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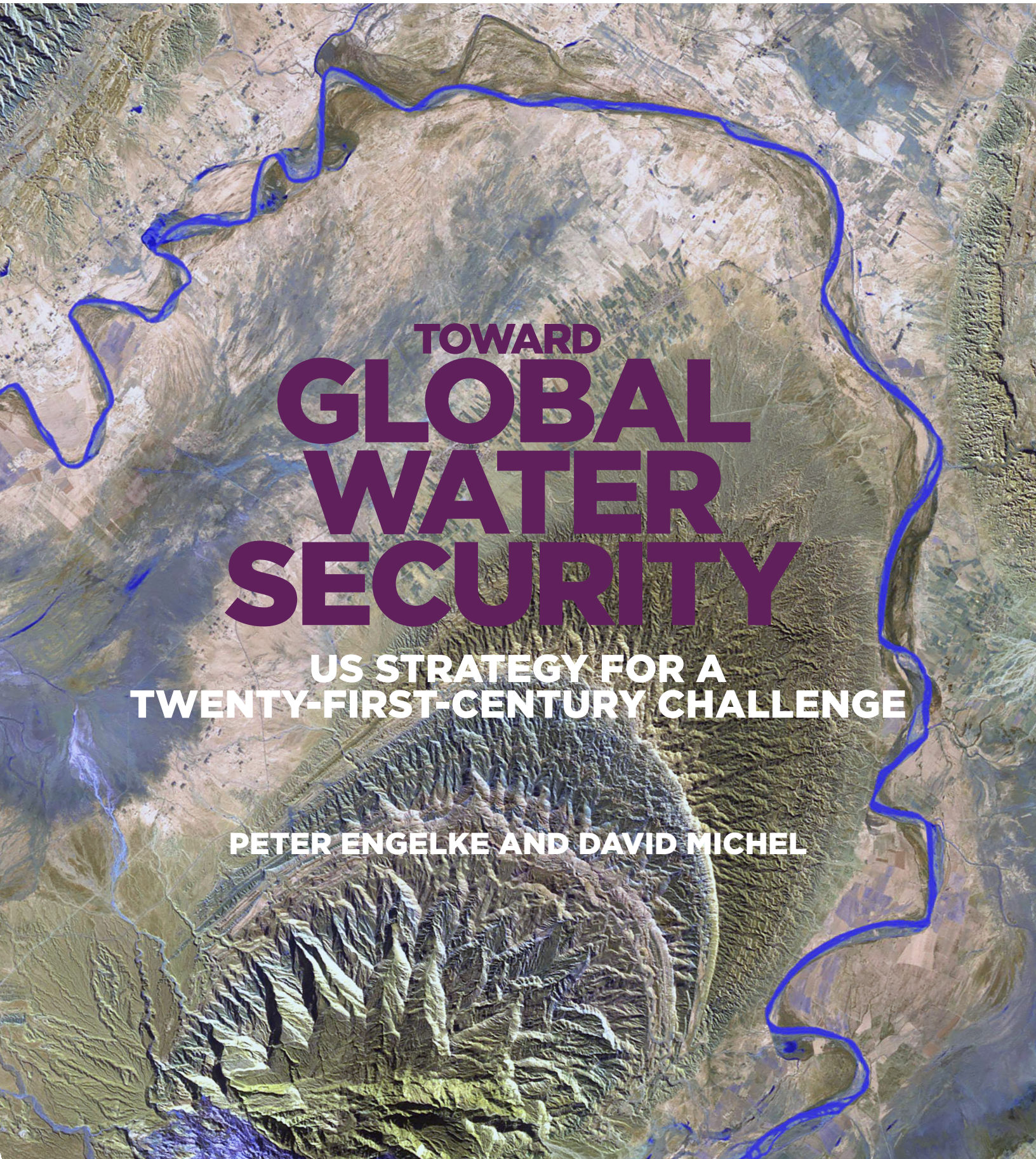

TOWARD GLOBAL WATER SECURITY

US STRATEGY FOR A TWENTY-FIRST-CENTURY CHALLENGE

PETER ENGELKE AND DAVID MICHEL

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Cover photo credit: US Geological Survey. Section of the Mand river, western Iran, as photographed from space by Landsat 7.

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About the Atlantic Council and US Water Partnership

The Atlantic Council promotes constructive leadership and engagement in international affairs based on the Atlantic Community's central role in meeting global challenges. The Council provides an essential forum for navigating the dramatic economic and political changes defining the twenty-first century by informing and galvanizing its uniquely influential network of global leaders. Through the papers it writes, the ideas it generates, and the communities it builds, the Council shapes policy choices and strategies to create a more secure and prosperous world.

The US Water Partnership's mission is to unite and mobilize US expertise, resources, and ingenuity to address global water challenges—at home and abroad. A joint effort of both public and private sectors in the United States, the USWP has more than one hundred partners, including those from government agencies, civil society, and the private sector. Focusing on technical exchanges, best practices, and innovation, the USWP is a catalytic platform, reaching more than 150 countries and impacting hundreds of thousands of people.

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EXECUTIVE SUMMARY

This report assesses the conditions under which a global Water Grand Strategy (WGS) might be created and implemented by stakeholders in the United States within the next one to two years. While numerous American organizations are addressing water challenges the world over, no explicit policy or vision coordinates their multiple endeavors. As a result, the United States does not maximize its influence in finding solutions to the world's most pressing water challenges.

This report evaluates the need for a WGS and explores the possible ends of such a strategy. It summarizes what the United States is already doing in the water space,[1] and identifies the current model's strengths and weaknesses. It outlines a process for forging a "Whole of America" water strategy—a stakeholder-driven process—and addresses key implementation challenges.

This report is part of an Atlantic Council/US Water Partnership (USWP) collaboration on global water security challenges. Leadership within both organizations believe that the US government should elevate global water challenges to the top of its priority list. Both organizations maintain that global water security challenges will become increasingly critical, including within countries and regions that are of the highest geostrategic importance to the United States.

This document asserts that the US government should heed the recommendations contained within a WGS and, in so doing, leverage the United States' numerous organizations working in the water space.

The proposed WGS would be built around the United States' considerable strengths in the water space, including those of its civil society and the private sector, but it would not be designed to address US domestic water challenges (in this report, we use "civil society" as shorthand to describe US citizens and nongovernmental organizations, or NGOs). This report focuses on how the United States government and other key stakeholders should engage internationally. There are many cases for which US actions in the international context might be replicated domestically. In so doing, the United States would benefit domestically from more strategic interaction on water issues abroad.

