Water Data Assessment Report:
Pecos Valley, New Mexico

Prepared and submitted by the Internet of Water in partnership with the New Mexico Bureau of Geology and Mineral Resources

Internet of Water

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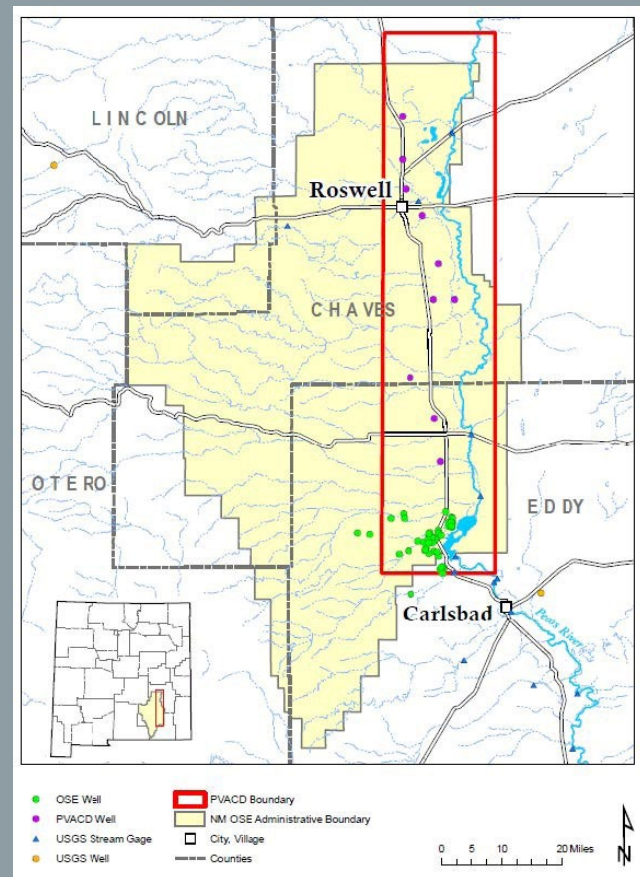
INTRODUCTION

This water data project, led by the New Mexico Bureau of Geology and Mineral Resources (NMBGMR), is designed to address water data challenges in the Pecos Valley region of southeastern New Mexico while developing a federated water data delivery service for the state of New Mexico, known as the Water Data Initiative (WDI). The pilot in the Pecos Valley region (see map), will facilitate better access to data in order to improve groundwater and surface water management and decision-making. Ideally, the pilot project will become a model for regional data integration and tool development for other regions of New Mexico and the West.

The WDI, working with the PVACD (Pecos Valley Artesian Conservation District), will create more efficient data collection, ingestion, management, and re-usability for regional and state water managers. Besides PVACD wells for groundwater monitoring, other datasets of interest may be sourced from federal and state sources, such as OSE, ISC, USGS, and US BOR.

In this first year (2021), the project focused on planning and outreach, particularly on building consensus around data management priorities (use cases), discovering data of interest, establishing a plan for data system improvements at PVACD, and evaluating options for data visualization. During this process, a needs assessment was conducted, employing focus groups and a survey. The purpose of the needs assessment was to gain a better understanding of needs in the region and barriers to water data modernization among the region's stakeholder groups.

KEY TAKEAWAYS: FOCUS GROUPS

Over the course of two months, focus groups were conducted with the Pecos Valley Artesian Conservation District, Interstate Stream Commission, New Mexico Office of State Engineer, U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, and The Nature Conservancy, with a total of 19 participants. From these focus groups, the following key takeaways were noted:

1. **Identify data gaps**: There were two types of data gaps discussed in focus groups. A) The first refers to data needed but unknown, which participants felt integrated data would illuminate. Identifying and remedying data gaps improves and increases the collection of data, resulting in more robust water management. For example, gage coverage is sparse in places as is coverage with weather stations, decreasing consistency and spatial variability in coverage of these important datasets as well as limiting the efficacy of modeling to inform decision-making. Comprehensive water management requires comprehensive data. Identifying areas of data needed is the first step in solving this issue. B) The second type of data gap discussed refers to those data that are currently needed and known but unable to be accessed. Participants referred to important gaps in the timing or frequency of data collection, and missing or difficult-to-access data from the Office of State Engineer, and on antecedent conditions in the river, groundwater levels, and critical habitat areas. Modernizing the data infrastructure in the region would alleviate some of these data challenges, in addition to illuminating other data needs that could then be remedied.

