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Before the Subcommittee on Environment and Subcommittee on Investigations and Oversight
Committee on Science, Space, and Technology
U.S. House of Representatives
Hearing on
An Examination of Federal Flood Maps in a Changing Climate
February 27, 2020

Madam Chair, Mr. Chairman, Dr. Marshall, members of the Subcommittees, I'm Ryan Branfort, a professional land surveyor and certified geographic information systems professional and Senior Vice President with Wilson & Company, Inc., Engineers & Architects, based in Salina, Kansas. Thank you for the invitation to testify. I am honored to present my views on how geospatial data, technology, and services can improve flood mapping of the Federal Emergency Management Agency (FEMA) and better serve the American people.

Our changing and evolving climate, sea level rise, subsidence, and other natural and anthropogenic phenomena affects flooding impacting American property owners, taxpayers, and FEMA as the custodian of the National Flood Insurance Program. As a Kansan, I can also tell you these phenomena also affect American agriculture, crop insurance, and our food supply.

Congress passed, and President Trump signed into law the Geospatial Data Act on October 5, 2018 as subtitle F of the FAA Reauthorization Act, Public Law 115-254. That law defines geospatial data as "(A) ... information that is tied to a location on the Earth, including by identifying the geographic location and characteristics of natural or constructed features and boundaries on the Earth, and that is generally represented in vector datasets by points, lines, polygons, or other complex geographic features or phenomena: (B) may be derived from, among other things, remote sensing, mapping, and surveying technologies; and (C) includes images and raster datasets, aerial photographs, and other forms of geospatial data or datasets in digitized or non-digitized form..."

America is blessed with a vibrant, capable, and qualified private sector geospatial community that provides Federal, state, and local government, as well as commercial clients, with an extraordinary array of data, technology and services that contributes to our quality of life. From total station data collectors for land surveying to satellite imagery and positioning, and a plethora of instruments, software, analytics, and applications in between, the geospatial profession provides data and solutions from the sky above the Earth to below the Earth's surface.

I'd like to share with you today some thoughts on how those technologies can be better used by FEMA and other Federal agencies for flood mapping and other applications, as well as observations on public policy issues that can contribute to a more successful program.

Specifically, the utilization of new mapping data and technologies can be used to predict future flooding rather than mapping flood results. This would significantly save lives, protect property, improve building practices, and save tax dollars.

Here are a few slides that show how state-of-the-art geospatial technology, data, and services can assist FEMA:

- **LiDAR.** The USGS 3-D Elevation program or 3DEP is satisfying the growing demand for consistent, high-quality topographic data and a wide range of other three-dimensional representations of the Nation's natural and constructed features, primarily through elevation data collected with Light Detection and Ranging (LiDAR). Among the applications that benefit from 3DEP data are flood risk management; infrastructure; landslides & other hazards; water resources; aviation safety; telecom; homeland security; emergency response; precision agriculture; energy; pipeline safety; and other areas. USGS has identified more than 600 applications that benefit from such enhanced elevation data and the list is growing every day. 3DEP promotes economic growth, facilitates responsible environmental protection, resource development and management, assists with infrastructure improvement, and generally enhances the quality of life of all Americans. The USGS, with involvement from the private sector and other stakeholders, conducted a National Enhanced Elevation Assessment (NEEA) to determine and document the need for national elevation data within government and private markets. The results indicated that enhanced elevation data have the potential to generate \$13 billion in annual benefits, at a benefit:cost ratio of 4.7 to 1. While FEMA has been the leading contributor to 3DEP apart from USGS itself, the program is not coming close to the \$146 million per year that is needed to complete the nation and implement an update cycle of eight years. This slide shows about 67 percent of the Nation has been mapped under 3DEP. But many flood-prone or flood-vulnerable areas still need new elevation data. Prior to the initiation of 3DEP, the average elevation data for the nation was 30 years old. Therefore, this program must be funded so the nation can be accurately mapped and the re-mapping process can begin. It must be noted that each time we put a shovel in the ground or natural disaster occur the surface changes. That is why remapping on a consistent cycle is so important. I would like to thank Committee members Representatives Foster of Illinois, Casten of Illinois, and Biggs of Arizona for cosigning the bipartisan letter to the House Appropriations Committee last year requesting robust funding for 3DEP in FY 2020.
- **Coastal Mapping.** If one reads Chief Justice Robert's dissenting views in the Supreme Court's decision in *Massachusetts v. Environmental Protection Agency*, 549 U.S. 497 (2007), it is noted that the plaintiffs did not submit any mapping to document the amount of shoreline it was losing. Justice Roberts wrote, "One declaration states that 'a rise in sea level due to climate change is occurring on the coast of Massachusetts, in the metropolitan Boston area,' but there is no elaboration. And the declarant goes on to identify a 'significan[t]' non-global-warming cause of Boston's rising sea level: land subsidence [i.e., the sea is not rising; the land is sinking]. Thus, aside from a single conclusory statement, there is nothing in petitioners' standing declarations and