This assessment is based on interviews conducted by the authors during February and March 2016, in addition to other background research. Interviewees included water experts from US government agencies and departments, corporations, universities, philanthropies, nonprofit organizations, and multilateral institutions (see Appendix). All interviews were conducted off the record in accordance with Chatham House rules.

1 "Water space" is defined as policies and activities to enhance the development, security, and governance of water supplies, infrastructure, and institutions.

THE UNITED STATES' LEADERSHIP OPPORTUNITY

It is axiomatic that water is fundamental to all human endeavor. Water quite literally runs through every sector and touches nearly every issue of significance to the United States. Yet our world is hardly water secure (see box 1). Many societies face either a chronic undersupply of clean fresh water or a dramatic variability in that supply. A great many places are experiencing a rising demand for water at the same time that climate change and overuse are threatening water supplies. According to the Organisation for Economic Co-operation and Development, the number of people worldwide living in river basins under severe water stress is projected to rise sharply, from 1.6 billion in 2000 to 3.9 billion in 2050, more than 40 percent of the global population. Nearly all of Central and South Asia, the Middle East, and much of China and North Africa will be so affected.[2]

The world needs to meet these challenges if it is to fulfill an array of critical ends (discussed at length in the next section), ranging from human development to economic development to international security. Possessing the fullest range of diplomacy, defense, and development resources and capabilities of any country on Earth (the so-called "3-D" assets), the United States is in a position to be the most important global actor in the water space. The US government, civil society, and private sector together have an unmatched combination of credibility, depth of resources, global reach, access to networks, and technical expertise.

The United States' leadership opportunity is to formulate and implement a global water strategy that takes systematic advantage of these strengths. Doing so could help ensure that all societies are "water secure," thereby helping the world attain one of the twenty-first century's core global public goods.[3] Providing a vision for US global water activities and a structure to coordinate those activities would position the United States as the recognized world leader in the water space.

BOX 1: GLOBAL WATER CHALLENGES

Water challenges are severe in many world regions, and becoming worse in some. Within the coming decades, increased water scarcity, poor water quality, and the impacts of climate change are likely to worsen and spread diseases, undermine economic growth, limit food and energy production, and threaten peace and security around the world. Water insecurity and poor water quality currently exact the biggest toll on human health and productivity. Diarrheal disease from unsafe water is the second leading cause of death in children worldwide and a key factor in global malnutrition and stunting. The lack of access to safe drinking water and sanitation remains a major impediment to the development and education of the poor, particularly women and girls who often are at a higher risk of unmet sanitation needs. Water-related disasters (e.g., droughts, floods) affect more people than all other natural disasters combined and are increasingly impacting global supply chains. Sources of freshwater, such as underground aquifers, are overexploited and becoming increasingly polluted—putting many major agricultural areas and drinking water sources at risk.

US interests are enhanced in four respects when it engages on global water security challenges.

First, American engagement advances security and stability in regions of fundamental importance to the United States. Water security contributes to America's foreign policy ends, including regional security, through improved human well-being and development and, conversely, the minimization of risk. Water security is a fundamental issue for countries that are of the highest geopolitical concern to the United States. Many of these nations are water-insecure states that depend on transboundary river systems, rendering water a crucial component of their regional politics (see table 1).

2 *Environmental Outlook to 2050* (Paris: Organisation for Economic Co-operation and Development, 2012), pp. 214, 218. Severe water stress is a ratio exceeding 0.40, consisting of the annual average water withdrawals divided by the annual average available water resources.

3 "Water secure" refers to maintaining "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability." UN Water, *Water Security and the Global Water Agenda* (Hamilton, Ontario: United Nations University Institute for Water, Environment & Health, 2013), p. 1.

Table 1: Overlap between Select Transboundary River Systems and US Geostrategic Interests

River Basin	Basin Countries & Territories*
Nile River	Burundi, Democratic Republic of the Congo Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Tanzania, Uganda
Niger River	Algeria, Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Guinea, Niger, Nigeria, Mali
Tigris and Euphrates Rivers	Iran, Iraq, Jordan, Saudi Arabia, Syria, Turkey
Jordan River	Israel, Jordan, Lebanon, Syria, West Bank
Indus River	Afghanistan, China, India, Pakistan
Ganges-Brahmaputra-Meghna River Basin	Bangladesh, Bhutan, China, India, Nepal
Mekong River	Burma, Cambodia, China, Laos, Thailand, Vietnam

*As defined by the Food and Agriculture Organization of the United Nations.

In the world water system, no country is an island, so to speak. Just as the global water cycle ignores political boundaries, so water insecurity can transcend borders to harm the United States. In 2011, for example, disastrous flooding inundated thousands of factories in Thailand, not only devastating that nation's economy, but also reverberating through interconnected global supply chains, shuttering production plants from Malaysia to California.[4] Similarly, as the US municipal water crisis in Flint, Michigan, amply demonstrates, citizens worldwide regard the provision of water services as a key indicator of government competence and accountability. Failure to meet these responsibilities can sap state legitimacy and spur political conflict. Many analysts argue that ineffective and inequitable water management policies, exacerbated by persistent drought, helped fuel societal grievances and population displacements that ultimately contributed to insurgency and civil war in Mali and Syria.[5]

The implications of a water-insecure world for US national security are multiple, profound, and unsettling. Water can be a source of conflict both within and between countries and is increasingly used as a weapon of war. A 2012 assessment of global water security conducted by the US intelligence community concluded that mounting water resource challenges risk increasing the future likelihood of state fragility and potential failure, aggravating regional tensions, and destabilizing countries important to the United States.[6] In water-insecure countries, the assessment warned, water could become a tool of political coercion or a weapon of war—a judgment since reinforced by the actions of the Islamic State of Iraq and al-Sham (ISIS) in Syria.

Second, water diplomacy should be seen as central to American diplomacy. Pursuing hydro-diplomacy enables the United States to engage with other societies on issues that they themselves prioritize and want to address, demonstrating responsiveness to tackling challenges that other nations view as vital to their own interests. Hydro-diplomacy thus realizes shared objectives, building partnerships that empower—and are seen to empower—other countries and communities to achieve their own ends while advancing US goals. By the same token, hydro-diplomacy also positions the United States as a global leader. The United States should treat water diplomacy as an opportunity to influence a field that other countries, including its global competitors, also play on (China uses water as a diplomatic tool, too).