2. **Improve efficiency and efficacy in addressing questions with data**: Modern data systems a) streamline and make current processes for tabulating usage more efficient; b) improve responsiveness to and the ability to address questions supporting litigation, c) allows for data query, d) improves understanding of historic trends, and e) supports broader state efforts. Currently, answering questions with the data available in the region is labor-intensive and, at times, prohibitive. Streamlining data processes for tabulating water usage would transform a process that currently takes months into a process that takes days. Additionally, supporting requests from litigation is labor-intensive because many records are in paper formats, requiring manual acquisition and tabulation. Modernizing current processes and digitizing historic records would greatly reduce employee time in answering requests and allow time for other activities, such as the analysis of historic trends or impact analysis from changing methods on water use. It would also allow for the possibility of data queries, such as "how many water rights are in place for a particular applicant." These basic questions are currently too labor-intensive or impossible to answer. A more modern, integrated data management

system for the region would improve efficiency and reduce employee time used for manual processing, resulting in money saved.

3. **Improve data literacy**: There remain many questions among stakeholders in the region about modern data infrastructure, best practices, and privacy and security. Addressing these questions requires a structured effort to improve data literacy. Such efforts would not only address the concerns listed here but would also improve the way decision-makers in the region engage with and visualize data to improve water management outcomes. Additionally, data literacy would address the challenges around legacy data frequently cited by participants. This type of training would ideally teach data managers how to create a process for digitizing legacy records (currently in paper form) that is both targeted and efficient, creating more sophisticated and flexible systems.

4. **Integrate data for dynamic water management**: Currently, a lack of integrated data in the region limits the ability to understand and communicate the impact that current practices have on the health and life of the aquifer. Integrating data such as soil types, topography, weather, demographics, surface water management, endangered species, stormwater and flood control, and water use would support more dynamic management of the region's water supplies, and possibly provide the knowledge needed to increase the willingness of stakeholders in the region to change or modernize practices. Better access to integrated data would improve modeling, which in turn supports and informs decision-making. Together the ability to employ data to effectively and accurately communicate current status as well as to predict future challenges would foster partnership in the region toward more sustainable practices.

5. **Address data quality concerns**: There remains a concern over data quality in the region. Methods for assessing and communicating data quality are integral to any new system to ensure confidence among data users. The preference among stakeholders was to prioritize less data of higher quality rather than more data of unknown or lesser quality. Methods to flag or categorize data by its quality standard will be an important component of any regional system.

NEW MEXICO-PECOS USER NEEDS SURVEY

In August-September 2021 the New Mexico Water Data Initiative and the Internet of Water distributed a survey to stakeholders in the Pecos region. The purpose of the survey was to gather information from those in the Pecos Valley regarding the information they receive about water, the source of their information, their trust of this source, their concerns over water in their community, and their preferences for how they would like to learn

more about their water. This survey was in follow-up to focus groups conducted with stakeholders from the region. Collectively the results of the focus groups and the survey will inform the New Mexico Water Data Initiative about how best to better understand water conditions, communicate information about water, and improve water management decisions in the Pecos region.

