New Mexico Water Data

Water Data Initiative:
Plan for Implementation of the Water Data Act

The New Mexico Water Data Initiative will improve water management and planning by making basic, essential data interoperable, as it is shared openly from state agencies, as well as other data providers who choose to participate. Information and tools can be developed from the data to support data-driven decisions and planning.

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Prepared by the New Mexico Bureau of Geology and Mineral Resources in collaboration with our partners

Point of Contact
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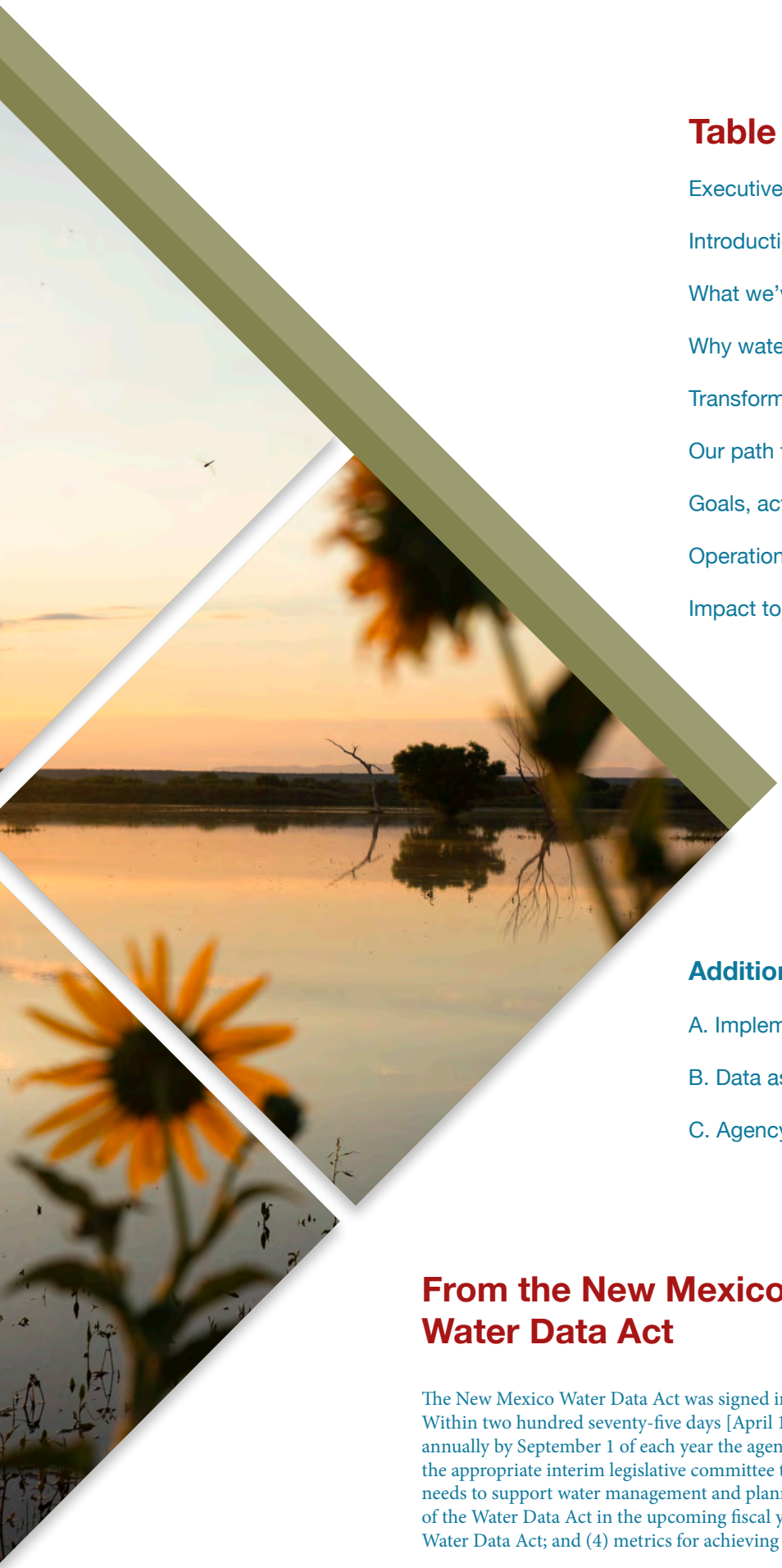

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Additional Materials

From the New Mexico Water Data Act

The New Mexico Water Data Act was signed into law in 2019. Persuant to Section 3D of this legislation—Within two hundred seventy-five days [April 1, 2020] of enactment of the Water Data Act, and thereafter annually by September 1 of each year the agencies shall develop and submit a plan to the governor and the appropriate interim legislative committee that details: (1) an assessment of water data and information needs to support water management and planning; (2) goals, targets and actions to carry out the purposes of the Water Data Act in the upcoming fiscal year; (3) budgetary resources to carry out the purposes of the Water Data Act; and (4) metrics for achieving the purposes of the Water Data Act.

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Executive Summary

Our vision for New Mexico is to make our communities resilient. Using data and technology we can increase our knowledge, respond to difficult circumstances, and improve our abilities to manage our critical water resources. As our water resources continue to change, we need to have access to key water data to make informed decisions. New Mexico is a rising leader in water data management and through the implementation of the Water Data Act, we are bringing together our widely distributed data and integrating it all in an open, accessible, online space.

The work so far includes development of a governance structure to facilitate the implementation of the water data act, and establishing a vision and goals for the project. We conducted an assessment of water data by reviewing datasets from over 100 state and federal agencies that collect water resource data relevant to New Mexico. Of the 375 sources of data inventoried so far, about 60% of the data are in a digital format and the remaining 40% are paper records or other legacy formats. We have built an initial online service for water data, which consists of a data catalog and map interface, highlighting some of our initial datasets.

This plan provides goals, actions, targets and metrics for near- and long-term Information Technology (IT) support for data sharing, building an IT and data infrastructure plan, refining data standards, and engaging with stakeholders. Hiring staff to support implementation of these goals is imperative. This plan provides direction for our next steps and lays out a preliminary long term plan of this multi-year effort.