4 The flooding in Thailand temporarily shrank global manufacturing output by an estimated 2.5 percent. See "Natural Disasters: Counting the Cost of Calamities," *Economist*, January 14, 2012.

5 Scott Straus, *Mali and Its Sahelian Neighbors*, World Development Report 2011 Background Case Study, World Bank, July 2011; Dona J. Stewart, *What Is Next for Mali? The Roots of Conflict and Challenges to Stability* (Carlisle, PA: US Army War College, November 2013); Peter H. Gleick, "Water, Drought, Climate Change, and Conflict in Syria," *Weather, Climate, and Society*, vol. 6, no. 3, 2014; Colin P. Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought," *Proceedings of the National Academy of Sciences*, vol. 112, no. 11, 2015.

6 *Intelligence Community Assessment: Global Water Security,* Office of the Director of National Intelligence, ICA 2012–08, February 2, 2012.

A water pump in Ghana provided by USAID. Worldwide, 663 million people currently lack access to an improved water source. *Photo credit*: USAID/Flickr.

Third, US prestige abroad is enhanced through active American engagement on water. As the authors of *Dynamic Stability*, the first Atlantic Council strategy paper (April 2015), observed, "American power ultimately derives from its ability to lead by ideal and aspiration, instead of by force."[7] America's reputational aura is burnished when the United States leads in furnishing global public goods. In this case, the United States' reputation is enhanced when it leads to solve water challenges around the world. US allies and partners want the same things in the water space: to see water used for its proper ends, including peace, stability, prosperity, and resiliency. Thus the United States shares common ends with its closest partners, including those who are recognized as global leaders in hydro-diplomacy (see box 2). The question, therefore, is less one of how to *convince* others to sign up to a common agenda, but rather of how best to *catalyze* and *coordinate* efforts with other countries seeking the same ends.

But success is hardly a given. The smooth coordination of states' agendas has been a core problem since diplomacy began millennia ago. In the water diplomacy arena, for example, representatives from the United States and the European Union member states may coordinate in a particular country on a project basis, but lack an overarching integrative vision to guide their water-related activities across the region, or across basins that may well be shared with other countries. This coordinating challenge is true even within the United States' sprawling diplomatic and development apparatus. Staff at US embassies, consulates, and missions abroad may know of specific water challenges present in a given country, but may not necessarily be aware of how other offices are addressing similar issues elsewhere. Conversely, foreign officials may be familiar with certain American activities and areas of US expertise, yet be unaware of all relevant US resources and capacities not already deployed in their country. For their part, Foreign Service officers have no systematic way of accessing the United States' deep network of water experts and institutions. A WGS would help provide a compass or a focal point for orienting and coordinating multiple endeavors across institutions, sectors, and regions.

Finally, American leadership in the water space will return significant benefits to the United States itself. While the United States is a global leader in the acquisition and provision of remote-sensing weather and water monitoring satellite data, in an era of resource constraints it does not have the capability to capture everything of scientific value alone. The United States would benefit from working with other actors, such as China or the European Space Agency, to collect better water monitoring data and to make the data publicly available. This resource pooling would benefit everyone, including the United States' technical agencies—NASA, the US Geological Society (USGS), the US Army Corps of Engineers, and so forth—because it would improve their ability to observe, measure, model, and assess Earth systems.

Moreover, American firms would benefit from a strategy that includes economic statecraft: One of the themes that we heard in our outreach was that the US government should be more deliberate in assisting American firms to compete in the growing water technology market. To provide just one example, American water technologies often

7 Barry Pavel and Peter Engelke, with Alex Ward, *Dynamic Stability: US Strategy for a World in Transition,* Atlantic Council, April 2015, p. 26.

have higher up-front costs compared with Chinese technologies, but over the long run (the full life cycle) American technology is cheaper. American firms therefore struggle with first-cost bids, and hence need financing mechanisms to help pay for their higher up-front costs. Our interlocutors suggested that other countries, including Sweden, Spain, Israel, the Netherlands, and others, are more explicit in linking and leveraging water diplomacy, water development, and economic engagement and opportunity. One constraint for a US water grand strategy, however, is that it should not be seen as a front for US commercial interests; as the United States remains the world's sole superpower, its interests and motivations, rightly or wrongly, may not be judged by the same standards as those of other states.

BOX 2: HYDRO-DIPLOMACY AROUND THE WORLD

All countries develop policies and measures to govern their water resources. A select few nations have proven especially active in deploying water management technologies and practices for greater diplomatic engagement abroad. Australia, Israel, and the Netherlands represent three countries with different approaches to hydro-diplomacy.

Hydro-diplomacy as technical expertise. Perhaps no country has more explicitly pursued hydro-diplomacy than Israel. Israel's arid climate, coastal location, and the early role of collective kibbutz agriculture in national development helped drive innovation in technologies such as desalination and drip irrigation. Israel's highly centralized water planning (all water is publicly owned and managed via the Israeli Water Authority and Mekorot, the national water utility) has ensured close connections between government and the private sector. State agencies serve as crucial incubators and key markets for private sector invention. The state and business sector view Israel's water know-how as an engine for growth in the global water sector and as a vehicle for building relations with water-stressed countries. During Israel's long diplomatic isolation, water often provided a bridge for establishing contacts that would have been impossible through official channels. From the early 1960s until the Islamic Revolution in 1979, Israeli hydrologists and engineers ran the majority of water projects in Iran. In the early 1980s, secret visits by Israeli experts to advise collective farms in communist China led to the first acknowledged civil society exchanges between the two countries. Today, following a 2013 agreement, an Israeli consortium is redesigning the water infrastructure of the Chinese city of Shouguang.

Hydro-diplomacy as policy expertise. Australia also draws on its knowledge to advance water security abroad. In 2015, the Department of Foreign Affairs and Trade established the Australian Water Partnership (AWP) to support public-private-NGO partnerships, and to share Australian capabilities with countries around the Indo-Pacific region. While the partnership functions to promote Australian technologies and practices, it also responds to requests from countries and international development organizations. Importantly, the AWP seeks not only to advertise its partners' technical capacities, but to put forward the country's policy expertise and experience enacting governance reforms, legal frameworks, and institutional innovations. Australia's history developing tradable water rights allocations in the Murray-Darling basin is a hydro-diplomatic strength. Finally, the AWP formally espouses an operating vision oriented around the "3-Ds": inclusive economic development; water security for all; and a reduction in social and environmental impacts and regional tensions.