DESCRIPTION OF PARTICIPANTS

During a six-week period, stakeholders in the Pecos region were invited to complete the Pecos Region Stakeholder Survey (n=53). The method of delivery was via email and social media, with anonymous survey links provided through Qualtrics. The largest portion of respondents self-identified as public agency employees, from both state and federal agencies (See figure 1). Other significant groups, though not as large, self-identified as decision or policymakers in the region or regional water managers (See figure 1). Additionally, regional representation was high, with a large number of the participants currently living in the region (58.9%) and many more living in other parts of New Mexico but with an interest in the region (34.2%).
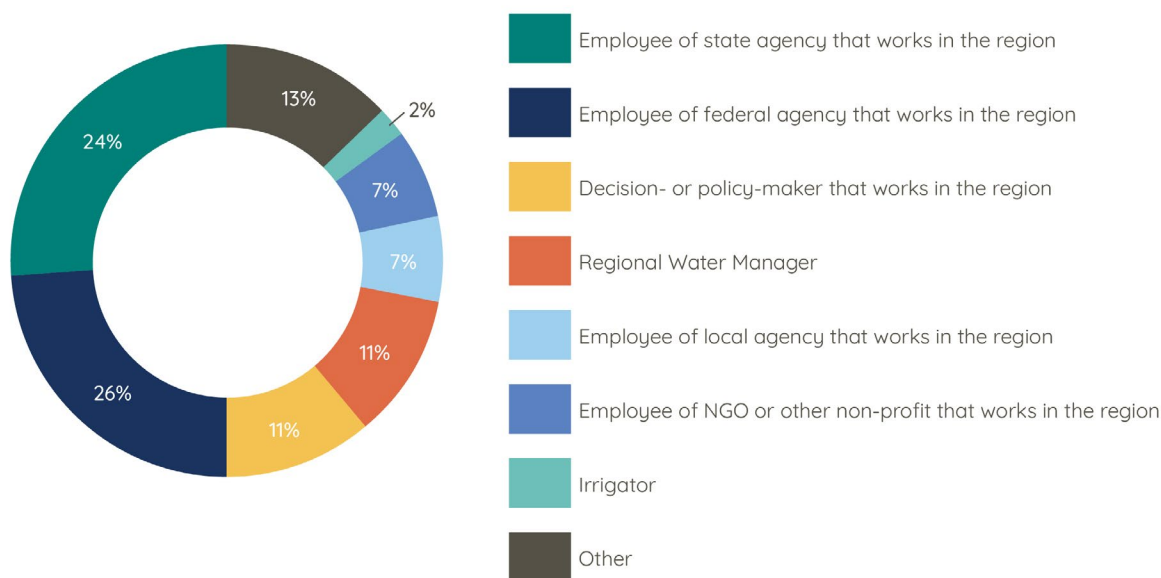

Figure 1: Self-identified classification of survey participants

Of these respondents, many indicated that their organization is either interested in learning more about tools and technologies to improve data management, access, and use (56%) or that their organization is currently implementing or has implemented new

technology to improve data management (33%) (See figure 2). This is a positive finding, indicating not only a need in the Pecos region for improved water data infrastructure but a desire to act on modernization efforts to improve water data infrastructure in the region.
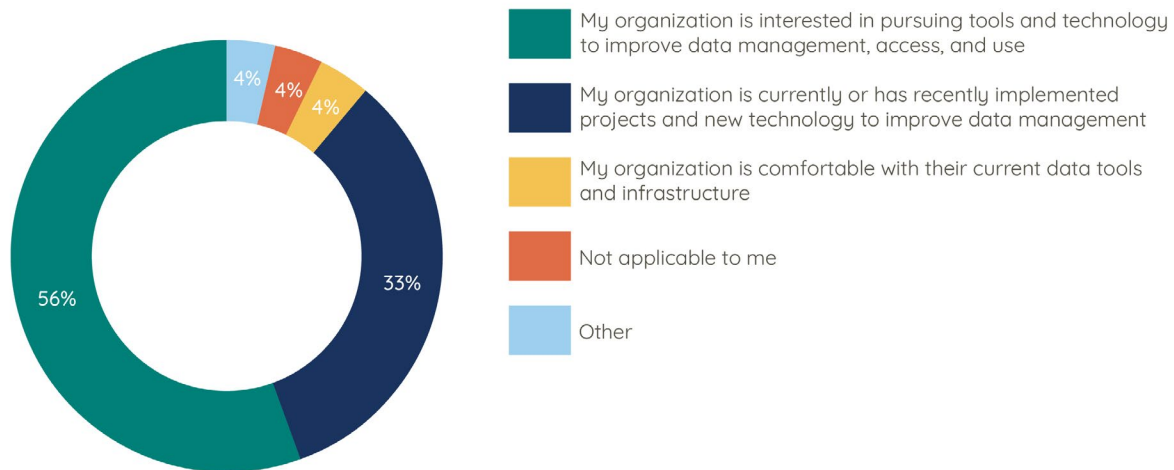

Figure 2: Participant opinions on willingness to improve water data infrastructure

CONCERNS OVER WATER USE

When asked about their greatest concerns, water availability and conflicts between groundwater and surface water use made up the lion's share of participants' top concerns (47.4% and 29%, respectively, for a total of 76.4%). However, many respondents selected climate change and interstate compact compliance as important issues as well. (18.4%) (See Figure 3). While participants did rank these concerns, several pointed out in comments the interconnectedness of these issues: "The conflict between groundwater and surface water is essentially a conflict between districts, and also an impact to compact delivery....really, they are all interconnected."

