. A U.S. Naval Admiral provided the insight that, as the commander of a small aircraft carrier while resupplying in international ports, U.S. taxpayers generally paid more for water than aircraft fuel.

While water in the past was often taken for granted in terms of defense logistics, it is no longer easy to obtain. This difficulty translates into significant and escalating costs. According to the U.S. Army Corps of Engineers (ACE), water costs the government as much as \$400 per gallon (2010). In terms of ability to project military power and even support domestic operations, the U.S. military is almost void of both water sustainment capabilities and investments in better water technologies. The 2018 National Defense Strategy and the multi-domain operations (MDO) battlefield operating concept, put installations in the strategic support area of the battlespace. Lack of adequate water supply, or serious disruption to service has thus become a National Security concern.

The ability to interrupt water directly translates into an ability to create leverage and achieve outcomes for an actor willing to do harm to others. Without adequate infrastructure protection or supplies, water becomes a natural soft target.

Since the inception of conflict, water has always been exploited. Regardless of the degree of technology possessed, and irrespective of who owns it. Control over water can be a decisive factor in security or defense scenarios, whether by a military knockout (hard power) or a diplomatic campaign (soft power).

A knockout blow to an adversary is the most desirable outcome of a well-organized military campaign. Going forward into a thirsty future, water security and stability must become central not only to the defense calculus of democratic nations, but also central to how those nations view their economic potential energy. Water must be viewed as a strategic national security resource and be prioritized as a defense imperative along with other raw materials.

This imperative means that policy and strategy must be adapted and followed to advance a nation's ability to mitigate impacts from real-world conditions at home and around the globe. Such strategies and policies must be implemented well in advance to mitigate water scarcity, bankruptcy, and ultimate economic and societal collapse.

On June 1, 2022, the White House issued its "White House Action Plan on Global Water Security," acknowledging the critical role of water, stating that water crises are becoming more frequent in the U.S. and that water security is central to national security.

Implications of Water as a Critical Infrastructure

The National Infrastructure Advisory Council (NIAC) provides the President of the United States with advice on the security and resilience of the critical infrastructure sectors. In 2016, NIAC released a report on water sector resilience with their final recommendations on how to best bolster our water infrastructure and resources security. They emphasized the widespread effects that a loss of water services can have on national security and infrastructure, stating:

"...the loss of water services can cripple other critical infrastructures and trigger additional disruptions. An analysis of vulnerability assessments conducted by the U.S. Department of Homeland Security (DHS) Office of Cyber and Infrastructure Analysis (OCIA) revealed that among surveyed critical infrastructure that depend upon water for core operations, services are degraded 50 percent or more within eight hours of losing drinking water services (Figure 3)."

NIAC further identified a core group of issues the water sector faces as it builds resiliency into its operating framework. These issues focused on the differences between water and other critical infrastructure sectors, such as electricity and transportation, which benefit from high visibility and a dedicated federal department and cabinet positions. The water sector, which is historically reliable and cheap, is relatively 'invisible,' and as such is mostly taken for granted. As a result, water-related issues are relatively unknown to the public and underfunded as a result.

Water quality issues are managed by the U.S. Environmental Protection Agency (EPA), which serves as the Sector-Specific Agency (SSA) for water. Management of water is disjointed across numerous Federal and state agencies–Federal responsibilities for the Water Sector are spread over three Emergency Support Functions (ESF), instead of being concentrated in one, such as Energy, Transportation, Communications, etc.

Water supply management largely falls within the jurisdiction of individual states where authority over surface and groundwater resources often rests with different agencies and follows different policy constructs. One issue unique to the water sector is the general heterogeneity and lack of connectivity among adjacent water networks, unlike our electrical grid or transportation networks, which are relatively homogeneous and extend across state boundaries, which poses a unique problem when holistically addressing water security problems at a nationwide level.

Heterogeneity further exacerbates attempts to achieve water security because it produces a wide disparity in the capabilities and resources of local water utilities as their rates, and thus sustainable security, vary so much.

The lack of connectivity, caused primarily by the economics of having to transport 62.4 pounds per cubic foot of water through pipes versus having to transport an electric charge through wires, illustrates the challenge of implementing solutions, such as Dual Path, to increase resilience of regional water systems.

NIAC also identified affordability as the cornerstone issue facing resilience improvement efforts, as many utilities take a path of least resistance, and the rates required to maintain water services are a reflection of a combination of

considerations including: affordability, ability of customers to pay higher rates, and the ability to get higher rates approved (by boards, commissions, elected officials, etc.) Water utilities do not generally enjoy the success that electric utilities obtain when seeking funding for resilience. More needs to be done to encourage water utilities to account for the need to upgrade critical water infrastructure as the nation's current systems approach the end of their lifespans. Asset management programs as well as long-term planning have helped to correct the problem.

Following Loss of Water Services

To address these issues and improve resilience, NIAC proposed five key recommendations:

- 1) Analyze and map the complex risks of major water disruptions and develop mitigations
- 2) Fortify water sector response and recovery capabilities
- 3) Increase federal funding, investment, and incentives to improve water infrastructure resilience
- 4) Increase technical and financial resources and expertise available to the water sector

5) Strengthen federal leadership, coordination, and support for water sector resilience

ISSUE AREAS

Insufficient Water Supply

Insufficient water supply can result from drought or from population growth. Drought is a period of drier-than-normal conditions that causes a variety of water-related problems, particularly in locations already stressed by growing water demands.²¹ Depending on the intended use for the water source and demands on supply, a drought can look different from stakeholder to stakeholder.

Drought, and other aspects of water, are inherently subjective, with farmers, meteorologists, hydrologists, and water managers all differing in the demands they place on a water source, and the metrics they use for assessment, and often, with bias to their own demands.

These variances make defining the start or end of a drought almost impossible to do in real time. As such, our water policy frameworks must be built with adaptability and resilience in mind to ensure effective and efficient responses to drought events. "Since 1980, 26 droughts have cost the nation at least \$249 billion, with an average cost of more than \$9.6 billion incurred during each event (Figure 4). Only hurricanes were more costly."²² As drought becomes more persistent and wider spread, the cost of dramatic and short-lived hurricanes may soon be exceeded by drought (Figure 5 provides an indication of the persistence of drought over the Western U.S. over the past several decades). While everything in theory is insurable,²³ insurance only spreads increasing costs to more of the population. The costs are still very real and felt directly or indirectly by everyone in the affected economy. Response to drought takes many forms.