Hydro-diplomacy as conflict prevention. The Netherlands, too, possesses widely recognized water expertise, especially in flood control, deltas, and integrated water resources management. Dutch specialists offer technical assistance and governance advice to countries around the world. Recently, foreign policy institutions have called upon the Ministry of Foreign Affairs to capitalize on Dutch expertise and water policy engagement to carve out a tripartite international role. First, they recommend the Netherlands position itself as a neutral mediator in water conflict resolution, drawing on the presence of the Permanent Court of Arbitration and the International Court of Justice in The Hague. Second, it should leverage state agencies, universities, and research centers as knowledge hubs, providing training, capacity-building, and technical education and advice for water management and conflict prevention. Finally, the Dutch government should act as a "norm entrepreneur" in the field of water law, urging others to ratify and follow instruments such as the United Nations Watercourses Convention and the United Nations Economic Commission for Europe's Water Convention.

A STRATEGIC CALCULUS

The United States should develop a global water grand strategy focused on making societies more resilient to changing water conditions. The strategy implies the United States should counter societal fragility, to engage in a form of risk management in the face of uncertainty, as well as potentially chronic and acute water stress. A resiliency strategy would contribute to the United States' ultimate goal, which is the creation and maintenance of a world that is more peaceful, stable, and secure.

On Means and Ends

One of the consistent messages put forward by interviewees was that water should be thought of as a means to a range of ends. Water might be essential for all human endeavor, indeed for life itself, but at the same time water is valuable because it is instrumental—it is a necessary component for the achievement of other goals. As one interviewee phrased it, "Water people are always in the middle of everything else," by which he meant that water experts routinely and necessarily find themselves embroiled in conversations about agriculture or health or development or conflict or some other topic.

Water is a kind of elixir, with which many other things become possible, and without which those same things quickly fall apart.

A WGS thus ought to treat water as fundamental to the realization of many foreign, security, and development policy ends.

Around the world, water policy is often fractured at multiple levels and scales, divided among different national and local ministries, offices, agencies, and utilities. Such fragmentation is both rational and inevitable because water is a tangible substance that at some basic level has to be managed by competent engineers and technicians. But in reality, water's significance is far greater than any one use or sector. Water is a kind of elixir, with which many other things become possible, and without which those same things quickly fall apart.

On Interim and Ultimate Ends

The means-ends distinction, while conceptually useful, creates a difficult conundrum: Water might be a single means, but there is an almost endless set of ends. As summarized in table 2, interviewees provided the authors with an extensive list of how water can be a means to many possible objectives. For example, some discussed how transparent water governance (through open and shared data, publicly accountable decision-making, and so on) might contribute to strengthening democratic governance. Others made similar arguments about building cooperative transboundary water regimes; doing so contributes to transparent international governance practices and institutions built on participatory principles. Still, others pointed to how water helps solve public health challenges or development challenges, contributes to scientific understanding, and helps with certain US foreign policy goals.

The challenge is to find a way to make sense of the great number of possible aims listed in table 2. Given this panoply of ends, how could a strategy be coherent? Is it possible or even desirable to treat water in strategic terms, given the diversity of its uses? One might question whether a coherent strategy is even possible—as an interviewee said, decisions about water are political trade-offs between competing uses.

We assert that a water strategy is useful for identifying, disentangling, and making sense of trade-offs. A coherent strategy would help avoid unnecessary conflicts between uses and lead to the identification of synergies across water uses.

We find it helpful to differentiate between two types of ends, *interim* and *ultimate*. Those listed in table 2 can be thought of as interim ends: Water can be used as a tool to help achieve each of them. A water grand strategy would identify and make available to policymakers, practitioners, and advocates a set of useful tools and orientations that can be applied in different contexts and places, to help fulfill these various ends.

But the reason why a water grand strategy is necessary in the first place is to realize an *ultimate end*. In foreign affairs, there are several possible ultimate ends, including peace and stability. We believe that the security frame, wherein security is defined broadly to include human security and

Table 2: List of Possible Ends under a US Water Grand Strategy

Access for all (water for equitable development)	Food-energy-water nexus	Water as alignment mechanism for US government strategy, policy, and practice abroad
Piped water as contribution to gender equality	Improvement of water governance as contribution to democratic/ accountable governance	US water diplomacy to improve US image/standing abroad
Clean water and sanitation to achieve key public health outcomes	Advance in-country "situational awareness" of water through remote sensing, analytics, and better data	Water cooperation as a means to achieve US diplomatic ends, including public diplomacy ends
Clean water and sanitation for early childhood development	Improved water monitoring as an early warning mechanism for crises (e.g., Syrian drought)	US water diplomacy as economic statecraft; enable US firms to compete more successfully and strategically abroad
Clean, piped water and sanitation at schools for girls' development	Better water data coordination as means to improve global knowledge of future water stresses	US water diplomacy leadership as mechanism to align US partners and allies around the world
Stable water supply for ongoing economic development (e.g., stable energy provision)	Greater American engagement globally as means to benefit US domestic water policy and practice	US water diplomacy leadership to improve relations among otherwise hostile riparian states
Stable water supply for maintenance of political stability	Prioritization of water efficiency to achieve other environmental ends (transition to a low-carbon economy; preservation of ecosystems and ecosystem services)	Enhance innovation through technological development; create emerging technology fund(s) to do so
Stable water supply to reduce stresses leading to conflict ("threat deflation")		
Building resilience to climate impacts, such as floods and droughts		

hard security, is the most appropriate, ultimate end for a water grand strategy. Security captures multiple ideas within a single conceptual frame. Among other things, security implies that societies are stable and peaceful (wherein peace is defined as the absence of systemic, chronic violence). Including both hard security and human security in this equation means that states and individuals have access to a peace and stability dividend.