Introduction

New Mexico enacted the Water Data Act (NMSA 1978, § 72-4B) in 2019 to identify, share and integrate key water data for New Mexico. The Water Data Initiative (WDI) is the project convened by the New Mexico Bureau of Geology and Mineral Resources (NMBGMR), involving state "directing agencies" including the Office of State Engineer (OSE), Interstate Stream Commission (ISC), Environment Department (NMED) and Energy, Minerals and Natural Resources Department (EMNRD). The legislation requires communication and collaboration among these agencies and others collecting or managing water data for the state. Other key partners, including the Internet of Water and Sandia National Laboratories, have been instrumental to our progress as well as our connection to the Western States Water Council.

Our goal is to make finding water data simple. The WDI's central repository will be a library of key water data enabling people to access all the data in one place. In order to achieve this visionary goal, we are building a unified data and IT architecture making datasets open, easily shared, and interoperable. In 2020, the Implementation Team, with the help of the IT support team, will build a multi-agency water data infrastructure plan, improve data sharing practices, refine our data standards to improve data connectivity and engage with stakeholders. To do this, we need to expand our capacity by hiring a team of experts including several new full time positions, to play specialized roles in implementing this large-scale project. At the same time, the agencies will work collaboratively to improve data sharing, formatting and metadata preparation, refine data standards, build the technical capacity to share data, and improve interoperability of their datasets.

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What we've done

To date, the Implementation Team has quickly and efficiently established the governance structure for responsibilities and tasks, and created a vision and goals for the project. Along with consultants at the ISC and Sandia National Labs, we conducted a water data inventory based on a review of datasets from over 100 state and federal agencies and programs that have water data relevant to New Mexico. While this inventory identifies where data are hosted, it does not provide context for the enormous volume of data being collected. Of the 375 sources of data inventoried so far, about 60% of the data sources are in a digital format (such as electronic database, spreadsheet or GIS) and the remaining 40% are paper records or other legacy formats. Some of the datasets (digital or not) are available online. Some are gathered for a specific purpose such as a report or regional study.

Water Data Initiative: Vision and Goals

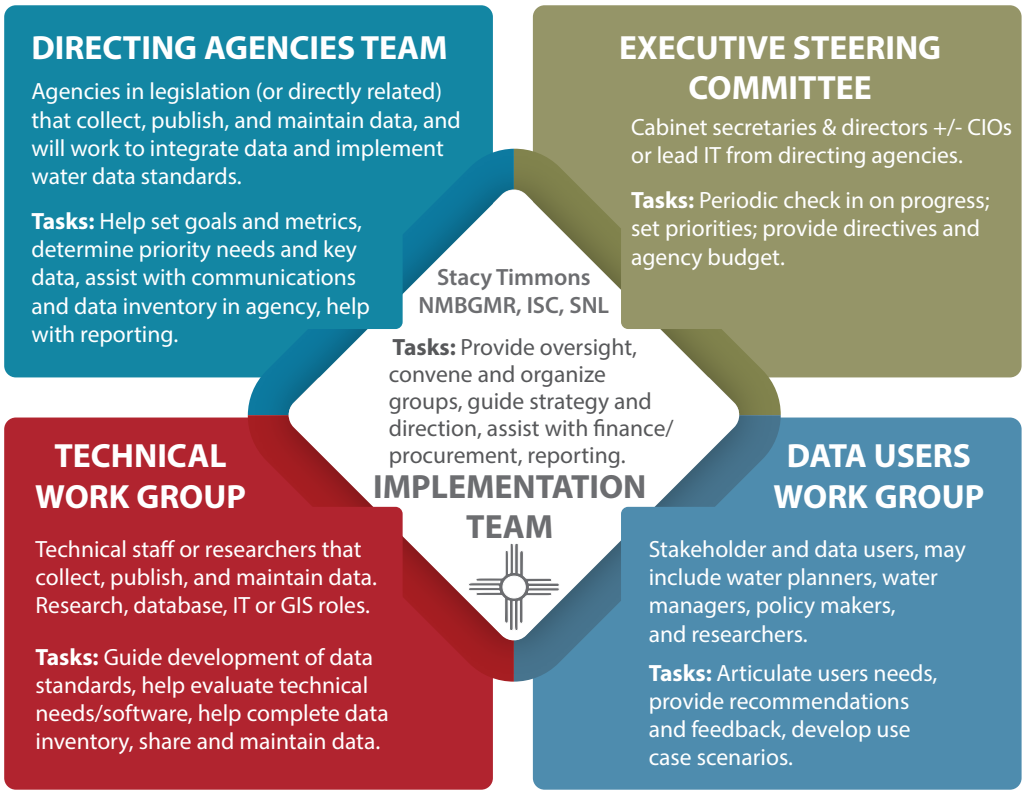
Vision:

New Mexicans will have accessible and useful data for water management and planning.

Goals:

- *We will have easy access to key water datasets.*
- *We will have common water data standards and definitions.*
- *Data gaps will be identified and prioritized.*
- *We will ensure that accessible water data are useful, such as for decision making, research, public inquiry, management, and planning.*

Governance



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Key data supporting water management and planning for New Mexico can be thought of in multiple ways. To ensure access for the broadest policy development in the long-term, and based on the comprehensive inventory of water data, we have defined baseline key data that support the varying priorities and needs of many stakeholders.

Identifying key data will be a process that is revisited over time as our knowledge of the available data improves, and as the needs for various science and policy-directed data uses become refined. This evaluation will require input from data users at many levels, from state leaders through data collectors and managers and data users at agencies and in the field.

	Key Water Data	State sources	Federal source	Other
Surface water	Evaporation / Evapotranspiration~	10	2	
	Soil Moisture	5	4	
	Precipitation	12	9	1
	Ecosystem health / biological health	8	6	
	Surface water location	4	2	
	Surface water flow (river or conveyance)~	32	8	3
Groundwater	Well locations	5	2	2
	Well depths	5	1	2
	Groundwater levels	19	5	2
	Aquifer parameters	7	1	
	Aquifer or geologic formation	13	1	
Groundwater and surface water	Permit for use (type)*~	24	2	1
	Permit for use (quantity)*	20		1
	Measured diversions / extraction~	1	2	2
	Water in storage^	14	3	1
	Water return / injection~	NA	NA	NA
	Water quality	22	8	1

* Related to water rights ~ Related to water use also ^ Reservoir, tanks or managed recharge

"Other" refers to datasets provided by local data providers such as irrigation districts, municipalities or community-scale projects.