On Wednesday, July 21, 2021, The New York Times wrote a front-*Potential Function Degradation* page article entitled "A Utah Town Halts Growth. It Lacks the Water." The article discusses how the Western United States is in a mega drought,24 with record heat waves,

21 USGS: The Water Science School, Droughts: Things to Know, June 8, 2018. https://www.usgs.gov/special-topics/water-science-school/science/droughts-things-

24 https://www.scientificamerican.com/article/western-megadrought-is-the-worst-in-1-200-years/

know#what

²² NOAA, The High Cost of Drought, January 23, 2020. https://www.drought.gov/news/high-cost-drought

²³ https://www.rma.usda.gov/en/News-Room/Frequently-Asked-Questions/Crop-Insurance-and-Drought-Damaged-Crops

and wildfires, resulting in depleted groundwater and streams vital both to farmers and cities drying up. Some farmers and ranchers are letting their fields go brown and selling livestock. While Utah has been the fastest growing state in the union it is starting to limit new house construction due to lack of water. 25

"Thousands have lived without love, not one without water." -H.

In Arizona, the United States Bureau of Reclamation will slash the amount

of river water most central Arizona growers receive in 2022 by more than half — and eliminate it entirely in 2023. Of the 40 million people who rely on the Colorado River, central Arizona farmers who hold the least-senior water rights will be among the first to be cut off. Most farmers are cutting back how many acres they plant — fallowing as much as 40 percent of their fields.26



Figure 4: Total Combined Economic Cost of Global Drought (1975-2021)

Las Vegas has two million residents and 36 million visitors per year with 90 percent of its water coming from the Lake Mead reservoir (Figure 6), which is suffering from a major drought. Hotels in the region have installed capabilities for capturing wastewater and purifying it to be used in fountains and lawn care. Laundry services recycled water which paid for itself in a little over a year. Residents and golf courses were encouraged to eliminate grass and go natural.²⁷ Unfortunately, centralized regional water management planning along the lines of Las Vegas is not commonplace.

Beyond Drought

Beyond drought events, insufficient water supply is caused by overuse of existing water resources.²⁸ In the western United States, this commonly occurs through the overpumping of aquifers.²⁹.

A key case study is the Ogallala or High Plains aquifer that underlies parts of Northern Texas to South Dakota. The Ogallala is the largest aquifer in the U.S. and provides nearly all the water for residential, industrial, and agricultural

²⁵ Jack Healy and Sophie Kasakove, "A Utah Town Halts Growth. It Lacks the Water." The New York Times, July 21, 2021

²⁶ Steven Robert Miller, "Extreme Drought Creates Unlikely Farming Allies in the Arizona Desert, National Geographic, January 28, 2022, https://www.national geographic.com/environment/article/extreme-drought-creates-unlikely-farming-allies-in-the-arizona-desert

²⁷ Charles Fishman, The Big Thirst, Free Press, 2021, pp 51-87

²⁸ https://www.wunderground.com/blog/JeffMasters/ten-civilizations-or-nations-that-collapsed-from-drought.html

²⁹ https://news.climate.columbia.edu/2015/08/03/the-growing-groundwater-crisis/#:~:text=Since percent20groundwater percent20that percent20is percent20very-, their percent20capacity percent20

to percent20store percent20water.

As of August 10th, 2022, 84% of the Western US is reporting drought conditions with 55% reporting Severe Drought or worse. Nationally, 65% of the Continental United States reported some level of drought conditions prevailed and 36% in Severe Drought or worse. As the graph indicates, all levels of drought, to include Exceptional Drought has increased significantly over the past 22 years.



Figure 5: Source: Westcott, Sunny. "National and International Climatology Study: Extreme Weather Events and Impacts." Cybersecurity and Infrastructure Security Agency (2022).



Severiano del Castillo Galvan, Las Vegas Review-Journal

Figure 6: Source: Follow a gallon of water from Lake Mead to a Las Vegas tap. Las Vegas Review-Journal. (2017) < https://www.reviewjournal.com/ local/local-las-vegas/follow-a-gallon-of-water-from-lake-mead-to-a-las-vegas-tap/>

use in the overlying region. Agriculture accounts for 94 percent of groundwater use.³⁰ The region produces one-fifth of the wheat, corn, cotton, and cattle in the U.S. The rate of groundwater depletion has increased since 1950 with the maximum occurring from 2000 to 2008.³¹ Rapidly declining water levels are impacting farming revenue as costs of pumping rises. To ensure sustainable use, effective aquifer management requires recharge to match or exceed pumping rates; however, in the Ogallala region, recharge rates average only three inches per year. Each state is addressing this differently.³² Declining groundwater levels also influences the freshwater ecosystem including streams and rivers that depend on the aquifer.

A study from Kansas State University predicted that by 2060, the Ogallala aquifer, which Kansas draws upon, could

- 30 Crisis on the High Plains: The loss of America's Largest Aquifer The Ogallala, Jeremy Frankel, May 17, 2018 University of Denver Water Law Review.
- 31 USGS Water Science School, groundwater decline and depletion
- 32 https://water.usgs.gov/watercensus/AdHocComm/Background/Ground-WaterAvailabilityintheUnitedStates.pdf

be seventy percent depleted. The aquifer can be extended to 2160 if farmers cut use by twenty percent now. Kansas is making strides because farmers are making real commitments but that does not mean that the Ogallala aquifer will be saved.³³

According to the USGS, many other areas of the U.S. are experiencing groundwater depletion, which is evidenced by drying up of wells, reduction of water in streams and lakes, and decline in water quality because of saltwater intrusion. Aquifers along the Atlantic coast are facing groundwater depletion and saltwater intrusion along coastal counties in New Jersey; Hilton Head Island, South Carolina; Brunswick and Savannah, Georgia; and Jacksonville and Miami, Florida.³⁴

Groundwater pumping by Baton Rouge, Louisiana, increased more than tenfold between the 1930s and 1970s. In response, groundwater levels declined approximately 200 feet over this period. Due to the large water level declines, saltwater from the Gulf of Mexico has infiltrated into several aquifers.³⁵

In a recent study completed by the Cybersecurity and Infrastructure Security Agency:

"The removal of water from aquifers without incoming rainfall or replenishment at the same or greater rate is causing the water table to lower beyond reach of wells and aqueducts which is resulting in deeper wells and more digging, further compounding the loss of water within the aquifer. Mexico City, Tehran, numerous localities in Iran, and various parts of California have radar-confirmed studies linking subsidence to this issue with lasting damage to the structural integrity of various types of infrastructure considered to be imminent and potentially deadly if not mitigated."³⁶

Population growth can also lead to insufficient water supply and cases are beginning to emerge where growth of towns, cities, or regions is being limited by local governments because the projected effects of population on the current and projected supply of water indicate that growth is not sustainable. The impact of climate change on future supplies is already being factored in by communities³⁷ and impact of climate change is one of the considerations used by FEMA under its BRIC grant program.

