**Supporting Statement B**

**for paperwork reduction act submission**

**Water Resource Management – Institutional Resiliency, Hazards Planning, and Data Delivery Needs Information Collection**

**OMB Control Number 1028-0131**

***This information collection request includes four total instruments (two online surveys and two interview protocols) that will be used to address two independent objectives:***

1. ***Better understand the data delivery needs of users of USGS water data and collect information to support the development of data delivery and decision support tools; and***
2. ***Develop metrics of resilience for water management institutions within the Upper Colorado River Basin and the Delaware River Basin.***

***While there is some overlap in methodology between the two, we will answer each question below separately for each objective in order to maximize clarity. The subheadings “Data Delivery” and “Institutional Resilience” will be used denote which objective corresponds to our following response.***

**Collections of Information Employing Statistical Methods**

The agency should be prepared to justify its decision not to use statistical methods in any case where such methods might reduce burden or improve accuracy of results. When the question “Does this ICR contain surveys, censuses, or employ statistical methods?” is checked "Yes," the following documentation should be included in Supporting Statement B to the extent that it applies to the methods proposed:

**1. Describe (including a numerical estimate) the potential respondent universe and any sampling or other respondent selection method to be used. Data on the number of entities (e.g., establishments, State and local government units, households, or persons) in the universe covered by the collection and in the corresponding sample are to be provided in tabular form for the universe as a whole and for each of the strata in the proposed sample. Indicate expected response rates for the collection as a whole. If the collection had been conducted previously, include the actual response rate achieved during the last collection.**

***Data Delivery***

The sampling method for the Data Delivery information collection instruments was purposive, with the intent of reaching individuals who were qualified to answer questions and offer meaningful insight related to the design and development of a new USGS water data delivery product (Palinkas et al., 2015). The respondent universe consisted of all individuals in the United States, over the age of 18, who use water data and information provided online by the USGS for any purpose. In alignment with Federal policy related to open science, USGS water data is available for anonymous public use and access is not tracked to specific individuals or organizations. Therefore, the true size of this universe is unknown. Sample selection took two forms. First, names and contact information for known users of USGS water data were obtained from a registry of Water Enterprise (i.e., the combination of Water Mission Area [WMA] and Water Science Centers [WSC]) stakeholders maintained and managed by the WMA Office of Planning and Programming. Additional current or potential users were identified through snowball sampling (i.e., referral) and targeted outreach at national conferences related to water resource management. The combination of individuals on the registry and those who were referred or self-identified through outreach made up the total sample population (Figure 1). Each sampled individual was sent a pre-interview online survey to gather general information about water data needs and workflows. Survey recipients had the opportunity to participate in a follow-up interview with a member of the Data Delivery team.

Timeline

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**Figure 1.** Sampling frame for Data Delivery objective

In late August, 2022, this ICR was approved by OMB as a 1-year pilot study. The responses we have collected over the past six months (Table 1) have yielded valuable information related to how participants use USGS water data and how they prefer that data to be delivered. Our methods have also revealed known and potential user groups that were initially under-represented in our sample, including tribal nations, agricultural producers, and urban water providers. These groups will be targeted more intentionally moving forward to ensure that their input is captured and their needs inform the development and delivery of our product.

**Table 1.** Non-Federal respondent estimates for each Data Delivery information collection instrument and response vs non-response rates for six-month pilot study (9/22 – 1/23)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Population Description | Instrument | Size of Universe | Number Solicited | Expected Responses | Actual Responses | Response Rate for Pilot |
| Public\* | Survey | Unknown | 149 | 100 | 47 | 32% |
| Public\* | Interview |  | 47† | 30 | 12 | 26% |
| State, local, tribal | Survey | Unknown | 85 | 75 | 29 | 34% |
| State, local, tribal | Interview |  | 29† | 30 | 7 | 24% |

\*Public includes (for example) academic; nonprofit; community, watershed, or basin organizations; and water utilities

†Interview participants are a subset of those who responded to the survey and thus, not additive when combined with the numbers provided for the survey instrument. Because the instruments were offered to participants sequentially (first survey, then interview) we considered the number of interviews solicited to be equal to the number of actual survey respondents in order to avoid inflating the interview non-response rate by including individuals who declined all participation at the survey stage.