accompanying exhibits to support an inference of actual loss of Massachusetts coastal land from 20th century global sea level increases. It is pure conjecture.” He went on to write, “The Court’s attempts to identify ‘imminent’ or ‘certainly impending’ loss of Massachusetts coastal land fares no better. One of petitioners’ declarants predicts global warming will cause sea level to rise by 20 to 70 centimeters by the year 2100. Another uses a computer modeling program to map the Commonwealth’s coastal land and its current elevation, and calculates that the high-end estimate of sea level rise would result in the loss of significant state-owned coastal land. But the computer modeling program has a conceded average error of about 30 centimeters and a maximum observed error of 70 centimeters. As an initial matter, if it is possible that the model underrepresents the elevation of coastal land to an extent equal to or in excess of the projected sea level rise, it is difficult to put much stock in the predicted loss of land. But even placing that problem to the side, accepting a century-long time horizon and a series of compounded estimates renders requirements of imminence and immediacy utterly toothless.” This landmark case ordered the EPA to regulate CO2 emissions under the Clean Air Act, as the lack of regulation allegedly causes polar ice caps to melt, resulting in rising sea levels that eroded the shoreline of Massachusetts and other coastal states. However, there is not a robust program to consistently map the shoreline over time to or quantify seal level rise and shoreline loss. In fact, as the National Academy pointed out, there are at least 22 different Federal, state and local definitions of shorelines and submerged lands. (A Geospatial Framework for the Coastal Zone, National Academies Press, 2004)

- Subsidence. There is natural and anthropogenic subsidence in many areas of coastal and inland America. In many studies, this is ignored or discounted, particularly when compared to sea level rise. USGS did a special local study in the Hampton Roads/Tidewater region of Virginia and concluded 50 percent of the change in land level was due to subsidence. “Data indicate that land subsidence has been responsible for more than half the relative sea-level rise measured in the region.” (Land Subsidence and Relative Sea-Level Rise in the Southern Chesapeake Bay Region (2013)) and nationally, “an area of more than 15,000 square miles in 45 States experience land subsidence.” (Land Subsidence in the United States, (1999)). As the images I provided show, there are portions of our Nation which are extremely vulnerable to subsidence, and other regions where we have no data at all. NASA is beginning a program, with USGS and NOAA, to provide a very small-scale National Land Level Change Map using existing Sentinel 1 satellite data with existing ARIA/GRFN data processing workflow. This is only a start. For larger scale, regional, local and site specific data collection, land surveys and other more accurate technologies will be required.
- Inland Bathymetry. Wilson & Company does a considerable amount of work for the U.S. Army Corps of Engineers. It is our experience that Corps reservoirs are now more than 50 years old and sediment buildup has substantially reduced capacity for storage of water. The same can be said for lakes and reservoirs of other owners, as well as inland waterways. Inland bathymetric and sediment monitoring is needed to measure the capacity of such bodies of water for more accurate flood forecasting, and the determine the need and extent of any required dredging.

- Structures Inventory. It is essential that all FEMA maps show structures. FEMA should investigate means for presenting flood risks to individual homeowners based on the elevations of their lowest adjacent grade (LAG) and/or lowest floor elevations compared with water surface elevations computed for standard flood frequencies. By showing the probability of flooding to various depths for individual structures, we believe many more homeowners would recognize that their risk of flooding is serious and may even be more probable than their risk from other hazards (e.g., fire). LiDAR technology, in particular, is ideal for determining the elevations of LAG elevations for automated comparison with water surface elevations for 100-year and 500-year floods that **have an annual chance of occurring each year**. This is needed for risk management, flood rating, mitigation, and for response when flooding does occur. Through LiDAR and ground surveying, a structure inventory is technically feasible. This can enable more frequent application of “Freeboarding”, a factor of safety usually expressed in feet above a flood level for purposes of floodplain management, and can help improve construction practices in vulnerable areas.

The reason Congress passed the Geospatial Data Act was because of past hearings, Government Accountability Office reports, and other studies that identified inadequate coordination among the dozens of Federal agencies involved in surveying, mapping and geospatial activities, as well as with state and local government, the private sector, and the university community.