Flooding

Extreme natural disasters are becoming more common (Figure 7), as climate change exacerbates conditions faced by systems already under stress from aging infrastructure; 2021 saw \$145 billion in weather and climate disasters in the United States.³⁸

As a point of perspective a single storm, Hurricane Katrina:

- 1. Hurricane Katrina was the largest and 3rd strongest hurricane ever recorded to make landfall in the US.39
- 2. In New Orleans, the levees were designed for Category 3, but Katrina peaked at a Category 5 hurricane, with winds up to 175 mph.⁴⁰
- 3. The final death toll was 1,836, primarily from Louisiana (1,577) and Mississippi (238). More than half of these victims were senior citizens. A primary objective of flood security should focus on keeping seniors safe and prepared for hurricane season.⁴¹
- 4. The storm surge from Katrina was twenty feet (six meters) high.⁴²

Storm water infrastructure helps manage and divert excess water during rain events, as impermeable urban

³³ Ibid.

³⁴ Barlow, P.M., 2003, groundwater in freshwater-saltwater environments of the Atlantic coast: U.S. Geological Survey Circular 1262

³⁵ Taylor, C.J., and Alley, W.M., 2001, Ground-water level monitoring and the importance of long-term water-level data: U.S. Geological Survey Circular 1217

³⁶ Western U.S. Drought and Wildfire Climatology Study - 2021 Sunny Wescott, Meteorologist and Critical Infrastructure Analysis.

³⁷ Jack Healy and Sophie Kasakove, "A Utah Town Halts Growth. It Lacks the Water." The New York Times, July 21, 2021 38

https://www.climate.gov/news-features/blogs/beyond-data/2021-us-billion-dollar-weather-and-climate-disasters-historical

³⁹ National Oceanic and Atmospheric Administration. "Hurricanes in History." National Hurricane Center. Accessed March 2, 2014. http://www.nhc.noaa.gov/out reach/history/#katrina

⁴⁰ https://infrastructurereportcard.org/

⁴¹ https://infrastructurereportcard.org/

⁴² https://infrastructurereportcard.org/



U.S. 2021 Billion-Dollar Weather and Climate Disasters

Figure 7: Source: Westcott, Sunny. "National and International Climatology Study: Extreme Weather Events and Impacts." Cybersecurity & Infrastructure Security Agency (2022).



Figure 8: The damaged spillway at Oroville Dam, CA. Image: CA DWR www.water.ca.gov

spaces struggle to accommodate the rapid influx of water these events entail. This infrastructure can include concrete storm sewers, roadside ditches, flood control reservoirs, rain gardens, and natural riverine systems. Despite the flood control capabilities these drainage structures can provide, many are inadequate, causing the American Society of Civil Engineers to give the nation's systems a "D" on their Infrastructure Scorecard.⁴³

Federal funding averages about \$125 million per year. To comply with current regulations alone, the country's systems need \$8 billion due to aging and the need to address the anticipated increase in flooding due to climate change.⁴⁴

In the wake of more than 40 years of minimal upgrades to dams and flood control regimens including levies, basins, and shoreline areas, the ability of legacy infrastructure to handle changes due to increased impervious cover in the uplands due to urban growth and climate or extreme weather events is increasingly concerning. Concern about these mitigation measures fades and they become a backburner issue until the next flood occurs.

In Norfolk, VA, the Navy installation is concerned by sea level rise. The Union of Concerned Scientists did a study and found that many naval bases along the Atlantic and Gulf coasts facing serious flooding events by 2050. It is common for people to check tide charts before parking their cars.⁴⁵ Tinker Air Force Base, OK.⁴⁶ is another location that affects national security due to flooding. There are over 91,000 dams in the U.S., many of which serve flood control purposes. In 2018, 81 percent of the dams were rated as high-hazard-potential had an emergency action plan on file with 2,300 dams lacking a plan altogether. States are generally underfunded and understaffed to track and inspect dams.⁴⁷

From January 2010 to April 2020, states have reported 270 dam failures and 581 incidents, episodes where dams could have failed without intervention or if circumstances had not abated.⁴⁸ Consequences can be considerable. In 2017, the Lake Oroville Dam on the Feather River in California spillway failed and displaced 180,000 people (Figure 8). In

Figure 9: Source: Bloom in western Lake Erie increasing. BG Independent News. (2021). <https://bgindependentmedia.org/bloom-in-western-lake-erie-increasing/>

cen

⁴³ https://infrastructurereportcard.org/

⁴⁴ Ibid.

⁴⁵ Nicholas Kusnetz, "Rising Sear are Flood Norfolk Naval Base and There's No Plan to Fix It," Inside Climate News, October 25, 20117

⁴⁶ https://infrastructurereportcard.org/

⁴⁷ American Society of Civil Engineers, Report Card for America's Infrastructure 2021, https://infrastructurereportcard.org/cat-item/stormwater/

⁴⁸ ASDSO, Roadmap to Reducing Dam Safety Risks, 2021, https://damsafety.org/Roadmap#The percent20Increasing percent20Hazard: percent20Summary per-

2016, in North Carolina, Hurricane Matthew resulted in a record seventeen dam failures. Despite this immense threat, seven states do not have the authority to require emergency action plans for dam failures.⁴⁹

All these events indicate a move towards more frequent and greater flood conditions than facilities have been designed for. Infrastructure is unable to keep pace, and action needs to be taken by the water sector to revise design assumptions by incorporating the projected effects of climate and land use change and to do so over the 75 to 100-year lifetime of facilities being built or enhanced.

