EXECUTIVE SUMMARY OF THE REPORT TO THE PRESIDENT

Improving Groundwater Security in the United States

Executive Office of the President
President's Council of Advisors on
Science and Technology

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EXECUTIVE OFFICE OF THE PRESIDENT
PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY
WASHINGTON, D.C. 20502

President Joseph R. Biden, Jr.
The White House
Washington, D.C.

Dear Mr. President,

Your Administration is committed to clean water and healthy communities. The 2021 Bipartisan Infrastructure Law and the 2022 Inflation Reduction Act contain directives and support to improve water quantity, quality, conservation, and use. Together with your Administration's America the Beautiful Initiative and America the Beautiful Challenge, they are focused mainly on surface water in lakes, wetlands, ponds, and other freshwater resources.

Groundwater is an often-overlooked resource across the nation. It resides in aquifers which are underground and accessed mainly through wells, but this subsurface water plays a crucial role in the entire hydrologic cycle, including influencing surface water. Groundwater is vital for agriculture, domestic manufacturing, construction, mining, energy production, and other applications. Moreover, it provides drinking water for half of the U.S. population and nearly all rural residents. Consequently, groundwater is fundamental to the nation's health, food, water, energy security, and economy.

The U.S. is facing a serious and unprecedented groundwater challenge. In many aquifers, groundwater withdrawal has outpaced natural recharge, which is exacerbated by the changing climate and precipitation variability. Much of the water in the major aquifers in the U.S. is fossil water, recharged over 10,000 years ago, and will not be replaced naturally on human timescales. In the western U.S., groundwater resources are being depleted at alarming rates, mostly from agricultural withdrawal. The depletion has caused land subsidence and earth fissures as well as permanent reduction of storage capacity. The depletion has national and global consequences as non-renewable groundwater in the west is embedded in agricultural products transported to the rest of the U. S. and in agricultural commodities exported globally.

Many federal agencies have programs to measure the quality and quantity of groundwater, as well as conservation programs for sustainable use of groundwater. PCAST applauds and endorses their efforts as well as those by state governments, non-governmental organizations, professional organizations, local communities, private citizens, and others, to manage their groundwater resources.

To ensure the sustainability of this indispensable resource and mitigate risks from its depletion, it is imperative that we enhance our understanding and management of groundwater resources. The recommendations that follow seek to enhance the important work so far. This includes investing in research, data collection, modeling and prediction, as well as innovative technologies to understand

and protect groundwater reserves. This also includes federal incentives to encourage the planning and sustainable management of groundwater. Equally important is active collaboration with stakeholders and training of the workforce. Only through a comprehensive and informed approach can we secure groundwater for future generations and maintain the health and prosperity of our nation and its citizens.

Sincerely,

Your President's Council of Advisors on Science and Technology

Executive Summary

Groundwater is an essential resource, critical to our nation's food, energy, health, and economic security. This report seeks to encourage and support efforts that promote sustainable use and long-term security of groundwater.

The U.S. is facing a serious and unprecedented groundwater challenge. Across the U.S., groundwater withdrawal has outpaced natural recharge, while slow natural recharge has been exacerbated by climate change and precipitation variability, including floods, droughts, and early snowmelt. Groundwater is a critical resource for agriculture, domestic manufacturing, construction, mining, energy production, and other uses. The largest use of groundwater, at 70%, is for irrigation. Moreover, groundwater supplies drinking water for half the U.S. population and nearly all the rural population. Sustaining and securing groundwater is thus central to our Nation's health, food, water, and energy security, and economy.

Adding to the challenge, much of the water in the major aquifers in the U.S. is fossil water, meaning it was last recharged over 10,000 years ago and will not be replaced naturally in centuries and millennia. In the western U.S., groundwater resources are being depleted at alarming rates, mostly from agricultural withdrawal. The depletion has caused land subsidence and earth fissures as well as permanent reduction of storage capacity due to inelastic compaction of the subsurface formation. The depletion has national and global consequences as non-renewable groundwater in the west is embedded in agriculture products transported to the rest of the U. S. and in agricultural commodities exported globally.

The Biden-Harris Administration has shown a strong commitment to clean water and healthy communities. The 2021 Bipartisan Infrastructure Law and the 2022 Inflation Reduction Act contain directives and support to improve water quantity, quality, conservation, and use. In addition, the Biden-Harris Administration's America the Beautiful Initiative and America the Beautiful Challenge have supported important conservation efforts relevant to surface water in lakes, wetlands, ponds, and other freshwater resources. The critical issue of groundwater remains insufficiently addressed.

The federal government has limited authority to regulate groundwater. However, there are many ways federal agencies engage with and address groundwater issues. The Department of the Interior (DOI), U.S. Department of Agriculture (USDA), the Environmental Protection Agency (EPA), and other federal agencies, in collaboration with state and local partners, monitor, forecast, and assess groundwater conditions to help inform local management strategies and decisions. These agencies also recognize the urgency of the groundwater depletion problem and have developed conservation programs to promote water security and mitigate risks. In our fact-finding, PCAST learned also of the work of state governments, non-governmental organizations (NGOs), professional organizations, and private citizens to manage their groundwater resources. PCAST applauds and endorses these efforts, and seeks to enhance them.

Groundwater governance in the United States is characterized by a highly decentralized framework, wherein each state is primarily responsible for creating and enforcing its own laws, policies, and regulations. A complex management system is both appropriate and inevitable in the case of groundwater, because of the level of physical (geologic, ecologic, and climatological), economic, and political heterogeneity among aquifers. The federal government does not direct the groundwater practices of states, local communities, and regulators, but it can provide incentives to foster a sustainable groundwater future. Groundwater storage is a crucial engine for the states', and hence the nation's, economy. With capacities that exceed the combined water storage of all surface reservoirs combined, groundwater is a strategic resource in the face of ongoing climate change. It is therefore in the nation's interest to incentivize groundwater conservation and management based on sound science and stakeholder inputs.