In 2012, Congress passed the Biggert-Waters Flood Insurance Reform Act, in the MAP-21 Act (Public Law 112-141). It included section 100220, which can be utilized to pool funding from Federal, state and local government entities for elevation data. Specifically, it calls for FMEA, with the Director of the Office of Management and Budget and others, to submit to Congress “an interagency budget crosscut report that displays relevant sections of the budget proposed for each of the Federal agencies working on flood risk determination data and digital elevation models”.

Section 100121 required a National Academy of Public Administration (NAPA) study on how FEMA can improve interagency and intergovernmental coordination on flood mapping, including a funding strategy to leverage and coordinate budgets and expenditures and establish joint funding mechanisms with other Federal agencies and units of State and local government to share the collection and utilization of data among all governmental users.

In 2013, NAPA published "FEMA Flood Mapping: Enhancing Coordination to Maximize Performance" in which it proposed (page 11): "Recommendation 15: The Office of Management and Budget should use the 3DEP implementation plan for nationwide elevation data collection to guide the development of the President's annual budget request." In light of the controversy over FEMA flood insurance rates, particularly as that influenced the recent enactment of the Homeowner Flood Insurance Affordability Act of 2014 Public Law, 113-89, on March 21, 2014, there is an even more urgent and compelling need for the high-quality elevation data that the USGS 3DEP program provides.

There is currently before Congress several legislative proposals that are worthy of support and should be enacted into law.

H.R. 3111 by Rep. Velazquez of New York, the "National Flood Insurance Program Administration Reform Act of 2019" makes improvements to the National Flood Insurance Program's appeals and litigation process following the numerous flaws identified in the oversight, accountability, and transparency of the claims process in the aftermath of Superstorm Sandy. It was unanimously approved last year by the House Financial Services Committee.

Section 2 authorizes a report to be presented to Congress by March 31, 2025, by the FEMA Administrator regarding the pilot program on pre-existing conditions of structures. This pilot program can be utilized by FEMA as the agency focuses on populating datasets leading to a National Structure Inventory.

Section 15 authorizes a study by GAO of the treatment, under flood insurance coverage made available under the National Flood Insurance Act, of earth movement and subsidence, including earth movement and subsidence caused by flooding, which shall include an assessment of the effects on the National Flood Insurance Program of covering earth movement and subsidence caused by flooding.

The Digital Coast Act, H.R. 2189, By Representatives Ruppertsberger of Maryland and Young of Alaska was added to a larger bundled package of about a dozen bills that passed the House in December. It is now part of H.R. 729, the "Coastal and Great Lakes Communities Enhancement Act". It authorizes NOAA to establish a constituent-driven program to provide digital geospatial information capable of efficiently integrating coastal data with decision-support tools, training, and best practices and to support collection of priority coastal geospatial data to inform and improve local, State, regional, and Federal capacities to manage the coastal and Great Lakes regions. The Senate version of the bill, S. 1069, has been reported by the Senate Commerce Committee.

H.R.3167, the "National Flood Insurance Program Reauthorization Act of 2019", introduced by Rep. Waters of California, won approval by the House Financial Services Committee by a bipartisan vote of 59-0 in 2019 and is awaiting full House action.

Section 201 authorizes \$500 million for each year over five years for flood mapping. This is an increase of \$100 Million above current \$400 Million/Year level.

Section 202 expands flood mapping to all areas of the United States. This section also requires FEMA to utilize updated mapping technology, such as LiDAR, and provides for digital displays, and property specific mapping. It requires FEMA to submit an annual report to Congress on the progress achieved in the mapping program under this section including recommendations to reduce the cost and improve implementation. Lastly, this section requires that in updating and maintaining maps, the FEMA Administrator shall ensure that maps are adequate for identifying future flood risk. Qualifications-Based-Selection (QBS) is applicable to all levels of contracting for the professional services of any surveying, mapping, and geospatial data collection associated with the NFIP. Specific emphasis is placed on the importance of LiDAR data collection and geospatial data-sharing as part of the U.S. Geological Survey's stream gage and streamflow networks and FEMA's NFIP. And finally, there is specific language on "cadastral data" and the need for such data for NFIP flood risk assessment.

Parts of this section are similar to H.R. 4905 from the 115th Congress, sponsored by Representatives Gonzalez of Texas and Mooney of West Virginia.

H.R. 2318, the "Flood Insurance Rate Map (FIRM) Interagency Technology (IT) Act", introduced by Representative Posey of Florida would direct FEMA to consult with the Department of Defense, USGS, and NOAA to obtain the most up-to-date information relevant to National Flood Insurance Program (NFIP) rate maps. This will allow Americans who utilize NFIP to have the most accurate data for flood hazard identification. This legislation focuses on data sharing, and specifically improving efforts on topographic and cadastral data where it is available while adding essential features to FEMA flood insurance rate maps (FIRMs), making greater use of state-of-the-art geospatial technology, and makes the maps more accurate and useful.