Water Quality Degradation

Pollution remains a dominant concern in the water sector, especially for drinking water sources since pollution has both health and financial impacts. Case in point: the Great Lakes hold 84 percent⁵⁰ of North America's surface freshwater supply, but they⁵¹ are susceptible to the effects of climate change, pollution, and invasive species. Agricultural runoff from fertilizer and overflowing sewers are harming all the lakes. Lake Superior has invasive species and a loss of winter ice. Lake Michigan suffers from invasive Zebra and Quagga mussels filtering the water and killing the plankton that are needed by many fish species including salmon. Lake Ontario is threatened by storm water and sewage and use of water for electricity generation. Lake Huron, like Lake Superior, has invasive mussels that have led to declines in baitfish and salmon.⁵²

Lake Erie had an algal bloom that carpeted the western part of the lake in the summer of 2019 (Figure 9) of the kind which can cause skin blisters and damage to the liver. These blooms are a recurring annual problem on Lake Erie and have only gotten worse. Municipalities with water quality issues can be found everywhere.⁵³

Case in point: Jackson, Mississippi has a continuing issue with the pH of source water, and this requires adjustment by adding lime. However, the added lime causes high turbidity which can increase the likelihood of disease-causing organisms and therefore requires frequent boil water notices when turbidity thresholds are exceeded.⁵⁴ Throughout the U.S., runoff from rainwater often carries fertilizers, pesticides, animal waste bacteria and viruses into waterways, and arsenic, copper, and lead are found in drinking water in every state.⁵⁵

Lead Service Lines

Problem: Drinking water systems serving communities and their constituent households and facilities still contain a substantial amount of lead in pipes, fixtures, or the solder used to join pipes (Figure 10). Lead is a regulated material since it can cause serious negative health effects and loss of cognitive capabilities. It is important to note that a root cause of lead contamination is corrosion that occurs in the distribution and service system; but, while efforts to control corrosion can, and have, reduced the amount of lead in water systems, efforts continue to replace the potential source of contamination altogether.

Flint, Michigan received a lot of media attention for the toxic levels of lead in its water supply, but there are many other examples.⁵⁶ Lead service lines (LSLs) pose a huge threat to water-supply systems, as they were widely used until the early 20th century. National plumbing codes form the basis of most water system policies, and they continued to approve the use of lead piping and plumbing components well into the 1970s and 1980s although systems that did so were recognized as a cause of lead poisoning by the late 1800s.

⁴⁹ Federal Emergency Management Agency. (2019). *The National Dam Safety Program Biennial Report to the United States Congress, Fiscal Years 2016–2017*. Washington, D.C.: Federal Emergency Management Agency.

⁵⁰ https://www.epa.gov/greatlakes/facts-and-figures-about-great-lakes. The Great Lakes contain 21 percent of the world's surface fresh water: 5,472 cubic miles (22,810 km3) (about 6 quadrillion U.S gallons).

⁵¹ https://www.sciencedirect.com/science/article/abs/pii/S0048969722000638

⁵² Tim Folger, "Saving the Great Lakes," National Geographic, December, 2020, pp 40-81

⁵³ https://www.bobvila.com/slideshow/these-are-the-places-with-the-worst-tap-water-in-america-52263

⁵⁴ https://www.jacksonms.gov/state-imposes-boil-water-notice-on-jackson/

⁵⁵ Melissa Denchak, "Water Pollution, Everything You Need to Know," Natural Resources Defense Council, May 14, 2018

⁵⁶ https://bestlifeonline.com/worst-drinking-water/

The replacement of these pipes has varied significantly primarily because water systems are built to last decades. When utility systems have passed their effective lifespan mark, they are extremely difficult and costly to excavate, leading many communities to continue to push the problem off to the following fiscal year as water utility issues are often "out of sight, out of mind." Water utilities are responsible for providing safe drinking water, which they achieve by treating water to regulatory standards and maintaining safe water quality throughout their distribution systems. Variances in water chemistry and disturbances to water mains can cause lead from older water lines to contaminate drinking water. The need to update these systems to prevent water quality degradation is clear.

Terms of Reference: Water service lines are defined as those extending from the water distribution system to and through the plumbing serving households, businesses, schools, etc. It is instructive to further break down water service lines into four distinct segments of water service lines, because doing so reflects responsibilities for service line maintenance, upgrade, etc., and because each segment contributes to the amount of lead that may be present in the end-to-end system.

These four segments are:

- 1) the distribution system
- 2) the segment from the distribution system to the curb stop or meter
- 3) the service line from the meter to the facility served
- 4) the facility plumbing.

NOTE: that distribution systems of the United States are virtually free of lead and that the term 'lead service line' generally refers to segments two and three, that is, extending from the distribution system to the facility served and responsibility is generally divided between the utility and the facility owner. Also note that the replacement actions specified in the Bipartisan Infrastructure Law do not include the 23 million (15 percent) U.S. households that use private wells as their source of water.

Water utilities, which represent the collective interest of the community served, are responsible only for the water distribution system and for the segment of the system from the distribution system to the meter. Nevertheless, many have accepted some level of responsibility for replacing lead service lines all the way to the facility served, especially in those communities comprising underserved populations. The scope addressed by the Bipartisan Infrastructure Law seeks to address segments two and three, which would split the responsibility between the utility and the facility owner. Because of the expertise vested in water utilities, they are in a better position to oversee lead service line replacement, but only if they are compensated for their supervision and administration costs.

Estimates place the number of lead service lines (LSL) to be replaced at between 6 and 10 million⁵⁷. LSLs, however, constitute only an estimated 50 to 75 percent of the total lead amount contributed by the systems used for conveying and supplying drinking water, from source to the tap. Corrosion control is the most prevalent mitigation measure, and it can address the entirety of the supply system. LSL replacement addresses only a portion of the system.

A key aspect of any program involving a potentially harmful substance such as lead is widespread and continued testing, that is, taking samples frequently in areas of potentially high incidence to continue to monitor the effectiveness of mitigation.