Native American and Tribal communities face significant groundwater security risks due to the extraction of nonrenewable resources on Tribal lands, contamination of both surface water and groundwater, and climate change. PCAST recognizes the Biden-Harris administration's dedication to ensuring the health, safety, and prosperity of Indigenous communities. We encourage the Federal government to prioritize the unique needs of Tribal communities in its water governance considerations by incorporating robust frameworks that strengthen Tribal sovereignty and self-determination, by recognizing and establishing groundwater rights, by providing incentives for sustainable water use, and by ensuring comprehensive data collection. Engaging Tribal organizations in policy development and implementation is crucial to addressing their specific challenges and fostering collaborative, culturally responsive solutions.

To ensure the sustainability of groundwater and mitigate risks from its depletion, it is imperative that we enhance our understanding and management of this indispensable resource. This includes investing in research, data collection, modeling, and prediction, as well as innovative technologies to understand and protect groundwater reserves. This also includes federal incentives to encourage the planning, recharge, and sustainable management of groundwater. Equally important is active collaboration with stakeholders and workforce training. Only through a comprehensive and informed approach can we secure groundwater for future generations and maintain the health and prosperity of our nation and its citizens.

Summary of Recommendations:

Recommendation 1. Accelerate the development of a comprehensive repository for data and toolkits for groundwater storage, withdrawal, and recharge at spatial and temporal scales useful for water managers and users.

The U. S. needs coordination and collaboration among all Federal and state agencies to facilitate comprehensive and reliable information on groundwater quantity and quality, and interoperability across all sectors and across all Federal agencies. **PCAST recommends that an Interagency Working Group on Groundwater Security and Sustainability be established to guide, coordinate, and provide oversight of the data, software and toolkits needed to do water**

accounting and prediction by local management, and to mitigate risk of irreversible water depletion.

Recommendation 2. Establish a research program to advance technologies and strategies for safeguarding the future of groundwater supply and quality.

In the coming decades, the demand for groundwater and safe drinking water is anticipated to increase, while supplies will fluctuate due to competing water use. Concurrently, water quality is deteriorating as both surface and groundwater become increasingly contaminated with nitrates from fertilizers, per- and polyfluoroalkyl substances (PFAS) from wastewater, and other contaminants in managed recharge. Given the critical importance of groundwater to the viability of some of the parts of our country and the economy, it is imperative to develop strategies that optimize the sustainability and economic returns of groundwater withdrawal. **PCAST recommends the establishment of research programs that include: (1) measuring the chemical composition of surface and groundwater; (2) supplementing and enhancing groundwater storage through recharge, recycling, reuse, re-engineering our towns, water pipelines, and new water sources; and (3) identifying opportunities to optimize sustainable use of groundwater to enhance food security and biodiversity.**

Recommendation 3. Establish a federal incentive program and a network of groundwater engagement hubs, including Tribal Nations groundwater engagement hubs, to support and assist in planning sustainable groundwater use.

The federal government has limited authority to regulate groundwater, but can deploy financial incentives, technical assistance, and convening power to promote groundwater sustainability. **PCAST recommends the establishment of a network of groundwater engagement hubs that provide easily accessible platforms for local communities to understand their groundwater resources, access the latest research in groundwater management, and support informed decision-making on sustainable development, agriculture, and business expansion. Personnel in this network would also engage the public in events like town halls to further understanding of local groundwater dynamics and patterns of use.**

Recommendation 4. Create a competitive grants program to incentivize the planning, sustainable management, and restoration of aquifers, along with the surface waters critical to their recharge and cleanliness.

Several portions of the country have already implemented new scientifically-grounded measures to manage and restore their groundwater aquifers, but these efforts are underfunded. Other regions are slow to embark on this transition because of funding constraints, while still others are not yet ready to begin. A grants program would incentivize managers of a groundwater–surface water system to join the early adopters and begin the transition to science-based sustainable management. It would also allow the implementation of promising techniques, such as enhanced recharge, at much larger scales which could dramatically increase sustainable withdrawals for all. The funding should be

primarily in the form of federal incentives for the non-federal entities who have the authority to manage an integrated groundwater and surface water system.

Recommendation 5. Incorporate the valuation of groundwater resources into natural capital accounting and ensure these estimates are integrated into all federal cost-benefit analyses and planning.

PCAST fully endorses the whole-of-government National Capital Accounting Strategy and efforts towards the development of methods to account for the value of the Nation's natural assets and to use these valuations when making economic decisions across the federal government. By including the value of groundwater resources in all Federal cost-benefit analyses and planning, the Federal government will become more effective in its stewardship of the nation's groundwater on federal lands directly and in its support of state and local managers indirectly.

Recommendation 6. Launch a comprehensive campaign to recruit, develop, and retain a skilled workforce in groundwater science, management, and stakeholder engagement.

PCAST recommends that the federal government invest in educational and training programs focused on the latest technologies and best practices in groundwater management and science. By forming partnerships with academic institutions, industry experts, and professional organizations, a pipeline of well-trained multidisciplinary professionals can be created to address current and future challenges. Prioritizing workforce development and stakeholder engagement will ensure a robust and capable team dedicated to maintaining the health and sustainability of the nation's groundwater resources.

Only through a comprehensive and informed approach can we secure groundwater for future generations and maintain the health and prosperity of our nation and its citizens.

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