A summary of the categories of key data is provided in the table above, along with a count of the number of data sources found in this initial inventory within state, federal or other domains. Most of the key data features relate to water quality, water quantity, and water use.

Working with UNM's Earth Data Analysis Center, we set up an online data catalog and map service where we are sharing selected water datasets (newmexicowaterdata.org). The Implementation Team (project management and planning) and the Technical Work group (data standards and data maintenance) each meet bi-weekly. We convened five directing agency meetings and one large stakeholder workshop, the New Mexico Water Data Workshop, to identify people's data needs and recommendations for how to make data presentable in a usable format.

The legislature provided $110,000 to New Mexico Tech and the Bureau of Geology annually for this project. The Healy Foundation generously provided an additional $25,000. We successfully leveraged this state funding to obtain an additional $300,000 in cost-shared federal funding for the next three years through a WaterSMART grant with the U.S. Bureau of Reclamation. This will support a specific case study to improve data management in the Pecos River basin.

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Why Water Data?

We know New Mexico is an arid state subject to amplified extremes, such as longer droughts, increasing wildfire intensity, and sporadic, more intense monsoon storms. Therefore, we must have highly dynamic planning tools and information, built from high quality, accessible, and interoperable water data. As identified in the 2018 New Mexico State Water Plan, access to data is one of the top eight water policy topics in the state, a priority that has been echoed repeatedly in town halls, water dialogues and news articles.

The water challenges we face rely on access to key datasets, which enable us to perform risk assessment, build robust predictive tools, and ultimately make informed decisions about how we use and share water in the state. Access to high quality, accessible data provides greater options for modernizing water management. With transparent data access, we gain the ability to build social capital and consensus by engaging the public in planning and decision making.

New Mexico is quickly becoming a leader as the second state in the country to enact policy that directs integration and access to water data. The Water Data Act underscores New Mexican's value of our state's water resources. It lays the foundation for water planning efforts within the state, developing a 50-year water plan, and building collaboration at a national scale, with federal agencies, and the Internet of Water project.

Transforming New Mexico's Water Data

We need to structure datasets so that they can be used together in more powerful ways, such as mapping and statistical analysis; essentially, transforming the *data* into *information*. Then, the information will be used for policy development and resource management. This transformation of our data means that it will conform to the internationally recognized data management concept known as *FAIR: Findable, Accessible, Interoperable, and Reusable*.

This is not a simple process. Our data reside in a wide range of digital and non-digital locations, in multiple forms and formats. Datasets were built by different groups for different purposes. To unlock the power of this data, we need to think bigger than we've ever done before in New Mexico.

First, we needed to find the data. The inventory process described in other sections is now being used to create a data library. Next, we need to transform the data and datasets so that we can fully share the data online, and it becomes usable for all. In the FAIR data process, this means that the data is *Findable*.

To do this, State agencies and other data providers will adapt their current datasets, or build new datasets in forms that can be shared. They will continue to own the data, and perform their own quality checks and controls. This is a challenge because agencies must do this at the same time that they are adding new data, using existing data and databases, and fulfilling their agency functions. Once the water data are transformed, the data platform will make them externally available. This means that the data are *Accessible* in the FAIR data process.

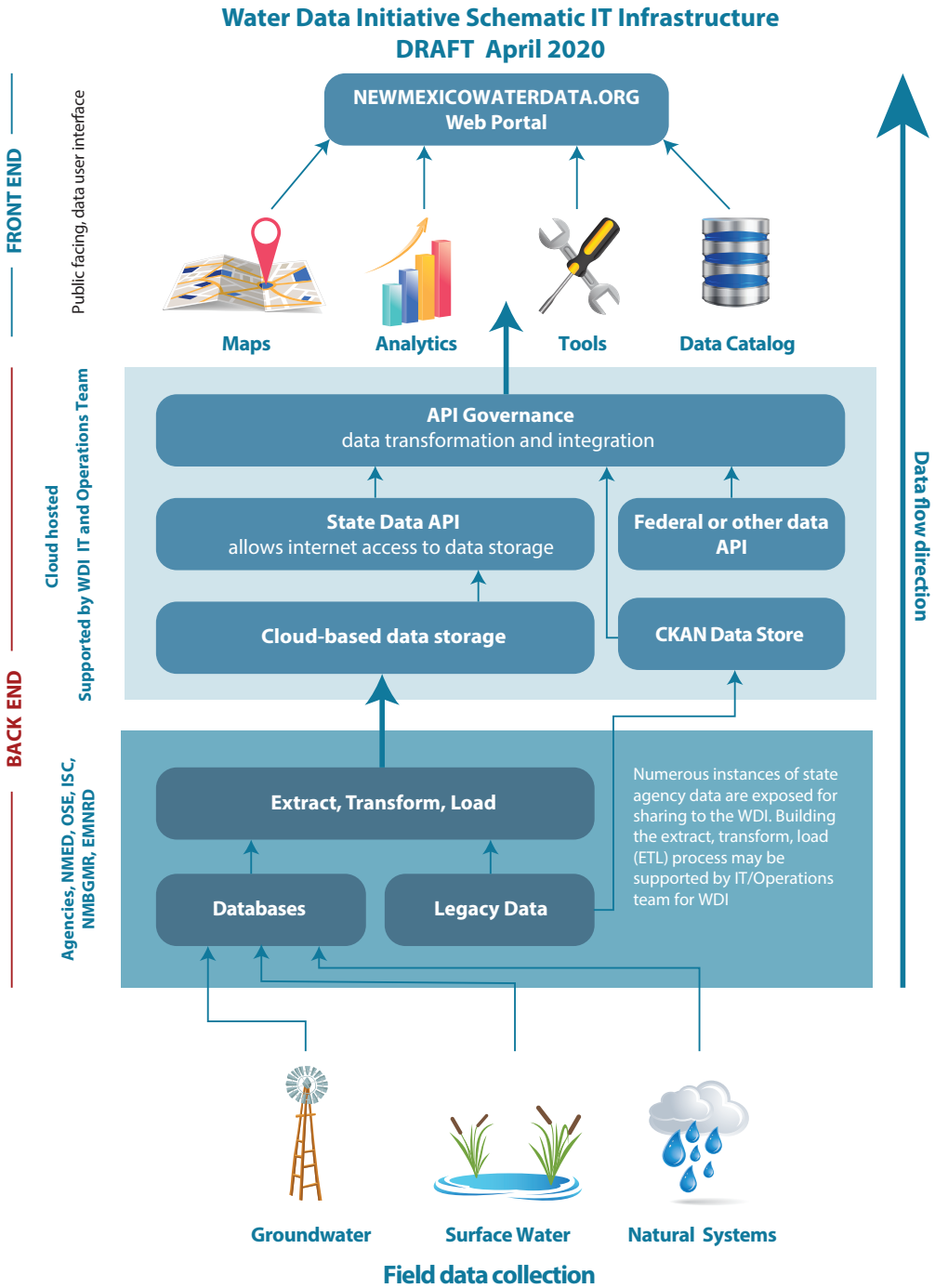
The power of the data will be unlocked when data that are related (for example, measurements of water quality), but hosted from multiple agencies (such as NMED, NMBGMR and USGS) are aggregated into integrated datasets. This means that the data will be Interoperable. *Interoperable* datasets can then be used for "big data" analyses, revealing trends and situations that were not visible before.