To produce security, the United States should adopt a strategy designed to make societies more resilient to shocks and other stressors, and therefore to reduce the risks of societal conflicts or breakdown. Whereas ultimate ends are static conditions, resiliency can be conceived as a dynamic condition. Because the shocks and stresses that may confront societies are not immutable, but emerge and evolve over time, so resiliency entails an adaptive capacity to resist, respond to, and recover from dynamic risks and pressures. Like the equilibrium of a tightrope walker, shifting their weight to stay balanced on a high wire, resiliency is defined by successfully adjusting to changing conditions. Resiliency is a quality that helps a society achieve and maintain its ultimate ends, including security, against a moving background.

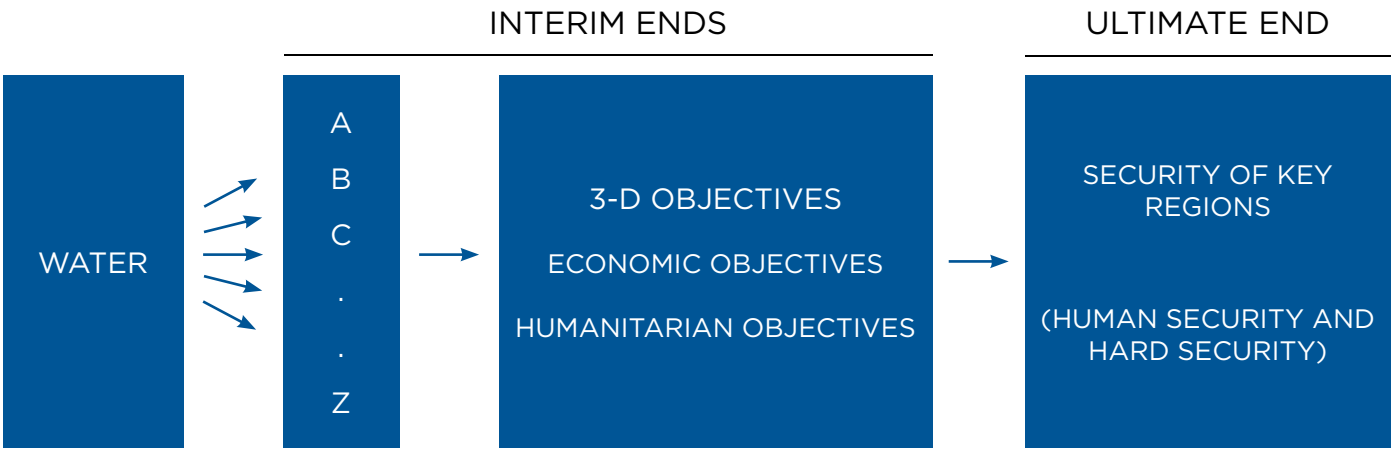
The US government, the private sector, and civil society together should identify a set of water tools that can be used in service of diverse interim ends. The consistent availability of, access to, and high quality of water contributes to social and economic development, improved public health, and greater trust in governing institutions, among other things. Through these pathways, water contributes to intra- and international security. Conversely, if water is not employed intelligently in pursuit of interim ends, societies can become more brittle and less resilient. Over time, inconsistently available, inaccessible, and/or polluted water weakens societies. Such conditions can contribute to economic stagnation or even contraction, degrade ecosystem services, lead to sickness and premature mortality, and erode government legitimacy. Under extreme conditions—such as the severe drought in Syria that began in 2006—these conditions can displace populations, lead to scapegoating minorities, and contribute to intrastate or even interstate violence.

Figure 1 illustrates this framework. Under a resiliency strategy, water's value is defined as a means to a set of interim ends (A to Z in the figure), of the type listed in table 2. Water is therefore a kind of tool for addressing America's "3-D" objectives

Water on the roof of the world: Sometimes called the Third Pole, the massive snow and glacier formations in the Hindu Kush-Himalaya mountain ranges feed the major rivers of South and Central Asia. Climate change threatens to disturb this indispensable source of water for billions of people. *Photo credit*: NASA/Wikimedia.

around the world. Security, the ultimate end, is defined as having both human security and hard security components. The strategy is "resiliency based" because the constant attention to these ends should make societies and regions more resilient to changing conditions, hence less fragile and unstable. While resiliency does not guarantee security, resilient societies are less likely to fail.

Figure 1. A Resiliency-Based Strategy



AMERICA'S CURRENT ENGAGEMENT IN THE GLOBAL WATER SPACE

American actors and organizations, from private firms and NGOs to academic institutions and faith-based groups, are present in innumerable water-related activities throughout the world. The US government likewise maintains expertise and engagement in global water issues. According to the State Department, over twenty separate agencies and departments make significant contributions to addressing international water and sanitation challenges. In fiscal year 2013 alone, US government investment for all international water sector activities surpassed $783.6 million.[8]

The State Department leads an Inter-Agency Water Working Group to coordinate US government global water policy among a score of technical and military agencies. Working directly with foreign governments as well as through international partnerships, such as the African Minister's Council on Water and the Lower Mekong Initiative, and collaborations with multilateral organizations, such as the World Bank and the United Nations Development Programme, the State Department works toward improved water resources management, mitigates tensions, and promotes cooperation around shared waters, and thereby attempts to ensure water security.

The US Agency for International Development (USAID) represents the largest US contributor and is the lead implementer of US water development programs internationally, devoting $523.8 million in 2013 to water and sanitation, water management, and disaster risk reduction in sixty-three countries.[9] Since 2013, USAID has been guided by a five-year Water and Development Strategy, the first of its kind, to advance global health and food security by building local capacities and leveraging new technologies and financing focusing on water resources. The Millennium Challenge Corporation provides multiyear support to development programs conceived and implemented by the host nations, providing $803 million in funding for water and sanitation projects in seven countries in 2006–2008, according to the Congressional Research Service.[10]

> American actors and organizations . . . are present in innumerable water-related activities throughout the world.