An extensive body of knowledge has been developed around this topic and it can be expected to grow as the replacement actions under the BIL start to roll out. EPA and AWWA have published an extensive amount of scientific, programmatic, and operational information providing extensive coverage of the problem, potential solutions, and strategies designed to address the mitigation and eventual replacement of LSLs. The EPA has also

⁵⁷ https://www.epa.gov/ground-water-and-drinking-water/lead-service-line-replacement#:~:text=It percent20is percent20estimated percent20that percent20there, remove percent20these percent20 lead percent20service percent20lines.

Figure 10: Source: Lead Pipes Are Widespread and Used in Every State. Natural Resources Defense Council (NRDC. https://www.nrdc.org/lead-pipes-widespread-used-every-state

published a strategy document for informing the public and taking action, though the strategy was published prior to BIL passage. LSL replacement (LSLR) is a nationally scoped program whose implementation can serve as a model for the execution of similar programs that address issues having a national scope, but with local action.

The program provides an opportunity to establish metrics of effectiveness and to strengthen governance structures at all levels, extending from individual households all the way up to the Federal government. Extensive information exists about the problem; now that funding has been provided, it is incumbent on policymakers to oversee the execution in a way that can set standards for similar programs in the future, especially programs that pursue broader objectives, such as continuous water pipe replacement.

Conviction is complete; it is now time to execute. See Call to Action and the U.S. Congressional Bipartisan Infrastructure Law.

Vulnerable Physical Infrastructure

The American Society of Civil Engineers Infrastructure Scorecard for 2021 gives water a C-rating, up slightly from the 2017 rating of "D." This is particularly concerning given the millions of miles of water piping in the US (Figure 10). It is no surprise that the Scorecard report found that there is a water main break every two minutes on average in the U.S., and an estimated 6 billion gallons of treated drinking water is lost per day.

A sinkhole caused by crumbling water, drainage, and sewerage pipes occurs every four days⁵⁸. Our infrastructure is rapidly crumbling, and local utilities are struggling to keep up. As reported by the New York Times,

"By 2020, the average age of the 1.6 million miles of water and sewer pipes in the United States will hit 45 years. Cast iron pipes in at least 600 towns and counties are more than a century old, according to industry estimates. And though Congress banned lead water pipes three decades ago, more than 10 million older ones remain, ready to leach lead and other contaminants into drinking water from something as simple as a change in water source."⁵⁹

Water utilities and wastewater systems rely on electric power. If the electric power grid were not available, water and wastewater systems would not be able to provide a normal level of service without generators or other power sources to maintain a business as normal status. This would include storing enough fuel to keep the power source operational for sustained periods.

In some cases regulatory policies have forced utilities to limit use of emergency power. For example, EPA places limits on the number of hours that generators can be operated, under the provisions of the Clean Air Act.⁶⁰

Lessons learned about the fragility of generators from extreme weather events including bomb-cyclones and torrential downpours over the last few years include:

- Generators started to fail after hours of operation and needed experts to repair
- There was competition for generators
- 58 Neer Home," Neer. https://neer.ai/

lead percent20service percent20lines.

⁵⁹ https://www.epa.gov/ground-water-and-drinking-water/lead-service-line-replacement#:~:text=It percent20is percent20that percent20that percent20there,remove percent20these percent20

⁶⁰ https://www.epa.gov/title-v-operating-permits/clarification-epas-position-use-emergency-backup-generators-during-power

not have their own generators.⁶² Those that do have generators tend to be larger water systems with the expertise needed to maintain them. Resilient water systems require reliable power systems, which in some cases means having a source of power independent of the main traditional power grid and capable of sustaining operations when that traditional grid is down.

Of the 160,000 water systems, many do

Very few utilities are capable of sustaining water services for periods extending beyond a grid outage lasting more than two weeks, let alone a Black Sky event where electric power could be out for a period of a month or more.

Security Threats

In 2002, Congress first required drinking water systems to:

1. assess their vulnerabilities to terrorist attacks, intentional contamination, insider threats, etc., intended to disrupt water service

2. submit these risk assessments to EPA

3. develop emergency response plans based on their assessments.

These requirements apply to community water systems that regularly serve at least twenty-five individuals yearround.

Further, in January 2022, the White House released a Water Sector Action Plan that outlined a 100-day surge of actions to improve the cybersecurity of the sector to facilitate the deployment of technologies and systems that provide security threat visibility, indicators, detections, and warnings. The action plan was developed in close partnership with the Environmental Protection Agency, the Cybersecurity and Infrastructure Security Agency (CISA), and the Water Sector Coordinating Council (WSCC). The federal government has limited authority to set security requirements for water infrastructure and requires cooperation from the private sector and municipal owners and operators.

Attacks in recent years include:

On February 5, 2021, the water computer system for the city of Oldsmar, Florida, which has a population of about 15,000, was hacked and the level of sodium hydroxide was increased by 100 times. Sodium hydroxide, the main ingredient in liquid drain cleaners, is used to control water acidity and remove metals from drinking water in treatment plants, but at heightened levels can be toxic and deadly.⁶³ After the hacker exited the computer, the

⁶¹ Powering Through: From Fragile Infrastructures to Community Resilience, 2016, InfraGard Electromagnetic Pulse Special Interest Group (now National Disaster Resilience Council), p 60

⁶² Ibid, p 62

⁶³ Jenni Bergal, "Florida Hack Exposes Danger to Water Systems," PEW, March 1, 2021

operator immediately reduced the sodium hydroxide back to its normal level and then notified his supervisor. Even if it hadn't been quickly reversed, the system had proper safeguards in place, and the water would have been checked before it was released, so the public was never at risk. State and local officials around the nation have been alarmed by this incident and have issued warnings and increased training.⁶⁴

In fall 2020, the Jersey City Municipal Utilities Authority was hit with a cyberattack that blocked access to "vital" information related to water and sewer services in New Jersey's second-largest city. The incident was determined to have threatened the "health, safety, and welfare of the citizens of Jersey City," per a resolution passed by the agency's Board of Commissioners. The Jersey City attack occurred despite the fact that New Jersey passed the Water Quality Accountability Act (WQAA) in 2017, requiring every drinking water system in New Jersey that serves more than 500 customers meet security standards.⁶⁵

Most of the 160,000 water facilities are nonprofit without security experts and may not have adequate support. These numbers, however, do not reflect the fact that the vast majority of the U.S. population is served by a few hundred large water systems that can afford to have security experts (Table 2).

