The New WVU Institute of Water Security and Science: Purposes and Directions

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Introduction

Background

Consistent with WVU's strategic goal of excellence in research and innovation, five Mountains of Excellence that represent multidisciplinary areas of strength and opportunity were created. Those areas of focus include (in no particular order): Addressing Health Disparities in Appalachia, Improving STEM Education and Scientific Literacy, Utilizing Shale Gas Responsibly, Achieving International Leadership in Radio Astronomy, and Promoting Stewardship of Water Resources. These focus areas are important socially and economically to the State of West Virginia and are viewed as holding great promise for integrated, interdisciplinary approaches to solutions. West Virginia University is committed to ensure success of the focus areas, and has followed through on that promise through support for faculty in terms of shared research facilities, workshops, funds to support graduate students and postdoctoral fellows, strategically aligned capital campaign funds, increased faculty recognition in focus areas, and also by adding faculty positions across the WVU campus that complement and will further advance progress in each of the focus areas. The Mountains Initiative was created to infuse curiosity, scientific advancements and strengthen the economy of West Virginia. The initiative is showing a great deal of early success.

The Institute of Water Security and Science

Water availability and management problems are more complex than any time in history. The intersections of human health and inequities, drinking and waste water, and economic development are increasingly blurred by complex policies that often result in little social or economic benefit to local communities. This concept is couched in the emergent concept of water security, which is transforming the way humans are managing freshwater resources, globally. Historically, water security referenced fresh water supplies for domestic purposes. However, more recently water security has been defined to include the sustainable access to safe, affordable, clean water, protection against water-borne pollutants, mitigation of water related disasters, and promotion of social and economic development and environmental protection (Sources: UN-Water; the Global Water Partnership). Federal, state and non-governmental

agencies, industry and institutes now realize that securing water resources sustainably will require integrated solutions that consider many aspects of water use.

Water may be one of West Virginia's greatest latent assets. By uniting the strengths of West Virginia's flag ship and Research-1 Institution with industry, agencies, partner institutions, science, engineering, policy, law and others, West Virginia will emerge with national leadership in water security and sustainability, and serve as a model for ensuring human health and well-being, natural resources vitality, and continued economic growth. The Institute of Water Security and Science (IWSS) is the "water" Mountain of Excellence and provides this conduit forward for West Virginia. The IWSS provides an identifiable organizational structure supporting this goal. WVU hired three faculty members in three colleges (Eberly College of Arts and Sciences, Statler College of Engineering and Mineral Resources, and Davis College of Agriculture, Natural Resources, and Design) to organize and lead water research efforts. These new positions compliment well over 60 faculty campus wide who have identified as having an interest in engaging in work with the IWSS in this important area. The IWSS will promote their work, enhance opportunities to gain external funding, and provide a mechanism for faculty to engage in sustained efforts to advance water resources science, technology and stewardship at WVU, in West Virginia, and well beyond.

While focused on research, the mission of the IWSS includes teaching and service, thus meeting the land grant mission of WVU and the diverse sets of water resources needs across the state of West Virginia. The IWSS will enhance collaborative, interdisciplinary activities across and beyond the WVU Campus, integrate existing resources and generate new resources that will facilitate study, problem solving and growth in West Virginia. This implies working closely with other colleges and programs across the WVU campus engaged at the nexus of food, energy and water, such as (but not limited to) Health Sciences, the College of Law, the Reed College of Media, the Davis College of Agriculture, Natural Resources and Design, the Energy Institute, Water Resources Institute, and many others. This agenda also implies working closely with Industry and partner State and Federal agencies to assist those entities with practical applied problems as they are presented, but also to work with those entities that are forward looking and wish to investigate new methodologies and technologies that may advance and prepare industry for what can be uncertain futures. Notably, while many agency and industry partner programs and faculty programs will be enhanced by the IWSS, it is not a goal (nor would it be realistic) of the IWSS to manage, or lead all of the diverse programs engaged in water resources research provided by WVU's many units. It is rather the interest of the Institute to offer coordination and facilitation, and seek synergies within and between these entities to advance progress and productivity for all participants.