Many other agencies throughout the US government contribute. To highlight but a few examples, the Department of Energy promotes innovation and best practices in the water-energy nexus, including the US-China Clean Energy Research Center. The Environmental Protection Agency backs water quality and water monitoring programs in East Africa. The technical agencies such as NASA, the National Oceanic and Atmospheric Administration (NOAA), and the US Geological Survey collect and make publicly available hydrologic, climatic, and other Earth sciences data. NASA's SERVIR Earth observation platform, for instance, will be employed to help the Himalayan nations improve their flood disaster resilience and response. Similarly, NASA, NOAA, USAID, the US Department of Agriculture (USDA), and USGS collaborate with national governments, international agencies, and NGOs to operate the FEWS NET famine early warning systems network, bringing together water resources and other data to monitor and forewarn of acute food insecurity risks. Elsewhere, the Department of Commerce, the Overseas Private Investment Corporation, the Export-Import Bank, and the US Trade and Development Agency furnish support for US investors and exporters in the water sector via such tools as loan guarantees, political risk insurance, structured finance, export credit guarantees, market research, training, and trade events. The US military also actively contributes to US water engagement through the projects

8 Office of Conservation and Water, Bureau of Oceans and International Environmental and Scientific Affairs, *Annual Report to Congress: Senator Paul Simon Water for the Poor Act, P.L. 109-121; Sec. 6 (g)(2),* Department of State, June 2014, http://www.state.gov/documents/organization/229278.pdf.

9 Ibid.

10 Tiaji Salaam-Blyther, *Global Access to Clean Drinking Water and Sanitation: US and International Programs*, Congressional Research Service, September 10, 2012.

and technical capacities of the US Army Corps of Engineers (USACE) and Army Reserve, as well as through direct project implementation in the field by engineers and experts in the Combatant Commands.

Finally, congressional action has played an important part in the US government's direction and objectives. The bipartisan 2005 Water for the Poor Act designates water, sanitation, and hygiene (WASH) as US foreign policy priorities. It was bolstered by the 2014 Water for the World Act, intended to enhance WASH programs and ensure that assistance is targeted to countries of greatest need.

BOX 3: WATER TECHNOLOGIES

Technological innovation will play a vital role in meeting the water challenges of the twenty-first century by boosting water supplies, enhancing sustainability through more efficient water use, and reducing the costs and impacts of meeting growing water demand. There are many innovative approaches available now to address global water challenges. Additional investment and action is required to disrupt thinking to ensure long-term, sustainable solutions for resilient water systems of the future.

Water data. Effective water management depends upon the availability of accurate, timely, and consistent information. Advances in remote sensing technologies allow systematic data collection on important indicators such as crop water use and evapotranspiration, land use changes, groundwater depletion, glacier retreat, and water quality parameters. Satellite observation will be complemented by drone-based sensors that can supply data on individual fields, streams, and glaciers at less cost and higher resolution than space-based platforms. Sensors in "smart" water meters, treatment plants, pumping stations, and water mains, connected wirelessly to centralized monitoring systems, are enabling providers to acquire data on water use, leaks, contaminants, etc., in real time. Further innovation in "big data" analytics permits water managers to integrate these multiple data streams—from climate patterns to demand trends—to formulate robust predictive models to help guide decision-making.

Water supply. The oceans contain 97.5 percent of the world's water. But desalination is expensive. The most common form of desalination—reverse osmosis—entails forcing saltwater through permeable membranes. New generation membranes incorporating nanoparticles, carbon tubes, aquaporins, and graphene-based materials are showing superior permeability and salt-rejection. Thermal-based desalination processes also show heightened performance and can rely on solar power and waste heat sources. Alternative technologies such as microbial desalination cells using electrical current from bacteria use no external energy source. Advances in membrane technologies, such as nanoparticles and biomimicry, can be applied to water treatment systems, allowing better filtration of micropollutants such as antibiotics, and to wastewater reuse and closed-loop recycling processes.

Water use. Agriculture uses some 70 percent of water worldwide. Precision irrigation technologies, such as drip irrigation systems, can be combined with sensors to create intelligent irrigation systems that can remotely monitor, activate, and modulate water delivery as soil moisture and weather change. Advanced genomics could optimize plant growing conditions. At the same time, genetically modified (GM) crops may produce greater yields with less water or that thrive in drier conditions. According to the McKinsey Global Institute, the total area worldwide sown with GM crops has surged from 1.7 million hectares in 1996 to 17 million in 2012.[1]

Despite the promise of novel breakthroughs, it is important to note that not all innovations and advances necessarily need be high-tech. In the area of water quality and water treatment, for example, numerous studies have found that natural and constructed wetlands can be extremely effective in removing nutrients, pathogens, and even persistent toxic metals from storm water, agricultural run-off, municipal sewage, and even mining wastewater. Much technological improvement will derive from advanced research and development and new products and processes, to be sure. But much will also spring from the wider application or novel combinations of existing technologies and practices.

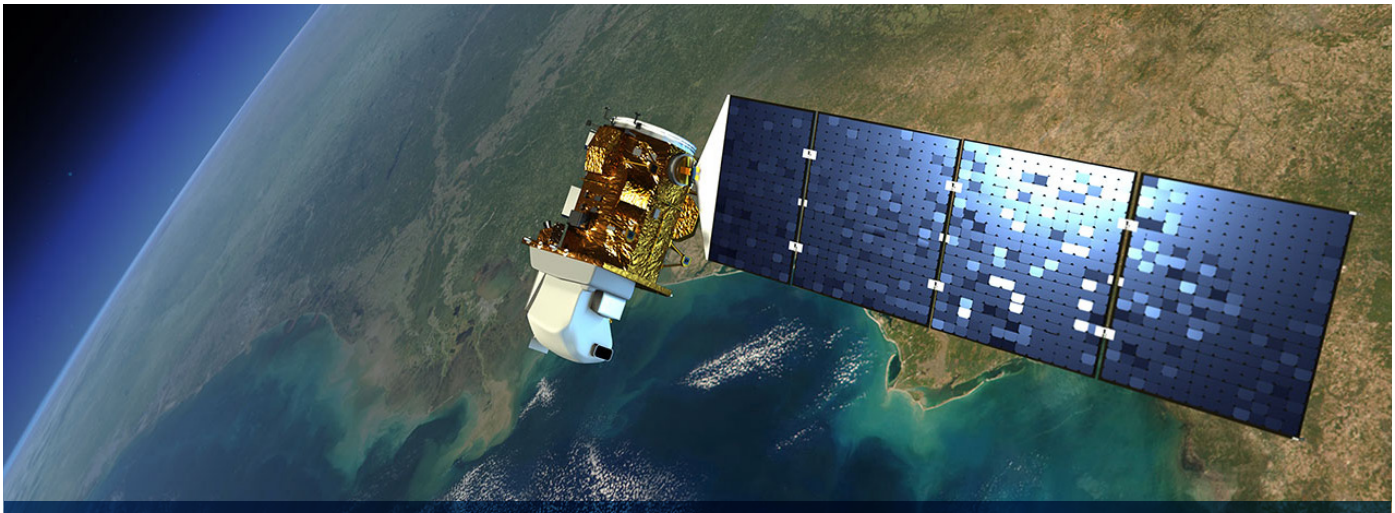
1 James Manyika et al., *Disruptive Technologies: Advances That Will Transform Life, Business, and the Global Economy,* McKinsey Global Institute, May 2013, p. 93.