Table 2: SIZE CATEGORIES OF COMMUNITY WATER SYSTEMS⁶⁶

System Size (population served)	Number of CWSs	Population Served (millions)	% of CWSs	% of U.S. Population Served by CWSs
Very Small (25-500)	26,963	4.6	54.2%	1.4%
Small (501-3,300)	13,334	19.2	26.8%	6.1%
Medium (3,301-10,000)	5,022	29.5	10.1%	9.4%
Large (10,001-100,000)	3,975	114.5	8.0%	36.4%
Very Large (>100,000)	446	147.0	0.9%	46.7%
Total	49,740	314.8	100%	100%

A threat to the security of the water utility sector is the continued use of outdated technologies. Most of the water systems use highly specific, outdated legacy IT systems in closed, proprietary formats.⁶⁷ Some systems continue to use analog data recording systems, which could be helpful in a cyberattack. This level of variability and the lack of standardization presents a security risk if the heterogeneous systems cannot be cost-effectively supported, and if they cannot be readily integrated with available AI and cloud-based monitoring systems to prevent, address, and mitigate attacks.

Lack of Financial Resources Dedicated to Water Security

Federal investment in water infrastructure has steadily declined over the years.⁶⁸ When the Clean Water Act (CWA) was enacted in 1972, it established a strong ecosystem of local-state-federal partnerships to utilize the \$60 billion in federal grants given to utilities nationwide. This grant program was eventually replaced by low-interest loan programs, with the Clean Water State Revolving Loan Fund passing in 1986 and the parallel Drinking Water State Revolving Fund passing in 1996.⁶⁹ As costs have risen, water utilities and state and local governments have had to increase their investments to make up for shortfalls or see a reduction in water availability in their regions.

⁶⁴ Ibid

⁶⁵ Michael Sol Warren, "Florida Water System Hack offers Lessons for Other States, Government Technology, April 19, 2021

⁶⁶ Michael Sol Warren, "Florida Water System Hack offers Lessons for Other States, Government Technology, April 19, 2021

⁶⁷ www.waterisac.org/system/files/articles/AA21-287A-Ongoing_Cyber_Threats_to_U.S._Water_and_Wastewater_Systems.pdf

⁶⁸ Funding for the EPA Water Infrastructure A Fact Sheet, Congressional Research Service, March, 2019

⁶⁹ Ibid.

Affordable H20, a joint campaign led by the National Association of Clean Water Agencies (NACWA) and the Association of Metropolitan Water Agencies (AMWA), states:⁷⁰

"By some accounts, the U.S. faces a funding gap of about \$1 trillion in investment in water and wastewater systems over the next twenty years [note: this funding would be as applied to legacy thinking and infrastructure]. The most recent EPA Clean Watersheds Needs Survey found \$271 billion in need for wastewater and stormwater systems, and the most recent EPA Drinking Water Needs Survey found \$473 billion in need for drinking water systems. These EPA surveys estimate the investment needed just to maintain existing systems. They do not include the costs of likely new regulations, population growth, system expansion, and climate change/resiliency."⁷¹

Unless we find alternatives, a combination of federal, state, local and corporate funding may have to cover the tremendous shortfall in water infrastructure (Figure 13).

Figure 12: Source: Cyber Risks and Resources. Cybersecurity & Infrastructure Security Agency. (2021) < https://www.cisa.gov/sites/default/files/publications/infographic-supply-water-national-critical-function-102021-508.pdf>

CALL TO ACTION

Everyone has an important role to play in addressing the water security issues. The following are some ideas of actions that can be taken to help improve the security and resilience of our water. Readers may think of their own suggestions and can add them to their own lists. Citizens, communities, industry, utilities, policymakers,

⁷⁰ NACWA and AMWA Launch Affordable Water, Resilient Communities Campaign, February 1, 2021, https://www.affordableh2o.org/wp-content/up loads/2021/01/AWRC-Launch-PR_Final.pdf

⁷¹ Affordable Water, Resilient Communities[™] The Growing Water Affordability Challenge: How Did We Get Here?, National Association of Clean Water Agen cies, https://www.affordableh2o.org/wp-content/uploads/2021/02/affordabilitychallenge_pt1.pdf

\$4.8 trillion

Source: AMERICAN SOCIETY OF CIVIL ENGINEERS

NEEDS TO BE INVESTED IN WATER INFRASTRUCTURE OVER THE NEXT TWENTY YEARS TO MAINTAIN A STATE OF GOOD REPAIR

Figure 13: Source: Value of Water. (2021) http://thevalueofwater.org/

and inventors are needed to make our water future more secure and resilient. This is a Call to Action!

Citizens

• Use water wisely.⁷² There are many water reduction opportunities, including:

• Installing water-efficient fixtures and appliances (can reduce water

use by approximately twenty percent⁷³ See EPS WaterSense for appliances and yards)

- Installing rain barrels or cisterns to capture rainwater to be used for landscaping
- Replacing landscaping with plants that are more acclimated to the local conditions, thereby reducing, or eliminating, the need for irrigation
- Performing water savings audits to identify other opportunities to save water (many utilities provide this service for free)
- Understanding local water issues. Citizens should understand water issues of their communities including those affecting local water supplies and sustainability.

• Engaging with the community and community leaders. Individuals and groups should engage with each other and their leaders to express their concerns and develop strategies for ensuring adequate, safe water into the future.

Communities

- Following the examples set by Portland, Oregon's Regional Water Providers Consortium, and the regional water use and conservation partnership between the City of Las Vegas and the Southern Nevada Water Authority, promote community water conservation and reuse through:
 - Community education,
 - Long-term joint community and utility planning, and
 - Providing financial incentives to retrofit appliances and changes to landscaping.
 - Study the FEMA BRIC program and determine if applying for a grant would help mitigate threats identified in utility vulnerability assessments.
- Adopt sustainable building practices, such as those instituted by Washington District government⁷⁴ that promote water capture and retention, such as:
 - Replacing impermeable surfaces;
 - Increasing storm water detention facilities to slow runoff in urban areas; and
 - Increasing groundwater retention/aquifer recharge schemes in groundwater reliant regions.

• Hold tabletop exercises with utilities and emergency managers/responders to improve planning and preparedness.

• Establish and conduct regional water resource planning efforts that examine a variety of initiatives holistically and evenly.