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Figure 3: Participant ranking of concerns over water in the Pecos region

- Figure 3 emphasizes the large concern over water availability in the region with all but one participant ranking it in the top 4 concerns.
- Conflicts over groundwater and surface water use are also of considerable concern to many participants, often ranking in as a top 3 concern.
- Climate change is consistently a concern and is considered closely linked with other issues in the region.
- Delivery requirements between districts are of least concern among these options to most participants.

SOURCES OF INFORMATION AND TRUST OF DATA SOURCES

Respondents were asked to identify the sources from which they receive information about their water (Figure 4). Significant numbers of participants receive their information from federal or state sources (66%), however, local offices (13%) are also important sources of information.
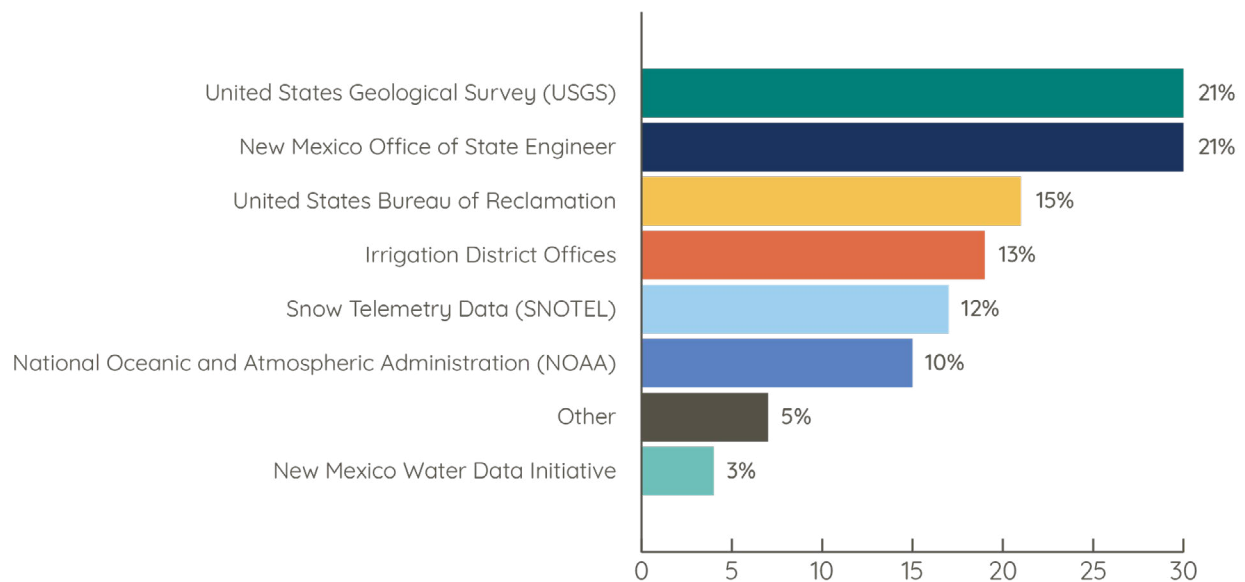
Figure 4: Sources of information about water

Interestingly, while only 3% of participants indicate that they currently receive information from the New Mexico Water Data Initiative, 29.3% indicated a desire to receive more information from this statewide initiative, indicating a willingness among participants to receive and trust information from the New Mexico Water Data Initiative.

Participants were also asked to reflect on the trustworthiness of their information sources. Sixty-eight percent of participants, a large majority, trust or likely trust their sources of information. Only 24% indicated uncertainty around the trustworthiness of their information sources and 8% likely do not trust their information sources. High trust of data sources is a critical factor in the use and reliance on data for decision-making and management of water resources in the region.