US ASSETS, RESOURCES, AND CAPABILITIES

The United States possesses tremendous assets, resources, and capabilities to meet global water challenges. Interviewees emphasized the United States' widely recognized expertise in data generation and knowledge management. US knowledge leadership takes several, mutually reinforcing forms, and resides throughout the whole of American society. The specialized technical agencies of the US government (NASA, NOAA, and the USGS, among others) marshal unparalleled data collection, monitoring, and modeling capacities, remote sensing, geographic information systems (known as GIS), and Earth observation platforms. US data acquisition capabilities are complemented by American expertise in information processing and utilization, exemplified by big data analytic applications such as "intelligent" municipal water systems and data visualizations for things such as water stress and flood risk mapping. Crucially, statutory requirements ensure that publicly funded US knowledge products such as NASA datasets and USACE river basin models are freely available around the world. US leadership in public data transparency vitally contributes to building the global knowledge base. (When Landsat made its images free in 2008, for instance, over one million images were downloaded in the following year, compared to a previous annual high of twenty-five thousand images.) The United States' free and open access further provides a persuasive best practice template for exchanging or pooling data with other countries (see box 3 for more).

The United States also has significant ground-level expertise. Specialists from USAID, USGS, and the Army Corps to the USDA, Bureau of Reclamation, and the Peace Corps have implemented thousands of water management projects, pilots, and studies in countless communities around the globe. So too have American businesses, NGOs, universities, and faith groups, giving the United States a virtually unequalled stock of field experience. America's educational system and professional training resources remain without peer in many areas. Water ministries worldwide are populated by hydrologists, engineers, and analysts formed in US universities or schooled by careers in American organizations.

Finally, as a number of interviewees noted, the geographical and institutional diversity of the United States gives it a wide range of management and policy experiences. As a practical asset to US global water engagement, this means that American water managers and decision-makers have direct experience with many water challenges, water policies, and institutional forms as the basis for mutual dialogue, knowledge sharing, learning, and cooperation with their counterparts abroad.



NASA rendering of the Landsat 8 satellite. Launched in 2013, NASA's Landsat 8 is the newest Earth-observation satellite in space. Landsat data provides indispensable open-source data on land and water use and ecosystems. *Photo credit*: NASA Goddard Space Flight Center/Flickr.

TOWARD A WATER GRAND STRATEGY

FORMULATION AND IMPLEMENTATION

This section provides a roadmap for a two-stage process toward a global water grand strategy. The first stage consists of a "Whole of America"-led WGS, built by civil society and the private sector in cooperation with the US government. This stakeholder-driven process would run from 2016 into 2017. The second phase would be to find ways to implement the WGS's core findings. To realize the second goal, the strategy must be developed as a close partnership between the US government, civil society, and the private sector. The highest agenda item would be to ensure that the next presidential administration accepts the frames, narrative, and goals of the WGS—to adopt the *grand strategy* itself and to translate the strategy into actionable policy and practice.

Water Grand Strategy: Formulation

The 2016–17 timeframe is opportune for WGS formulation and implementation, for two reasons.

First, as the 2016 presidential election will bring a new administration to Washington, civil society—the United States' community of water experts and organizations—has an opportunity to influence the next administration's thinking and policy toward global water issues. This opportunity will be maximized if civil society and the private sector can speak with a cohesive voice on water, and come equipped with an explicit strategy.

Second, by October 2017 the next administration is required to submit a Global Water Strategy to Congress under the Paul Simon Water for the World Act. That strategy must include how the administration intends to address WASH issues, water resource management, and water conflict challenges around the world. In our opinion, this requirement makes it more likely that the next administration would be willing to adopt, in whole or large part, a WGS designed by civil society and the private sector. We believe that this outcome will be most likely if the WGS is coherent, actionable, and practicable; if it is proposed in late 2016 or early 2017; and if it can show that the US water community is aligned.[11]

Table 3 suggests a WGS formulation process. That process should convene a high-level task force to frame the strategy and solicit input and buy-in from stakeholders in the United States and abroad. Stakeholders include public, private, and nonprofit experts from the water community but also from communities of interest including, for example, water experts from agriculture, energy, cities and municipalities, and science and technology. The formulation process includes extensive public and private outreach within the United States and around the world. The WGS would be drafted in the fall of 2016, previewed around the presidential election, and released publicly at the very end of 2016 or early in 2017.

Among other subjects, the final WGS should address the following areas:[12]

Capacity building: Implement reforms and create enabling environments in water ministries and utilities

Infrastructure: Support infrastructure financing through credit enhancements and loan guarantees

Diplomacy: Shape international action on transboundary waters where water could drive conflict in the future

Emerging technologies: Invest in innovative technologies and approaches

Data: Improve access to data and scientific tools

Intergovernmental organizations: Prioritize water within the United Nations, World Bank, regional development banks, and other multilateral institutions

Partnerships: Bring civil society and the private sector into partnership with the United States government and (where appropriate) foreign governments.

11 "Summary: H.R. 2901—113th Congress (2013–2014)," H.R. 2901—Senator Paul Simon Water for the World Act of 2014, United States Congress, https://www.congress.gov/bill/113th-congress/house-bill/2901.