Mission Statement and Purpose

The mission of the IWSS is to develop sustainable solutions addressing contemporary water quality and quantity problems, while strengthening West Virginia's water security, environmental, economic, social and cultural well-being, and broadening West Virginia University's water stewardship impact and prominence nationally and globally. Affiliates and members (faculty, researchers, agencies, and others) of the IWSS will identify key needs and

innovations in water resources, design and develop new technologies, techniques and methods and validate best practices that advance water resources science and stewardship, broaden outreach and service to state and Federal agencies, landowners and managers, and foster broader integrated interdisciplinary participation in water resources research while training tomorrows water resources professionals and improving awareness of water resources issues among the public. The IWSS will promote activities that improve water resources awareness, management and security in West Virginia.

This is an ambitious agenda. However, water is the great integrator. It is therefore common ground for all disciplines and all humans. Therefore, the IWSS will naturally focus on multi-disciplinary research, and will therefore, by implication, integrate expertise from many disciplines to address research questions and pursue technological advancements. It is anticipated that the IWSS will quickly earn a reputation for water resources innovation and serve as a conduit of water resources expertise, and by virtue of pursuing and resolving complex contemporary water resources problems, increase national awareness and recognition of WVU as a progressive model for water security and science.

Impact and Engaging with the Institute

A major focus of the IWSS is to determine how human activities affect water quantity, physical, chemical and biological characteristics of water and subsequent processes in aquatic ecosystems. This information informs allowable limits for human activities that, through management, provide sustainable water resources yielding maximum benefit for human use. This work recognizes all five classes of water use – domestic, industrial, agricultural, recreation and fish and wildlife propagation. These issues are particularly critical in mining and agricultural landscapes where food and fuel production result in non-point release of nutrients, contaminants, and sediment. These pollutants and their consequences will be intensified by a warming climate. Specific objectives of the IWSS include (but are not limited to):

1. Enhance collaborative, integrative, and/or multi-interdisciplinary activities across the West Virginia University campus.
2. Address the land grant mission of teaching and learning, discovery and creative activity, and outreach and community engagement.
3. Enhance and promote diversity, including developing international dimensions and perspectives.
4. Contribute to West Virginia's environmental, economic, social and cultural well-being.
5. Leverage existing resources demonstrating a high degree of commitment from units, e.g. new funds or redirection of current resources.
6. Generate new resources that will allow for continuation and possible growth of proposed activities.
7. Engage the commitment and passion of people and IWSS affiliates.

The objectives of the IWSS include to strategically increase research, education, and outreach related to sustaining and enhancing West Virginia's water resources. Research capacity and innovation is enhanced for all participants with faculty, industry, agency and private partners

that possess key research expertise that when integrated will develop synergy to advance basic and applied water resource science. Outreach efforts fostered by the IWSS will disseminate scientific findings to West Virginia residents and management agencies, and provide a knowledge base for addressing West Virginia resident concerns and questions. This organized effort will strengthen collaborations with Federal, State and Local agencies as well as industry, and private companies and enhance outreach programs. If you wish to engage with the IWSS and / or become informed of various activities of the IWSS, simply send an email to the Director, Dr. Jason Hubbart (Jason.Hubbart@mail.wvu.edu) to request addition to Institute information and electronic news.

Directions Moving Forward

The IWSS will have many focus areas moving forward including (but not limited) to those shown in Figure 1. Despite being a new organization (January 1, 2016), there are already a number of multi-disciplinary synergistic initiatives in the IWSS that range from local to regional to state-wide in scale.