The IT support team will assist each agency with the technical aspects of this transformation. This team will support collaboration between the agencies, helping them to build and use common data standards and formats to enable data interoperability. This step requires strong technical IT support and leadership. Ultimately, these steps will make the data externally visible online, and *Reusable* beyond its original purpose for collection.

We continue to build new partnerships in the public and private sector. Special projects, such as accessing legacy data and improving data collection techniques, are starting now and will continue. A draft Schematic IT Infrastructure plan is provided below for conceptualizing some of the details for the public, front-end user interface, the back-end data connections, and integration steps. In this draft Schematic IT Infrastructure Plan, all of the "cloud hosted" services would need to be built or pieced together from existing

software options by the IT Support team. The website newmexicowaterdata.org presently hosts data in an open-source catalog called CKAN - which is our initial data service, and will be an integral part of the overall IT infrastructure plan.

The transformation is already happening with the implementation of the Water Data Initiative, and the concurrent actions at the agency level. **Perhaps one of the biggest successes so far is that multi-agency collaborations and connections are growing stronger through the Water Data Act implementation**. The WDI provides an essential link among the agencies, to help them become more efficient and to unlock the potential of their data. Ultimately, the data, transformed to information, will be a powerful mechanism for creating resilient water resources for the future of New Mexico.



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Our Path to Success

Both the productivity and pace of this project are dependent on available funding. We are gradually working to achieve our goal of shared interoperable water data. In fiscal year 2021, with the current funding available, we will work to build, at a minimum, a basic IT support team. We also aim to build the online water data service with automated data connections, refine the data standards requirements, and engage with key stakeholders to determine data and information needs. The IT support team will work to improve data sharing practices currently in use at state agencies and support the agencies with their data development tasks.

The table below provides a 5-year work plan for Water Data Initiative (WDI) activities and indicates where additional funding and support is required. Several "core projects" are necessary to help move this project forward in an efficient and sustainable manner. The most fundamental of these core projects is planning and building the IT infrastructure for integrating data from multiple agencies. We will review IT and data infrastructure plans used in other states or nationally to make informed decisions. This project will require cooperation and coordination among the directing agencies executives and chief information officers. In order for New Mexico's plan to scale up to other national efforts, or down to regional efforts, support from our partners at Internet of Water will be essential through this planning step; as well as other western states, through collaboration with the Western States Water Council. Other core projects include addressing the legacy data issue (paper data) and making improvements to data collection and integration.

Actions	Funding estimate	Additional requirements	2020	2021	2022	2023	2024
Establish governance, vision, and goals for water data initiative	Funded		■				
Initial inventory of state water data	Funded	ISC consultants	■	■			
Document data management and data sharing practices	25%	IT support[1]; Agency IT Staff	■	■			
Build **online water data service**[2]	50%	UNM EDAC; contract services	■	■			
Establish data standards for Water Data Initiative	50%	Technical working group; IT support	■	■			
Stakeholder engagement - evaluate data needs	75%	Facilitation services	■	■			
Core Project[3]: Plan and design IT data infrastructure	25%	Agency CIOs; Agency IT staff		■	■		
Implement IT / data infrastructure	None	IT support; contract services			■	■	■
Data connect or upload to **online water data service**	25%	IT support; Agency IT staff		■	■	■	■
Data integration - write scripts to transform data to interoperable, dynamic datasets	25%	IT support			■	■	■
Develop tools / applications to view and use interoperable data	25%	IT support; contract services			■	■	■
Core Project: Data digitization / retrieval of legacy data	None	Agency CIOs; Agency IT staff			■	■	■
Stakeholder engagement: Application / tool development and review	25%	IT support; contract services			■	■	■
Refinement of tools / apps used for water management and planning	None	IT support				■	■
Core Project: Improve data import from data collection	None	IT support; Agency IT staff			■	■	■

1 - IT support team is ideally 4 FTEs hired as part of the Water Data Initiative; could include contract services to fill some position needs

2 - Newmexicowaterdata.org - website and data services

3 - Core projects - Integral projects to this effort; may be proposed under Special Appropriations for Information Technology (C2)

In the upcoming year, the Implementation Team will stay apprised of funding opportunities and find ways to support implementation of the Water Data Act. The Implementation Team has already been successful in securing additional funding from the U.S. Bureau of Reclamation through a WaterSMART grant for a pilot data project in the Pecos River Valley. We will continue to pursue creative means to seek additional funding. We hope to increase financial support for the WDI by strengthening public-private opportunities, as we have with our Healy Foundation partnership in FY20.

