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"Exploring the Effects of Drought on Energy and Water Management"

Chairman Wyden, Ranking Member Murkowski, and Members of the Committee, on behalf of the Congressional Research Service, thank you for this opportunity to appear before you. I am Nicole Carter, Specialist in Natural Resources Policy. The Committee requested that CRS discuss how the 2012 drought affected navigation and electric generation.

Droughts Force Difficult Tradeoffs in the Face of Uncertainty

Droughts and floods force difficult tradeoffs and draw attention to the management of the nation's rivers, lakes, and reservoirs. Today, there are fears of flooding along some of the nation's rivers. Only recently some of the same rivers were experiencing low flows from drought.

Like floods, droughts focus attention on water resources management and the role of storage reservoirs. Droughts also bring attention to the role of groundwater, its use, and long-term management. Aquifers store and supply water for irrigation, rural communities, energy production, and some urban areas.

The 2012 drought destroyed or damaged a significant portion of the U.S. corn and soybean crops, with impacts on U.S. livestock sectors as feed costs reached record levels. Drought-reduced corn yields also lowered ethanol production and brought attention to the drought vulnerability of domestic fuel production. The 2012 drought also tested the resilience of the navigation and electric power sectors.

2012 Drought: Navigation Impaired but Maintained

For those moving mid-continent agricultural, energy, and other products by waterway, the 2012 drought raised fears of repeating the navigation experience of 1988. During that drought, the Mississippi River and its tributaries experienced extensive navigation closures and barge backups.

In 2012, commercial navigation suffered short-term closures and restrictions, but no extended closures. By most accounts, the U.S. Army Corps of Engineers maintained the congressionally authorized navigation channel on the Mississippi River. The authorized channel is notably narrower and shallower than what is typically available on the Mississippi for commercial navigation in a normal water year. For example, in the Middle Mississippi River between St. Louis, Missouri and Cairo, Illinois, the authorized channel is 300 feet wide and 9 feet deep.

The more limited channel dimensions on the Mississippi and its tributaries in 2012 reduced waterway transportation efficiencies and increased transportation costs for shippers and carriers. Tows moved 15

rather than 30 or more barges at a time. Barges were light-loaded to meet the shallower draft. Tow operators had to account and schedule for segments where traffic was limited to one-way. While these conditions were difficult, the extreme disruptions and extended closures of 1988 were avoided.

The Corps maintained the Mississippi River navigation channel through a combination of measures previously put into place and actions taken during the drought. For example, additional structures to concentrate the river's flow into the navigation channel were constructed after the 1988 drought. These structures improved flow and reduced the need for emergency dredging. During 2012, the Corps also removed rock pinnacles in the authorized channel and dredged critical locations.

The Coast Guard, the Corps, navigation industry representatives, and others communicated through regular standing forums established since 1988. During 2012, improved information and technologies also helped avoid groundings, allowing commercial navigation to continue, albeit at reduced efficiencies.

The Corps during the 2012 drought monitored 17 reservoirs that influence navigation conditions on the Mississippi River and its tributaries below the Corps' locks and dams. At times the Corps altered reservoir releases to benefit Mississippi River navigation while attempting not to interfere with the congressionally authorized purposes of those facilities.

The impaired navigation conditions in 2012 renewed discussions about the relationship between water management activities in the Missouri River basin and navigation conditions in the Mississippi River. Missouri River flows can and do influence navigation conditions during drought on the Middle Mississippi River.

The Missouri River's system of federal reservoirs was designed to provide multi-year and multi-purpose storage to assist the basin in managing both droughts and floods. The Corps operates its Missouri River reservoirs according to a Master Manual adopted in 2006. The Missouri River basin provides instances of dry conditions lasting one or two years, as well as droughts lasting six to twelve years.

After record runoff in the upper Missouri River basin in 2011, federal reservoirs were full in early 2012. During the basin's dry summer and fall of 2012, the Corps released stored water in accordance with the Master Manual to fully support Missouri River navigation. These flows incidentally, but critically, supported Mississippi River navigation. The Assistant Secretary of the Army recently reaffirmed that the Corps lacks authority to modify Missouri River system operations for the express purpose of benefiting downstream Mississippi River navigation.

Based on declining Missouri River reservoir levels and 2013 runoff forecasts, the Corps implemented minimum water releases for the 2012-2013 winter, thus reducing contributions from the Missouri River to

the Mississippi River beginning last December. This reduction occurred while the drought continued to impair navigation on the Middle Mississippi River.

Dry conditions persisted in the Missouri River basin until recently. How recent and ongoing storms may affect spring and early summer runoff forecasts, especially for the reservoirs in the upper basin, remains unclear. What is known is that managing reservoirs in times of droughts embody difficult tradeoffs, such as whether to release stored water to offset near-term harm or store water for future use in case of continued dryness.

2012 Drought: Mixed Effects on Electric Generation

The 2012 drought also affected electric generation in a variety of ways.

Some individual power plants curtailed operations due to water access problems or water temperature issues; others pursued regulatory waivers to continue operations at higher water temperatures or made cooling system investments. Lost generation at drought-impaired facilities was offset by other generation. The mid-continent electric grid as a whole appears to have avoided major drought-related disruption in 2012. This experience contrasts with the experience of the power grid serving most of Texas, which asked customers in 2011 during a period of intense regional drought to voluntarily conserve to avoid rolling blackouts.

In 2012, hydropower production nationally was above average. Hydropower generation in the Pacific Northwest, although drought-susceptible, was unaffected by the 2012 drought. The Missouri River basin's strong hydropower generation in 2012 can be attributed to full reservoirs at the beginning of the year and the generation associated with releases of stored water to augment low river flows. The most recent hydropower forecast for the Missouri River, which was produced prior to recent storms, anticipated a 20% drop in generation in 2013. For large reservoirs and reservoir systems, it is often the multi-year droughts that most significantly reduce generation, as illustrated in the Colorado River Basin.

The drought's impact on navigation did not appear to materially affect regional power plant operations. Base-load coal plants that are dependent on waterways for fuel delivery generally have coal stockpiles located at the power plants to reduce their vulnerability to short-term delivery disruptions.

In addition to coal, other energy products are transported on the inland navigation system. There was a dramatic decline in the movement of crude product by barge down the Mississippi River in

December 2012 and January 2013, relative to the previous year. Whether this decline can be attributed to the drought's effect on navigation costs and reliability is unclear.

Drought Resilience

The 2012 drought provided a single year of data on the drought vulnerability and resilience of a significant portion of the United States. It reinvigorated debates about water management; who should bear the costs of droughts, and the most cost-effective drought preparations and responses. Congress and the Administration are faced with deciding what lessons to draw from 2012 to improve single and multi-year drought resiliency.

Thank you and I welcome your questions.