Artificial recharge allows surplus stream flows to be diverted into infiltration basins designed to artificially recharge the aquifer. See for example, efforts conducted by SWIFT, an innovative water treatment initiative in eastern Virginia designed to ensure a sustainable source of groundwater while addressing environmental challenges

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⁷² https://wateruseitwisely.com/

 $[\]label{eq:https://www.epa.gov/watersense/statistics-and-facts \#: ~: text = Each percent 20 American percent 20 and percent 20 average, water percent 20 Efficient percent 20 fixtures percent 20 and percent 20 applianc percent$

https://www.adaptationclearinghouse.org/resources/washington-d-c-district-of-columbia-stormwater-ordinance-2013-rule-on-stormwater-management-and-soilerosion-and-sediment-control.html

such as Chesapeake Bay restoration, sea level rise and saltwater intrusion. SWIFT Water is treated to match the existing groundwater chemistry and added to the Potomac Aquifer, the primary source of groundwater throughout eastern Virginia.⁷⁵

Such infrastructures are thus far more expensive to create than actions taken to preserve the natural basins, so, a focus on more rapid cleansing to portability of surplus streams and reinjection of that flow by the local water supply can make a disproportionate economic impact in places including the U.S. Great Lakes, where otherwise expensive storage basins are required and have been or are being constructed in Chicago76, Cleveland, Detroit, and other cities. But storm flows often have a high sediment content which reduces the efficiency of the recharge basin and makes treatment and handling more like wastewater flow management. Communities and regions should include and evaluate a variety of measures when conducting water resource planning, funding, and implementing.

Industry

- Develop and promote water conservation and reuse practices. Available opportunities vary by sector:
 - Agriculture improve water distribution efficiency by reducing leaks in existing systems; install, where possible, high-efficiency irrigation equipment; implement irrigation schemes that more
 - efficiently distribute water to crops; install soil moisture and other sensors to inform more appropriate use of irrigation resources; and switch to lower water-use crops in arid regions.

• Electric Power - limit use of open-loop cooling; expand utilization of low water use generation technologies (such as natural gas combined-cycle, solar and wind); install high-efficiency cooling systems; foster reduced energy use.

- Mining recycle produced water, expand use of non-fresh sources of water.
- Manufacturing install efficient water use technology.

• Provide guidelines to manufacturers regarding how to build efficient water use into their products. Incentivize them to do so, through tax relief and other means like the WaterSense Program.⁷⁷

• Increase water storage and detention using green and gray infrastructure.⁷⁸ (Green-gray infrastructure includes mixing natural measures (including natural coastal buffers such as mangroves and seagrasses) with conventional approaches (such as concrete dams and seawalls).

• Improve management of nonpoint source pollutants (fertilizers, toxic chemicals, sediments from construction sites, etc.) produced by industrial practices.

Utilities

Prepare

- Build a reliable water system.
- Replace end-of-life infrastructure versus running to failure.

• Install stationary emergency standby power generation at all critical facilities, if possible, or plan for, and employ mobile generators if there are funding constraints.

• Redesign infrastructure to combat the changes in weather impacts and rising sea levels.Build in system redundancies, including the ability for the water system to run manually, alternate sources of supply, alternate pumping, and interconnections with neighboring water utilities.Support research into alternative water supply technologies.

• Develop alternative sources of water that can deliver the appropriate quantity at required delivery pressures. Examples include water re-use, desalination which requires regulator support, the understanding of the additional cost associated with alternate water sources and developing public

77 https://www.epa.gov/watersense

quires percent20changing percent20our percent20infrastructure.

⁷⁵ https://wateruseitwisely.com/

⁷⁶ https://www.chicago.gov/content/dam/city/depts/water/general/Engineering/MS4/MS4_Stormwater_Plan.pdf

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support. Consider new emerging technologies such as generation of water from air.

- Look for methods with minimal impact to the environment and community.
- Collaborate with regulators and lawmakers to develop informed regulations around water.

Develop relationships

- With your commercial energy suppliers, including electric, natural gas and fuel.
- With your chemical suppliers and operators in your supply chain.
- With local emergency managers, first responders, community leaders and regulators.
- Be part of and create mutual aid agreements with your surrounding communities.

• Market the value of water, making sure your community understands how important water is to health, safety, and economic well-being.

- Have a Plan.
- Conduct all planning with a future perspective of 50 or 100 years.
- Develop an emergency response plan, exercise/practice it and share it with all stakeholders.
- Perform risk assessments of the water system to better inform vulnerabilities and identify solutions.

Protect

• Protect the people, places, and things needed to maintain the water supply in sufficient quality and quantity for public health and safety.

• Create safe work environments for employees in their daily work but also during emergencies. This includes protecting, not only the employees, but their families in times of crisis. If an employee's family is not safe, the employee will not be present.

• Protect facilities from natural and manmade threats. Include sources of supply, treatment plants, pumping stations, storage tanks, the distribution, and control systems.

• Protect all the utility equipment and supplies, including trucks, construction equipment, replacement parts and chemicals.

- Protect data and provide cybersecurity. Adopt a cybersecurity framework to better protect information and operational technology.
- Protect against electromagnetic threats and educate shareholders on the needed protection.
- Plan for extended power outages lasting two or more weeks, over a large area.

Many of the recommendations require capital investment and funding, but others focus on making more effective and efficient use of existing assets, such as through asset management programs.⁷⁹

Water utility customers' bills should reflect the true cost of water service with adjustments made for true economic hardships and underserved communities. The true cost of creating, delivering, and protecting reliable, clean water should be reflected in all water utility customers' bills. Pricing should reflect affordability and the cost of maintaining reliability, sustainability, and safety. Communities are responsible for meeting their own needs.

The state and federal governments should be prepared to underwrite risks that are beyond the capacity of the community through means such as those provided by the Infrastructure Investment and Jobs Act.⁸⁰

Policies for all levels

• Create new funding streams to support technology development and demonstration aimed at creating water (atmospheric water generation) and to treat non-fresh sources of water (treatment (e.g., seawater, brackish water, produced water, wastewater recycling). New technologies are coming online.