We also will support agencies in their efforts to request annual state funding that will improve agency data management and data sharing. Finally, we will seek legislative and executive support to build recurring base funding for the WDI. Our initial proposed funding request for the WDI is $410,000 annually recurring to the Water Data Account at New Mexico Tech.

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Goals, Actions, Targets and Metrics

The following section outlines the goals, targets, actions to be performed, and metrics to evaluate actions for FY 21 in order to meet the baseline requirements of the Water Data Act and move the project forward in preparation for next steps in future years. The underlying focus of this plan is to support the directing agencies to expand their capacity to share data, establish real-time data connections, create a data-provider IT support team, and refining data standards for functional interoperability. Future years (FY 22 and beyond) will focus more on data integration and interoperability, engaging users outside of the agencies and building a robust data integration system.

The funding for FY 20 and FY 21 ($110,000 recurring at NMT) is insufficient to accomplish this complex multi-agency effort. All of the directing agencies expressed the need for additional staff to focus on improving their agency's data documentation and support to development of the WDI. Additional funding can result in a much improved data sharing experience for the data providers, development of a more thoughtful, sustainable data service, and, ultimately, an improved data user experience. Further information on the budget and objectives can be found in the following section.

SUCCESS

The biggest success of the Water Data Act is simply the connections built around water and data among state agencies and other data users. There has never been a time when those who collect water data have been asked to work carefully together to accomplish a common goal of interoperability. As the Water Data Initiative continues to connect our actual water data, the human connections between data sources remains an essential part of the framework for success.

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Goal 1: Provide IT support to improve data sharing

- Build a basic IT support team and services for WDI to work with data providers.
- Increase project services to support state agencies in their transition to shared data practices.

Actions:

- Maintain online water data services for federating data (newmexicowaterdata.org).
- Develop small contract services to fill essential roles for IT support, such as providing data sharing assistance and coordination to agencies and users
- Present or discuss funding needs with executive or legislative committees, as requested.

Targets:

- Work with state agencies to assist with data sharing, formatting, and metadata preparation.
- Coordinate interactions between agency IT staff and water data service managers on contracts.

Metrics:

- Build real-time (API) connection of at least one key water data feature for each of the directing agencies to the NM Water Data Service online.
- Hire contractors for data integration and site hosting tasks in FY 21.
- Demonstrate additional funding results such as proposals and awards in FY 21.

Goal 2: Develop robust IT and data infrastructure plan

- Work with leadership at directing agencies and IT support team to research and evaluate data infrastructure options.
- Develop an initial draft plan that improves data sharing and is capable of data integration.

Actions:

- Stakeholder engagement: IT support to convene agency chief information officers and leadership to outline needs for integrated water data.
- Leverage partnerships (such as Internet of Water) to research options utilized in other states working on water data integration.
- Draft initial IT infrastructure plan.
- Obtain “peer review” of draft IT infrastructure plan from experts.

Targets:

- Summarize report on basic research findings from other state water data integration projects.
- Complete initial draft infrastructure plan and make available for review.
- Identification of staffing gaps, software or IT needs to accomplish this draft plan.

Metrics:

- First draft water data integration IT plan to be available for review by June 2021.
- Highlight next steps and gaps for September 2021 Water Data Plan.

Goal 3: Refine data standards

- Work with IT support team and Technical Working Group to build the initial draft of data standards which will improve and facilitate data integration steps.

Actions:

- Research and evaluate data infrastructure options.
- Create a summary list of data standards for review.
- Stakeholder engagement: IT support team to convene with Technical Working Group to outline needs, data standards / needs.
- Leverage partnerships (such as Internet of Water) to research and evaluate data standards utilized in other states and at a national level.

Targets:

- Provide up to two workshops focused on data standards development.
- Summarize findings in IT technical document.

Metrics:

- First draft water data standards available for review by June 2021.

Goal 4: Continue stakeholder engagement opportunities

- Provide opportunities for interaction, training, and discussion between water-related state agencies, among leadership, upper management, and technical staff members.

Actions:

- Create an "executive steering committee" composed of key technical and executive agency staff needed to provide agency support and buy-in on activities and priorities for the WDI.
- Provide a workshop, training, and/or outreach event for data providers and data users in NM.
- Establish periodic emails and webinars for data providers regarding topics of interest such as data management and funding opportunities.

Targets:

- Refine the data needs to address specific water issues and identify data sources that may not be sourced from the state.
- Host one water data workshop or training event.
- Post website updates.

Metrics:

- Provide at least one workshop or training and outreach event in FY21.
- Maintain website so it is operational and current.

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Operational budget: Fiscal year 2021

The initial implementation of the Water Data Act has been supported by a small team of part-time staff at the NM Bureau of Geology, consultants provided by the NM Interstate Stream Commission (water planning program), donated service and support from Sandia National Laboratories and Internet of Water, with some small contract services through funding in the Water Data Account at NMBGMR. This funding is leveraged with a generous donation from the Healy Foundation to this account ($25,000) for FY 20.

The current budget (FY 21) for the Water Data Act is the annually recurring fund set up at NMBGMR, for a total of $110,000. This fund is enough to support one full-time employee (FTE) or several partial FTEs, possibly with some low cost software or minimal contract services (i.e. data/software management, website design, and outreach). However, the $110,000 is insufficient to support the IT needs and support required to accomplish true data integration service. Funding should include enough to cover major software platform upgrades, the hiring of a full IT / operations team to support anything beyond the basic goals discussed above, or funding directly to support state agency staff to participate in the WDI.

The NMBGMR recently received a cost-sharing grant from the U.S. Bureau of Reclamation for a WaterSMART project. This project will leverage the state funding to bring an additional $300,000 in federal dollars to address water data issues for a pilot project. For this project, the work team managed by NMBGMR will develop new tools and information to support decision making in the Lower Pecos Valley over the next three years.

This is a complex, multi-year project that will include building a robust IT system to support management of water data, the cost of which is not represented here. The plan presented here relates to building the staffing and operational requirements to launch this effort. For FY 22 and beyond, funding would grow to fully support the IT support and operations team with up to four full-time dedicated staff, providing technical support solutions to cooperating state agencies for data sharing and integration, assisting with funding and grant writing, convening different stakeholder and work groups, and guiding the overall direction of the WDI. To build a WDI IT support and operations team, the structure of the team and various contract services is estimated below. Note that costs are approximate, for estimation purposes, and intended to include fringe benefits in total cost. We will work to develop a full budget that can support the IT requirements in future plans.