12 The authors thank the US Water Partnership for providing this list of subject areas.

Table 3: US Global Water Grand Strategy—Formulation

Topic	Process
Leadership	• Convene a high-level task force, co-chaired by a former US foreign policy luminary and one or more nongovernmental representatives (e.g., tech sector CEO, major philanthropy president, and/or well-known thought leader); task force members should be drawn from the water community and other specializations (e.g., agriculture, energy, climate, economics, city planning, international relations, philanthropy, foresight)
Stakeholders	• Water experts from public, private, nonprofit, philanthropic, academic, science and technology sectors; representatives from other sectors and specializations, per above
Mechanisms	• Off-the-record roundtables in Washington and elsewhere in the United States (e.g., San Francisco, Milwaukee, Denver) • Public roundtables in tandem with private expert roundtables • Consultative process across US government departments and agencies • Individual consultations with experts from the United States • Global outreach, especially to recognized global water leaders, including the Netherlands, Singapore, Israel, and Australia • Ambassadorial roundtable(s) in Washington • Outreach to US presidential campaigns and (after November 2016) the president-elect's transition team
Timing	• 2016 through 2017
Roll-out	• The WGS should be privately previewed to select stakeholder audiences in Washington and around the United States in the fall of 2016 • Public roll-outs of the WGS should occur in late 2016 and early 2017 in Washington and in select US cities • An online, interactive version will be released at the same time
Outreach and Briefings	• Ends after an intensive outreach and consultation process through 2017, designed in part to influence formulation of a coherent water strategy within the next presidential administration • Stakeholders should engage in a coordinated outreach effort in Washington and elsewhere in the United States designed to shape public and elite opinion within the United States, including on Capitol Hill, in the next administration, and among thought leaders and the general public • Methods to include social media, traditional print media, television and radio interviews, briefings

In addition, a WGS ought to include a recommendation about whether the United States government should prioritize specific water geographies around the world. Interviewees indicated that there are pros and cons to such identification (a positive is to focus resources on areas of the world of greatest importance to US geostrategic interests, while a negative is that doing so publicly would involve important diplomatic costs). One simple way to understand water geography is to divide the world into transboundary river basins. But interviewees suggested that hot spots defined by international basins (e.g., northern Nigeria or Yemen), individual countries, and cities are also water geographies deserving consideration.

Water Grand Strategy: Implementation

Table 4 asks how the WGS should be implemented. The table begins with "Whole of America" questions. In the twenty-first century, no single government or even set of governments can begin to solve challenges like water without building lasting partnerships alongside nonstate actors,

Table 4: Water Grand Strategy—Implementation

Topic	Implementation Questions
Whole of America	• How could a WGS improve coordination among the United States' diverse water sector actors? • What roles should nongovernmental actors play in WGS implementation? What roles can they not be expected to play? • How should the US government engage civil society and the private sector as partners in a WGS?
US Government Leadership	• Is it a given that the US government must lead a WGS? • If the next administration does not adopt the WGS findings in whole or in large part, how can parts of the WGS be made actionable nonetheless? • Who within the US government should have leadership responsibilities? (White House, National Security Council; Office of Science and Technology Policy; a water "czar"? State Department, secretary's office? Other?)
Interagency Process	• How should WGS implementation be aligned across executive branch agencies and departments?
Congress	• Is it possible to align the executive and legislative branches around WGS goals? • Is it possible to engage Congress on a coherent WGS, given the number of committees that are active in the water space? • Who should engage Congress on water issues, from the executive branch, private sector, and civil society? • How should messaging be coordinated across diverse water-sector representatives on Capitol Hill?
Geographies of Implementation	• Should the WGS identify specific geographies around the world for priority attention? • How should US geostrategic priorities influence prioritization of water geographies under the strategy? • How should water geographies be defined? By river basin, region, country, or water "hot spot" (i.e., severely water stressed regions, regardless of geographic overlap with a river basin, such as northern Nigeria)?
Targets/ Measurement	• How can WGS goals be measured? Are all goals subject to objective measurement? • Should targets be identified and measured against? • What are the different timeframes for success?

including philanthropies, NGOs, individuals, the media, corporations, and so forth. Yet the US government is the most important single actor in the United States' engagement with the rest of the world. Hence, implementation priority must be given to ensure the next administration takes up the core findings of the WGS.

The US government possesses the strongest collection of what we might call the "5-C" assets—convene, compel, coordinate, convince, catalyze. In the water space, the next administration can have profound influence through very practical activities that actually cost little, such as, for example, by issuing a Presidential Policy Directive (PPD) on global water security. Issuing a PPD would help organize the US government's activities, signal to American society that the administration is serious about water, and emphasize a commitment to integrating water into US national security policies and planning.[13]

13 Different administrations use different titles for these decision directives. The Barack Obama administration uses the PPD nomenclature, while the George W. Bush administration used the term "National Security Presidential Directive" (NSPD). See "Presidential Directives and Executive Orders," Federation of American Scientists, http://loc.gov/rr/news/directives.html.

CONCLUSION

It is worth asking what would happen if the next presidential administration does not accept the strategy's underlying frames, objectives, or processes. In our opinion, such an outcome would not render a water strategy moot. Even under a scenario wherein the next administration did not participate in the WGS—whether in formulation or implementation—going through the strategy-building process would still have enormous merit.

Our interviewees believe that the US civil society and private sector bring fundamentally important resources, ideas, and activities to the table. As the nature of our society is government through participation, going through a "Whole of America" strategy design process would help motivate civil society and the private sector to articulate their interests and thereby push the federal government to act. The reverse is true as well: If the US government takes up a leadership role, then it would be able to draw upon the enthusiastic support of the US water community—precisely because the WGS process helped to organize that community.

The world needs stronger and more forceful leadership from the United States to solve [its] great water challenges.

Water-oriented development and diplomacy initiatives enjoy broad public support. Polling generally supports the notion that most Americans believe access to clean water should be a top priority of US development policies abroad. Water-oriented legislation also has a long history of bipartisan support in Congress, extending back at least to the passage of the Clean Water Act of 1972. Democrats and Republicans joined to pass both the milestone 2005 Water for the Poor Act, making safe drinking water and sanitation cornerstones of US foreign development assistance, as well as the 2014 Water for the World Act, sponsored by members of both parties.[14]

A strategy should not be formulated as a monolithic either/or proposition. Rather, it would be a package of ideas and proposals, one that makes us think about trade-offs, alternatives, priorities, synergies, and emergent possibilities. As such, different components of the WGS could be pursued by different constellations of actors over time, even if the whole is not embraced by everyone all at once.

These questions aside, the 2016–17 timeframe is ideal to formulate and implement a global Water Grand Strategy, given the 2016 presidential election and the 2017 Water for the World Act requirements. But there is a far more fundamental reason to begin now, which is that the world needs stronger and more forceful leadership from the United States to solve the great water challenges that are ahead of us.

14 Information in this paragraph drawn from Marcus Du Bois King, "Water, US Foreign Policy and American Leadership," Elliott School of International Affairs, The George Washington University, October 15, 2013.

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