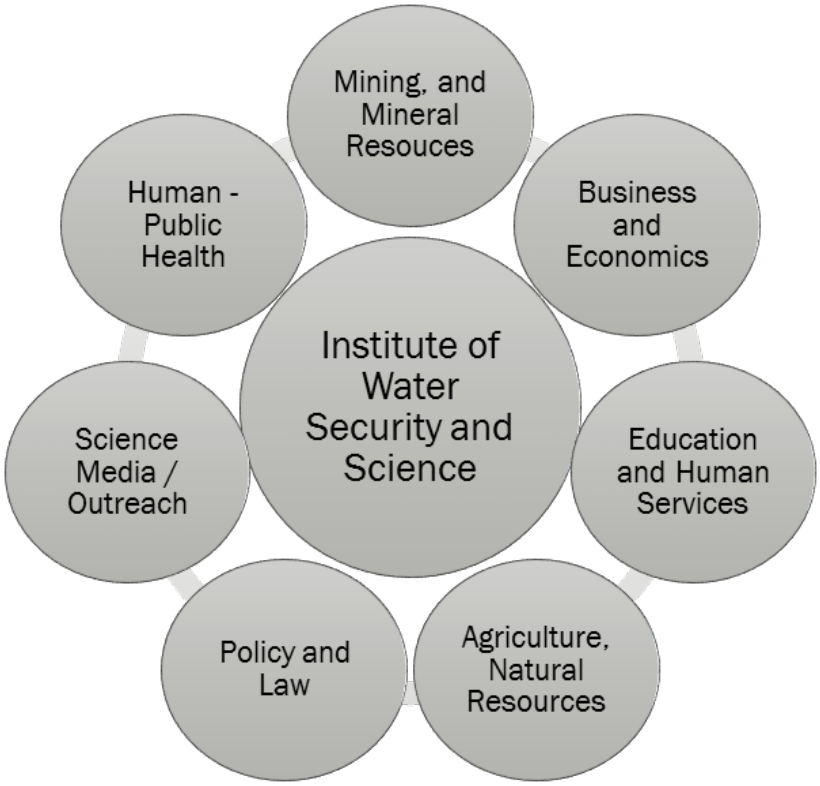

Figure 1. Current and future areas of engagement (not an exhaustive list) in the West Virginia University Institute of Water Security and Science (IWSS).

Since March 2016, the IWSS is engaged in a large synergistic activity that includes a community of scholars and researchers that organized as the Appalachian Freshwater Initiative (AFI) and were subsequently awarded a National Science Foundations (NSF) EPSCoR Research

infrastructure Improvement Program Track-1. This is a $20 million award, which will help address research areas of local and national importance. The research foci address fundamental science questions that align with West Virginia's science and technology plan (Vision 2025) and NSF priorities in water resources science and gravitational wave astrophysics. West Virginia has a history of balancing industrial development with environmental concerns, and understanding, mitigating, and remediating risks associated with industrial development is the key to achieving an effective balance of ecological and ecosystem services. Research efforts are led by research teams at West Virginia University (WVU), Marshall University (MU), and West Virginia State University (WVSU). Predominantly Undergraduate Institutions are also actively engaged in related research and workforce development activities.

This broad partnership builds on recent investments by all three institutions, the state, and federal agencies in new faculty hires, shared experimental facilities, high-speed networks, and comprehensive workforce development programs. This project further provides opportunities for scientists, engineers, mathematicians, computer scientists, and students in academic institutions and federal research centers to collaborate at many scales including the watershed level.

For example, there is a local multi-disciplinary, multi-team (including the IWSS) effort to create a teaching and research demonstration site in the West Run Watershed located in Morgantown, WV. This is a timely initiative that dovetails with plans of the IWSS to implement the West Run Watershed with a paired and scale-nested experimental watershed study design that by summer of 2016 will include five permanent gauging stations to monitor the flow regime and water quality constituents of concern of West Run at multiple locations. West Run drains directly to the Monongahela River at the northern edge of Morgantown. The Watershed is approximately 8.5 mi^2 and is located in-part in Morgantown city limits and entirely in Monongalia County. Flooding has become more prevalent in recent years in the watershed due to ongoing development activities that often result in increased runoff and alteration of timing of runoff. However, it is not possible to quantitatively characterize the flow regime in West Run Watershed without permanent hydrologic monitoring sites. Therefore, installing permanent gauging stations will provide critical continuous datasets that will enable quantification of baseflow and stormflow regimes in the watershed in various land-use regions in the watershed (e.g. agriculture, forest, and mining, and industry, rural and urban development).

Initiating a long-term monitoring program in West Run Watershed also provides a model to show West Virginia citizens how such a study design can work in complex contemporary watersheds that include many different land-uses ranging from mining to urban development. There have been relatively few such studies conducted globally, and the design requires long-term investment and dedication for success. The approach being implemented in West Run Watershed in Morgantown, WV, can be applied to any watershed in West Virginia, at just about any scale and is fully customizable to address the most pressing water balance or water quality questions of concern. Information collected can provide streamflow and water quality information to help land-owners, industry, or citizen groups meet local, State, regional and national requirements. Methods are standardized and thus transferrable, comparable and subject to the same quality assurance and quality control guidelines.

We at the IWSS would like to hear from you. Is this approach something that could be useful in West Virginia? Is this approach of use in your industry to monitor flow outputs and water quality? Are there other approaches you might recommend? How do you feel the IWSS can best serve the State of West Virginia and its various stakeholders? Please feel free to contact the IWSS Director Dr. Jason Hubbart with your questions, comments or concerns at Jason.Hubbart@mail.wvu.edu.