Staffing Requirements

Goal for FY22–FY24	Title	Responsibilities
$115,000	Project management	Coordinate overall effort / implement vision; communications and outreach
$115,000	IT solutions architect	Overall IT infrastructure design, develop/grow funding for sustainable IT solutions, planning for tool/information development
$100,000	Technical support	Connections to data providers, data users, set up data connections as needed
$100,000	Data liaison	Evaluation of data readiness, QC metadata, data transformation and integration.
$10,000	Contract services	Web site maintenance
$40,000	Contract services	Data manager, IT infrastructure build
$40,000	Contract services	Data transformer, as needed
$520,000	SUBTOTAL	
$110,000	Water Data Account annual budget (at NMT/NMBGMR)	
$410,000	**Funding Goal FY22–24**	

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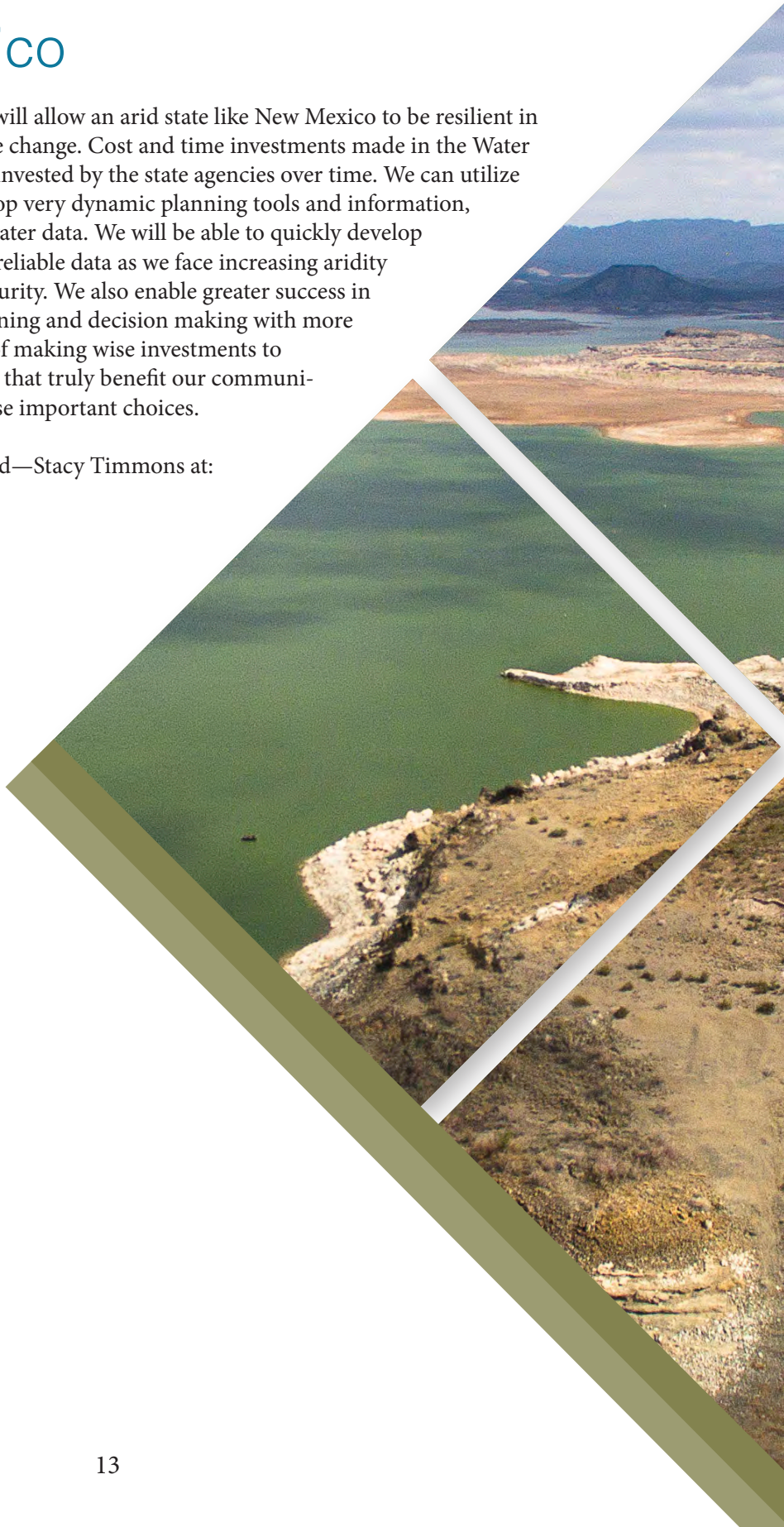
Impact to New Mexico

The impact of having modernized our water data will allow an arid state like New Mexico to be resilient in future conditions increasingly impacted by climate change. Cost and time investments made in the Water Data Initiative will mitigate the hours and dollars invested by the state agencies over time. We can utilize the power of data and technology to help us develop very dynamic planning tools and information, built from high quality, accessible, interoperable water data. We will be able to quickly develop creative solutions to water management based on reliable data as we face increasing aridity and amplified extremes—enhancing our water security. We also enable greater success in building consensus by engaging the public in planning and decision making with more transparent data access. We will be more capable of making wise investments to support water management decisions and projects that truly benefit our communities and environment with the data to support these important choices.

Please direct comments or questions to project lead—Stacy Timmons at:
stacy.timmons@nmt.edu



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Additional Materials

A. Implementation and Recommendations

As of April 2020, the topics below highlight our assessment of New Mexico's water data and recommendations to carry out the Water Data Act.

LEADERSHIP: Accomplishing the goals of the Water Data Act will require periodic check-in with directing agency leadership. The activities since the start of this endeavor (July 2019) have largely been accomplished by representatives from the directing agencies who were appointed by the leader of the agency, or asked to attend by that appointed person. The composition of the Directing Agencies Working Group may not have the authority for decision making, as is occasionally required to meet our goals. Leaders of the agency need to be periodically informed in order to provide alignment and direction to the agency representatives related to topics involved on the Water Data Initiative. This high-level support at the executive level of the agencies is critical to the success of the Water Data Initiative.