DESIRED TYPES OF INFORMATION ABOUT WATER

In addition to indicating the sources of information they trust, respondents were asked to specify the kind of information they would like to receive about their water. Options included:

- Water quality
- Topography
- Water use
- Reservoir levels
- Meteorological (rainfall, temperature, etc.)

- Diversion amounts
- Aquatic and ecosystem health
- Evapotranspiration
- Streamflow data
- Groundwater conditions

Respondents were asked to rank these options from most to least important. The responses from participants were clustered in three general categories (Figure 5). Streamflow data, water use, and reservoir levels were strongly desired data sources. Data on groundwater conditions, diversion amounts, and meteorological data were somewhat desired by participants. And data on water quality, evapotranspiration, aquatic and ecosystem health, and topography were the least desired. These findings can provide a roadmap to determine which data to prioritize for water data initiatives in the region.
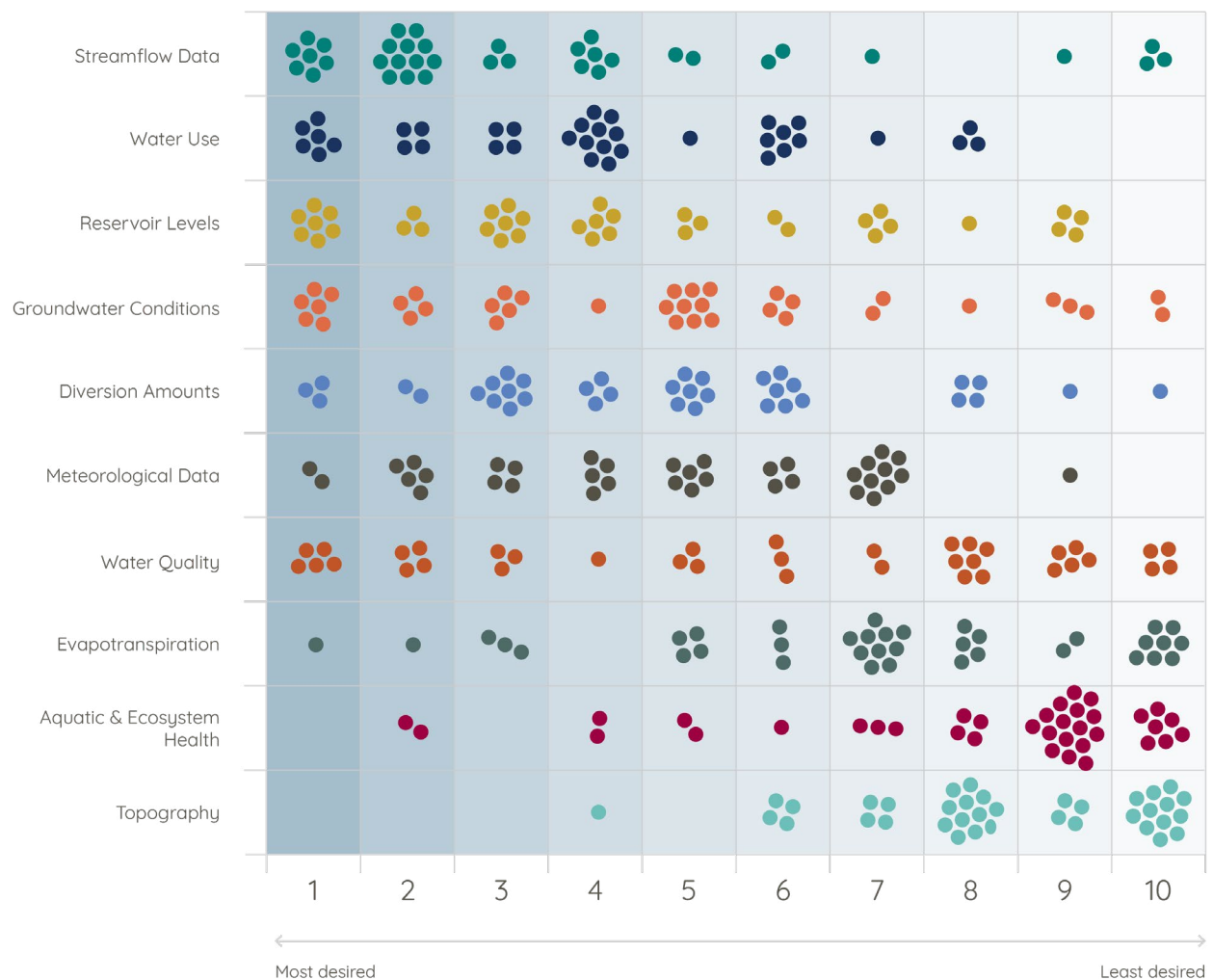