⁷⁹ https://www.awwa.org/Resources-Tools/Resource-Topics/Asset-Management

⁸⁰ https://www.congress.gov/bill/117th-congress/house-bill/3684/text

• Invest in expanded and new data collection. Data are critical when making decisions on investments and actions to improve infrastructure; consequently, we must leverage ongoing advances in IoT and data analytics to collect more data and analyze it better. In addition, the data could be essential in modeling to make more informed decisions. Public communications are essential and will be enhanced with better data and models.

• Continue efforts to ratify and clarify water rights, treaties, compacts, settlement agreements, etc., to improve the management and equitable distribution of contested water resources. Review new policies for their joint impact on linked infrastructure sectors including water, energy, food, and the environment.

• Plan for loss of electric power for at least up to 30 days for water and wastewater systems including backup generation and fuel maintenance.

• Encourage funding for water sector programs through currently existing programs, such as the FEMA BRIC program, the Clean Water State Revolving Fund, or a new specific national fund, like a Storm Water State Revolving Fund, or a loan — and loan — guarantee program like a Water Infrastructure Finance and Innovation Act (WIFIA) for storm water.

• Adopt or review policies that require flood control infrastructure that mitigates future risk and response to flood events in real time if mitigation systems are overwhelmed. Projects can include construction of levees, river dredging, bank reinforcement, and increased cleansing to reintroduce storm water to existing potable systems.

• Adopt policies that require water retention like house detention tanks, dry ponds, and underground storage.

• Encourage federal, state, and local agencies to develop all-hazards risk mitigation plans which could also include climate-exacerbated extreme water-related events.

• Explore new ways to encourage following the Safe Drinking Water Act and ensure the provision of funding and technical assistance to bring intractable utilities and utilities serving small and/or disadvantaged communities into compliance.

- Encourage following the Clean Water Act, specifically by targeting source water protection. This could include incentive programs through USDA, EPA, and others.
- Research and restrict the sale of emerging contaminants that lead to adverse health effects when introduced in drinking water.
- Encourage utilities to use adaptive management and maintain stopgap solutions in the interim while services are being restored.

Congressional Bipartison Infrastructure Law

We have an unprecedented opportunity to act given the 2021 U.S. Congressional Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act) which invests \$55 billion⁸¹ in drinking water, wastewater, water reuse, conveyance, and water storage infrastructure over five years.

It also includes supplemental funding for the Drinking Water and Clean Water State Revolving Funds, targets lead service lines and emerging contaminants, and increases support for tribal, rural, and EJ communities. While the American Society of Civil Engineers says we need nearly \$1 trillion in investment, this infusion of funding can make a big difference if done right. It will take citizens, communities, industry, utilities, policymakers, and inventors of new technology to make our water future secure.

The BIL funding will be distributed through EPA, DOI, DOC, and HHS programs. The two primary agencies are the EPA and the DOI (primarily through the Bureau of Reclamation). Funding for water infrastructure is administered through the US Army Corps of Engineers, and a handful of programs are administered through DOE, DHS, and the USDA; \$23.43 billion will be provided as supplemental funding to the two State revolving Funds (SRFs). The Clean Water SRF is a partnership between the EPA and state environmental agencies, and functions as a financial assistance

⁸¹ https://www.whitehouse.gov/bipartisan-infrastructure-law/

program/environmental infrastructure bank.

The Drinking Water SRF functions in the same way as the CWSRF, but eligible projects specifically target public health goals through water infrastructure investment, rather than environmental goals. Both programs benefit from extreme flexibility in implementation practices, as the funds are distributed to an appointed state agency, then administered at the state level.

The breakdown of the other funding streams can be seen below in Table 3.

Table 3. Breakdown of Bipartisan Infrastructure Law funding for water.

Lead Service Lines	\$15 billion
PFAS and Emerging Contaminants	\$10 billion
Public Health Outcomes and Water	\$1.8 billion
Indian Water Rights	\$2.5 billion
Rural Water Issues	\$1 billion
Western Water Issues	\$7.1 billion
Water and Sewer Tax	\$1.25 billion

The Bipartisan Infrastructure Law represents the largest investment in the resilience of physical and natural systems in American history. The White House Action Plan on Global Water Security committed to conserving 30 percent of U.S. lands and waters by 2030, which will promote resilience and conserve important watersheds and includes the Drought Resilience Interagency Working Group.

CONCLUSION

Water is life for all of us and the lifeblood for our economy.

Water security and resilience in the U.S. is at an extremely critical point where action is essential, and problems must not be ignored. We have outlined issues with water and provided A Call to Action to help with the issues. Our economy and thus the nation is dependent on water. Each person, community, industry, and utility can act and policymakers have a big role. New technological development can play a strategic role in providing innovative solutions.

The water sector and our nation's water supply face a myriad of complex, emerging, and compound challenges. These issues put even the most capable industries, municipalities, and leaders to the test. Because of the evolving nature of critical water issues, governments must continue to foster a holistic understanding of the environment, the opportunities, emerging technologies, and then use these to inform options and take action. The failure to act is an act in itself. But it's often not the beneficial kind. With water issues cascading into every area of both the public and private sectors, leaders must be aware that the risks posed by inaction can far outweigh action even if it's imperfect. The caution to all leaders is that what the United States is experiencing with respect to water is real and it is now. We must respond to these realities and conditions with actions that enhance the well-being and stability of our communities.

If we fail to do this, nature and malevolent actors will continue to adversely impact water supplies and critical infrastructure with greater effect.

While the US Congress and Federal Agencies can create courses of action for all communities, communities are best served when there is a combination of federal support and citizen engagement, with leadership coming from all levels.

A bottom-up strategy with a pioneering and independent spirit are the hallmarks of the American people. We can be and should strive to be resilient, self-sufficient, and demonstrate to our government that together we can solve the hardest of issues locally through cooperation and intelligent strategies that allow all stakeholders to have a voice.

So, what do we do about it? Please act and consider some additional ideas including:

- Advocate for responsible investment in infrastructure improvements.
- Encourage spending on water, the most important substance we need for life, industry, economy, and country to ensure resilience.
- Advocate innovation—in water management, water making, water cleansing, water storage, water preservation, water resilience and water security.

We must promote environmental stewardship, resilience, innovation, and unity all at the same time. Our nation is great, and we must be sure it can remain.

Water is life for all of us and the lifeblood for our economy. The economy is in turn the lifeblood for our way of living and our democracy. Water must be viewed as a national defense imperative. Water is Vital.

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