Recommendation: Integrate the directing agencies leaders to create an executive steering committee composed of executives and key technical staff to provide agency support and buy-in on activities and priorities for the WDI. This steering committee is thus proposed to have cabinet secretaries and directors, plus the chief information personnel from each of the directing agencies. This group would provide occasional check in on progress, and help align agency budget needs.

REPRESENTATION: Currently, the community of interested water data users or data providers in New Mexico has not been given adequate opportunities to participate in this process. The result is that some water data within the state remains inaccessible and some data needs may not be heard. While the legislation only mandates that the five directing agencies share their data and make it interoperable, there is huge potential benefit to involving other entities, such as greater cooperation leading to less litigation; eliminating the duplication of efforts leading to greater efficiency in the expenditure of human and financial resources; and broader water planning and management efforts leading to equitable sharing of natural resources.

Recommendation: Fund outreach and education opportunities with data users or other data providers, such as universities, regional water groups (municipalities, conservancy and irrigation districts), and nations, tribes, and pueblos. As data users express desire for how data should be made accessible, data providers can learn more about modern and technically-sound data management and data sharing practices.

STAFFING: The work accomplished in FY20 related to the Water Data Act has in large part been done by a small working group composed of part time staff, consultants or volunteers. In addition, directing agency participation has been an additional duty for staff, taking away from primary assignments, and reducing the respective levels of customer service to New Mexicans.

Recommendation: Fund workshops for training and discussion between state agency personnel for the purposes of continuing to discover mutually-useful datasets and eliminating duplication of effort.

Recommendation: Fund a fully dedicated "Operations Team" to move this process along more efficiently and effectively by providing the technical support needed for each data provider and the means to organize multiple working groups and dialogues about water data needs, sources, and management.

Recommendation: Fully fund staffing needs the state agencies tasked with collecting, maintaining, and sharing water data.

DATA SERVICE: Since some state and federal agencies and data providers have developed their own water data platforms, the WDI does not need to duplicate these efforts. Rather, they can build from this work to develop a federated system to facilitate multiagency data interoperability. The current water data service (newmexicowaterdata.org) is built on the Comprehensive Knowledge Archive Network (CKAN), and was selected primarily because it is built from open-source code, which is free of charge. However, it requires human resources and time to learn its capacity and

build necessary components specific to New Mexico's water data providers. The CKAN platform is an important small step forward to illuminating New Mexico's water data, and an important part of the project, but it may not be the most sustainable, long term solution for New Mexico water data service.

Recommendation: Fund a New Mexico Information Technology Special Appropriation Project (C2) to research and evaluate the data service options, and develop an agile-approach, sustainable plan for New Mexico's water data for a long-term data infrastructure.

LEGACY DATA: Every state agency involved in the Water Data Act recognizes some degree of challenge related to legacy data issues. The legacy data may be in the form of paper records or older digital formats which will require time and resources to identify, catalog, and convert to current formats and usability. The lack of resources to document and make legacy records available also directly impacts agency ability and response time to produce these records for the public.

Recommendation: Fund a second New Mexico Information Technology Special Appropriation Project (C2) to work through legacy data by prioritizing datasets to bring out of older formats, and establishing the process for digital conversion. Allocate funding to current directing agency efforts to digitize their paper records.

DATA STANDARDS: Setting data standards may be relatively easy but meeting them often has a cost burden for the staff time it requires to complete the data descriptions and follow the standards. Meeting set data standards may include documenting how data are collected or units of data (metadata), building data dictionaries (understandable descriptions of features in the data), or reformatting datasets. Each agency or data provider may have an extra burden to meet the data standards. This activity of documentation should naturally fall to the data collectors and data managers where the data originate.

Recommendation: Survey the directing agencies to identify long term policy needs or questions to be addressed by key data. With this approach, the key data are fundamentally defined as those parameters used to answer the specific problems or questions in the realm of water planning and water management.

Recommendation: Fund IT staff or fill vacant positions, and provide training to enable achievement of metadata standards. Provide necessary funding for upgrade or conversion of agency data, software, and equipment to the common standard through agency-specific budget requests.

FUNDING: State agencies or other data providers need funding to document data management structures, to bring data up to standards set by the Water Data Act, to establish IT requirements to share the data, and to maintain IT hardware, software, and expertise.

Recommendation: Avoid the unfunded mandate. The WDI can help unify state agencies and their water data by providing staff and resources toward integration of the water data. Utilizing staff connected with the WDI could be a cost-effective way to help data providers and state agencies share water data, rather than each agency hiring a person to do this potentially short term work. This may be particularly important at a time when trained, technical staff are hard to find, and may be more effective for the WDI because of its flexibility to hire as needed or to create short term contracts to get specific tasks done.

DATA COLLECTION: Many state agencies collect data for the ongoing management of our water resources. Funding for basic data collection, data management and staffing at state agencies has been reduced in the last 10 years, as reflected in the decreasing budget for basic groundwater level measurements and high vacancy rates at state agencies. Additional data collection would improve our water resource management through:

- Improved groundwater and surface water models
- Metering water use
- Better estimates of water budget components
- Delineation of impacted sites
- Improved aquifer mapping

The availability of quality data of sufficient sample size, as well as the personnel to analyze the data, all bear directly on availability of water for agriculture, extraction of natural resources, recreation, and public health, and thus, the state economy.

Recommendation: Fund basic data collection. Identify data collection needs in a systematic process through working group conversations or surveys developed through this Water Data Initiative.

New Mexico Water Data

B. Data assessments and recommendations

1. External inventory

New Mexico is partnered with the Internet of Water (IOW, https://internetofwater.org/) from Duke University, which is a non-profit research organization that was formed to assist states with upgrading their water data infrastructure. The IOW is a no-cost partner with the Implementation Team, helping with project startup, project management, data inventory, and software selection as a state pilot project (https://internetofwater.org/pilots/new-mexico/). The IOW also provides a means of cross-learning with other states to facilitate the transition from legacy software systems to interactive data systems. As part of the partnership, IOW performed a review of New Mexico water data from an "outsiders" point of view. Using a systematic, structured search mechanism to detect online water data and data sources, IOW researchers searched state and federal agency online sources, and compiled and reported the results, summarized here.