Figure 5: Desired data ranked by participants

CHALLENGES TO IMPROVING WATER DATA INFRASTRUCTURE IN THE REGION

For many organizations, significant barriers to the implementation of programs that would improve water data infrastructure remain (See Figure 6). In the Pecos region, participants indicated that their largest barriers are lack of organizational capacity and funding for such efforts (24% and 20% respectively, for a total of 44%). Lack of capacity is often tied to funding; however, it can also mean a lack of expertise or skills in an organization. Other important barriers included a lack of access to resources and a lack of understanding of technologies (15% and 10%, respectively). These two barriers could possibly be resolved with training and education. Finally, other barriers are due to organizational limits, such as agency approval or legal barriers. In addition to these concerns, one participant listed "*cooperation between and among stakeholders*" as a barrier.
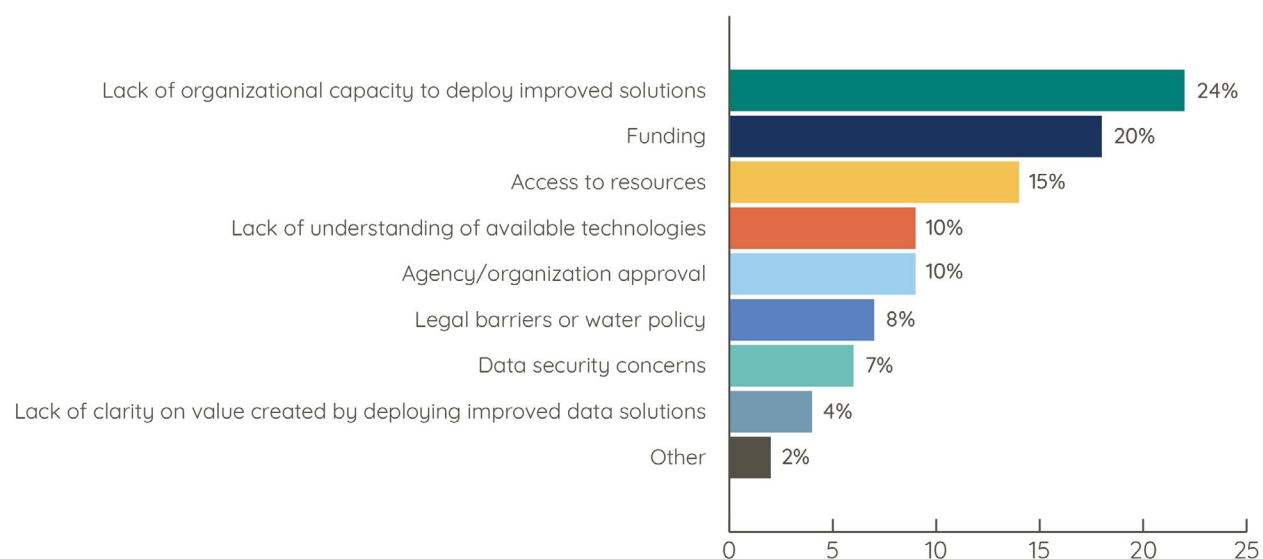

Figure 6: Barriers to improving water data infrastructure

The impact of these barriers is often reflected in participants' descriptions of their experiences working with data in their organizations. For example, 55.56% of participants indicated that working with data is either somewhat difficult or difficult in their organization, with 11.1% stating that working with data is very difficult. Likewise, participants described their experience managing data as largely manual or time-consuming. This is likely due to either non-digitized data or digitized data that is fragmented across multiple locations. For example, 32% of participants indicated that they manually access and compile data, while 56% indicated that they access data via one or more databases but that this data requires a manual integration process. Additionally, data fragmentation is a challenge for 61.14% of participants because data are collected and stored in paper formats or on

their colleagues' local computers.