There are a few other issues of which Congress should be aware that are important to FEMA, other Federal agencies, and the nation in general.

First, governmental agencies are not taking full advantage of the extensive resources and highly technical capacities of the private sector. While great progress has been made, there is still too much government competition with, and duplication of, the private sector. While FEMA does not have in-house mapping capabilities, and agencies such as USGS have made significant transformations (the 3DEP program is entirely performed by private sector contractors to USGS), there are still many commercial activities in the surveying, mapping, and geospatial field that are performed by government employees.

The challenge for FEMA and other Federal agencies is to continually move ahead with more accurate and efficient technologies while restraining use of antiquated or even early, unproven methods and technologies. That is why it is critical to have oversight of all surveying and mapping activities by a licensed professional. This will ensure a thorough understanding of the basics of map accuracy. Professional knowledge of datums and coordinate systems to ensure mapping data is accurate and relative to other data and designs is also essential. One of the lessons of Hurricane Katrina was the need for strong understanding of datums.

With technology ranging from satellites, to collection from manned airborne platforms, to drones, to field surveying, to ground penetrating radar, subsurface utility engineering, and underwater hydrography and bathymetry, an understanding of the capabilities and limitations of the most efficient hardware, software, and computer systems is essential to any mapping project or program. This can be a great asset to reduce costs and increase map accuracies. No single, perfect technology or approach can be universally applied to all mapping projects. Similarly, there are lower cost "one button" mapping systems with unproven claims that can also cause problems. Having experienced, licensed professionals involved in such programs provides guidance needed to match the proper tool to the project.

I would urge Congress to focus our Federal workforce on inherently governmental activities and utilize the private sector for those activities that are commercially available.

Second, there is no coordination among Federal agencies, or with the National Science Foundation, on surveying, mapping and geospatial research and development. R&D dollars are

expended on an ad hoc basis, with no strategic objectives. Geospatial R&D is not a topic on the agenda of the Federal Geographic Data Committee (the Federal entity responsible for coordination) or the National Geospatial Advisory Committee (the Federal entity established to provide outside advice to the government). Private geospatial firms have seen too many instances where universities are funded by NSF, only to find those university programs competing with the private sector. Moreover, NSF has no mechanism for vetting its R&D agenda, funding opportunities, or proposals before professionals in the private sector. As a result, tax dollars have too frequently gone to universities to perform research and development on tools, methodologies, instruments, hardware, software, and applications that are already readily available in the commercial market.

Finally, I would call to the attention of the subcommittees a 1984 report by this Committee, (Structural Failures in Public Facilities (H. Rept. 98-61)). Based on hearings of the Subcommittee on Investigations and Oversight, chaired by then Representative Al Gore, Jr. of Tennessee, Congress recognized the importance of professional licensing in design disciplines in its report which recommended “all necessary architectural and engineering design and on-site services in public construction projects are furnished by licensed professionals who are qualified and experienced to assure the construction of safe structures”. I would argue the same principle is true of surveying and mapping. All 50 states license surveyors and I am concerned that some states are failing to recognize the impact surveying-related services have on public health, welfare and safety. The movement to relax occupational licensing that is sweeping the Nation fails to distinguish between architecture, engineering and surveying on one hand and floral arranging and hair braiding on the other hand. I would urge legislation expressing the sense of the Congress on this distinction and recognizing the importance of licensure in the design professions.

That same report also pointed to the importance of competence and qualifications, as opposed to low bid, in the procurement of professional design services. It found, “procurement practices that lead to or promote the selection of architects and engineers on a low bid basis should be changed to require prequalification of bidders with greater consideration given to prior related experience and past performance.” Again, this principle applies to flood mapping as well. For the record, this is not a partisan issue. As President Ronald Reagan said at a ceremony recognizing design excellence in Federal buildings, “Good design doesn’t cost money. Good design saves money, and you know how that warms my heart.” I would urge Congress to strengthen the “Brooks Act” (40 U.S. C. 1101 et. seq.) to assure that all agencies use the qualifications based selection process for the broad range of surveying and mapping services we are discussing today.

In conclusion, I want to commend FEMA for doing the best job possible. It is a difficult job. I hope the constructive recommendations I put forward today will be accepted and the program can build on its past success and provide an even greater service to our Nation.

Madam Chair, Mr. Chairman, Dr. Marshall, thank you for the invitation to present my views and I will be happy to answer any questions.