Four information areas were evaluated and compiled not only for New Mexico, but also for federal agencies and several other states. In New Mexico, these results are briefly described below.

- **Entities collecting water data:** The organizational chart for the state of New Mexico was very antiquated. The network of agencies collecting water data was searched along with identifying the primary purposes of collecting those water data features. Sixty water-related entities were identified, including Energy, Minerals and Natural Resources Department, NM Environment Department, NM Game and Fish Department, Office of the State Engineer, NM State University, University of NewMexico, NM Institute of Mining and Technology, NM State Land Office, Department of Agriculture,and Department of Health.
- **Water data service:** Forty-seven different state-hosted data sites were discovered to becollecting some type of water data in New Mexico.
- **Summary of water data collected:** The research highlighted which data types are collectedby which entities, the types of data most often collected, and which entities provide access to thegreatest variety of water data. Eighteen data types and four broad data categories (quality,quantity, use, and infrastructure) were summarized.
- **Openness scorecard:** The scorecard provides a relative score to compare how findable,accessible, interoperable, and reusable (FAIR) data are within and across inventories. This scoringcan be used as a template for self-diagnostic tools and understanding how to improve openness.

The data openness scorecard was developed for New Mexico along with federal agencies and other states evaluated below. While this scorecard has limitations from the online data search, New Mexico sits in the middle compared with other states in terms of the openness factors of Findability, Accessibility, and Interoperability. The results of this outside survey provide examples of how "data about the data" could be displayed and used for further learning in New Mexico about the extent, quality, and availability of our existing data sources.

Recommendation: Perform repeat evaluations following the IOW protocol to be used as metrics to quantitatively score improvements as the WDI progresses after 5 years.

*Combined scores for data **findability**, **accessibility**, and **interoperability**, from several state and federal data searches.*
Source: Internet of Water, 2019.

2. Internal New Mexico-based data inventory

The water data inventory is a listing of over 100 state and federal agencies that collect water data for managing New Mexico water resources. The data inventory evolved from the 2018 State Water Plan policy on Data Collection, Accessibility and Monitoring (ISC, 2018) which identified sources of data. The Water Data Act inventory has expanded to include more detail within each agency and to help identify the accessibility of the data. While this inventory identifies where data are hosted, it does not provide context for the enormous volume of data being collected and maintained.

Some datasets are very well managed—organized in a digital format and available online for easy access and findability (such as the stream flow data collected by the U.S. Geological Survey). Other datasets are in a digital format, but are only organized for the specific purpose of program responsibilities. Many individual research projects include reports that involved a detailed assessment of a particular resource issue and thus the data is only published as a report format, which may or may not be available online. These types of projects rarely have data that is digitally findable and useable. Overall, few of these datasets are set up following FAIR data principles, relating to findability, accessibility, interoperability, and reusability for purposes beyond their original purpose.

The result of the water data inventory performed by consultants to the NM Interstate Stream Commission identified 375 sources of data, of which 152 are currently in a digital format and available for download. Another 70 are compiled in some type of digital format, either a spreadsheet, database, or GIS, but the data must be requested from the agency. Overall, about 60% of the data sources are in a digital format (such as electronic database, spreadsheet, or GIS) and the remaining 40% are reports or other paper records that may or may not be scanned as pdfs.

Recommendation: As data are compiled and cataloged for the water data service, water resource managers and planners should be convened to assess the adequacy of the existing network of data collection.

Recommendation: The data inventory will need to be continually updated and used to track the progress of integrating data features into the Water Data Service.

New Mexico Water Data

C. Agency-Specific Planning

Each of the directing agencies were asked to complete a survey to describe how they envision their agency will participate in the Water Data Act, and provide estimates for budgetary requirements that would expedite the goals of the Act. This is provided for estimation and consideration of what the agency needs to meet the requirements of the Water Data Act, and **should not be considered an official budget request**. Agencies will complete their entire agency official budget requests, with goals, targets, actions, and metrics related to the Water Data Act for each fiscal year in their agency budget submissions.

NM Environment Department

Major activities: Modifications to current databases / structures, new dashboard development, new portal development for external data (to reduce paper data), direct linking of data via API, digitizing paper data (pilot test first), and multiple staffing needs.

- One time funding estimate: $440,000 (contract services, IT / Database modifications)
- Recurring funding estimate: $990,000 (~4 FTEs, contract services, software licenses, digitizing services, interns)

NM Office of the State Engineer

Major tasks: Digitizing paper data, improvements of monitoring networks, new database for geophysical well logs, improve and maintain current databases, multiple staffing needs.

- One-time funding estimate: $1,250,000 (software and new equipment)
- Recurring annual estimate: $923,000 (8 FTEs, 1 contract services)

NM Interstate Stream Commission

Major tasks: Organize and document multiple datasets in different bureaus for improved data sharing; digitizing paper data, improvements of monitoring networks, multiple staffing needs (water planning, monitoring, modeling, GIS/IT staff).

- One-time funding estimate: $ 0
- Recurring annual estimate: $125,000 (GIS application developer to assist in water use models)

Energy, Minerals, and Natural Resources Department

Major tasks: WDA planning in upcoming year, staff are needed for WDA participation.

- One-time funding estimate: $500,000 (staff or contract services; planning)
- Recurring annual estimate: $125,000 (1 FTE)

NM Bureau of Geology and Mineral Resources

Major tasks: Improved documentation of databases, improve API connection to databases, improve field data collection (digital)

- One-time funding estimate: $75,000 (software / new equipment)
- Recurring annual estimate: $265,000 (2.5 FTE and on-going data collection)

NM Game and Fish Department

While not named as a directing agency, this state agency houses state records of ecological and biological data required by the Water Data Act.

Major tasks: Combine multiple databases, digitize paper records, and document of database structures.

- One-time funding estimate: $200,000 (contract services database documentation/design)
- Recurring annual estimate: $100,000 (1 FTE)