The consequence of manual processes and a lack of modern water data infrastructure means that participants cannot easily visualize or analyze data. A large majority of participants (69.2%) indicated that they either cannot visualize or analyze data or that it is difficult to do so. This is in large part due to an inability to easily share and integrate data. Over 77% of participants indicated inability or difficulty in integrating data across other divisions or organizations, with 79% indicating difficulty sharing data across divisions or organizations. The large number of participants that indicated difficulty with sharing, integrating, visualizing, and analyzing data may appear to reveal an unwillingness or disinterest to do so; however, 94.5% of participants indicated that they can envision themselves using data from the Pecos region in their work. This shows that while there is a desire to use data, the mechanisms that would support or encourage such activities are sparse.

Finally, participants were asked about data quality. The focus groups revealed a concern regarding data quality in the region and the survey exposed a likely cause of these concerns. Forty-six percent of survey participants indicated that while data quality is documented, it is done so in an unstandardized way that may not be legible to those outside a division or organization. This may be a key driver in the concern over data quality, particularly in cross-agency or organization sharing, especially when combined with the 15.9% of participants who indicated that data quality is not documented.

TOOLS FOR DATA DELIVERY

A surprising finding from the survey revealed a disconnect among participants. When asked if they would use a tool to support decision-making in the region, only 26.3% of the respondents indicated that they would use such a tool. However, as Figure 7 shows, when asked how they would like to receive information about the Pecos region 76% of participants indicated a desire for an interactive dashboard. This is a significantly larger group of participants than those who would rather use a data catalog, receive email or text alerts, or rely on pdf reports, each at 8%. This discrepancy highlights the need for a human-centered design approach to the development of any tools that support decision-making in the region. With 57.89% of respondents indicating they might be willing to use a tool for decision-making in the region, there is opportunity. While it is not possible to understand the underlying reasons behind this gap, it is possible that those who express uncertainty about employing a tool for decision-making might do so because of past experiences with ineffective or difficult-to-use tools. With a properly designed tool that addresses user needs, those who are uncertain about the use of a tool may decide that there are benefits to using one.
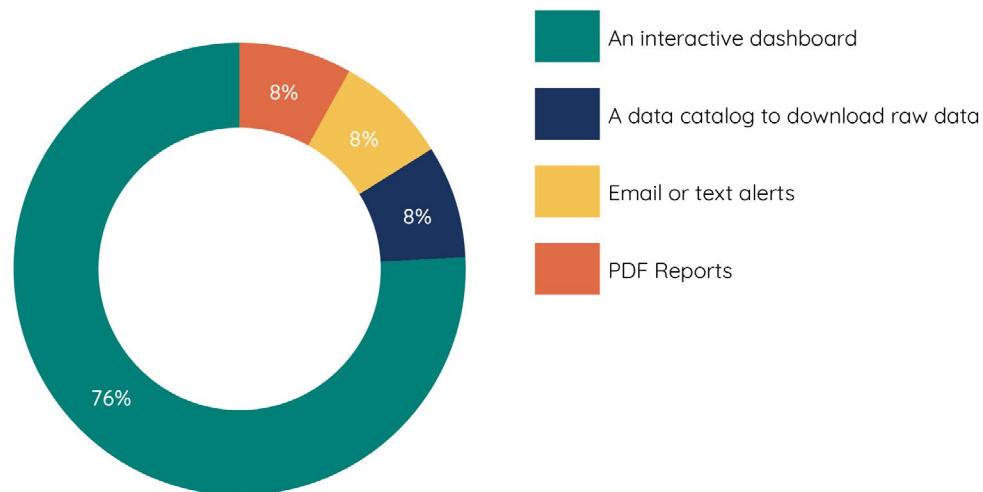
Figure 7: Participants' perfered way to recieved information about the Pecos region

CONCLUSION

The focus groups and user needs survey highlight opportunities for the New Mexico Water Data Initiative in the Pecos region. The observations expressed by the focus group participants were similarly expressed through a broader user survey that indicated that the focus group participants were an accurate representation of those who live and work in the region. Together, these resources provide a roadmap to improve water data infrastructure in the region and provide insights to help the New Mexico Water Data Initiative gain critical support from those who live and work in the region.