***Institutional Resilience***

The sampling method for the Institutional Resilience information collection instruments was purposive (Palinkas et al., 2015). Our intent was to reach individuals who possessed the necessary professional expertise to answer questions and offer meaningful insight about resilience and decision-making in water management institutions. We defined “water management institution” broadly as public or private entities involved in the management of water or water-dependent resources including (for example): state engineer offices, irrigation and conservancy districts, fisheries managers, state wildlife or natural resource management departments, regional or municipal water utilities, dam and reservoir operators, hydro-electric power providers, parks and public recreational areas, and regulatory agencies. The study-relevant respondent universe was comprised of any individual working for a water management institution in the Upper Colorado River Basin or the Delaware River Basin. Within this universe, our sample consisted of organizations and agencies we obtained from publicly available websites and directories maintained by the Upper Colorado River Basin Commission, the U.S. Bureau of Reclamation, and the Delaware River Basin Commission, as well as through informal conversations with USGS regional leadership and individuals within the WMA Integrated Water Availability Assessment program who are actively engaged in work throughout the basin and could identify key institutions (Figure 2). Within each institution we included as many employees as possible (based on the availability of contact information provide on public websites) to capture the widest range of experts and decision-makers. In both basins, final participant lists were vetted by USGS leadership prior to our initial outreach in order to maximize the utility of the information we collected while also minimizing burden for the entire network.

Our broad definition for these institutions, combined with the nebulous jurisdictional boundaries of hydrologic systems, means that the exact size of our respondent universe is unknown. Furthermore, this basin-specific universe could be considered a subset of a much larger and similarly unquantifiable universe that includes all employees of any water management institution within the United States (Figure 2). Focusing our study on this smaller universe will, by definition, limit our ability to generalize these results to other geographic areas; however, our study objective is to gain a depth, rather than breadth, of understanding when it comes to the tacit knowledge and lived experiences of our participants.

Text

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**Figure 2.** Sampling frame for Institutional Resilience objective

In late August, 2022, this ICR was approved by OMB as a 1-year pilot study. The responses we have collected over the past six months (Table 2) have provided keen insight into how decision-makers in water institutions conceptualize and operationalize resilience at both the organizational and the system level. Continued data collection will inform an even deeper understanding of how to define and measure the resilience of water management institutions – a key aspect of water availability in complex systems threatened by changing climate and increasing consumption.

**Table 2.** Non-Federal respondent estimates for each Institutional Resilience information collection instrument and non-response rates for six-month pilot study (9/22 -1/23)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Population Description | Instrument | Size of Universe | Number Solicited | Expected Responses | Actual Responses | Response Rate for Pilot |
| Public\* | Survey | Unknown | 95 | 15 | 13 | 14% |
| Public\* | Interview |  | 13† | 10 | 5 | 38% |
| State, local, tribal | Survey | Unknown | 173 | 75 | 18 | 10% |
| State, local, tribal | Interview |  | 18† | 25 | 3 | 17% |

\*Public includes (for example) academic; nonprofit; community, watershed, or basin organizations; and water utilities

†Interview participants are a subset of those who responded to the survey and thus, not additive when combined with the numbers provided for the survey instrument. Because the instruments were offered to participants sequentially (first survey, then interview) we considered the number of interviews solicited to be equal to the number of actual survey respondents in order to avoid inflating the interview non-response rate by including individuals who declined all participation at the survey stage.

**2. Describe the procedures for the collection of information including:**

**\* Statistical methodology for stratification and sample selection**

**\* Estimation procedure,**

**\* Degree of accuracy needed for the purpose described in the justification,**

**\* Unusual problems requiring specialized sampling procedures, and**

**\* Any use of periodic (less frequent than annual) data collection cycles to reduce burden.**

***Data Delivery***

The Data Delivery information collection methodology follows best practices for usability and human-centered design research as outlined by GSA’s technology and design consultancy group 18F ([18F: Digital service delivery | Home (gsa.gov)](https://18f.gsa.gov/)). Both the survey and the interview collection instruments were written with the goal gathering the necessary information to inform the next steps in our product design process, such as affinity mapping, constructing user personas, and storyboarding ([About this guide | 18F User Experience Design Guide](https://ux-guide.18f.gov/)). The methods of human-centered design research are intended to maximize insights into product design and functionality, rather than yield statistical insights about the population. For this reason, participants were not randomly selected, nor were they stratified for analysis. The information that is collected will provide context and guide development of an initial product prototype. The user-led nature of this process means that the degree of accuracy cannot be pre-defined, but rather will emerge and be continually refined throughout product development by follow-up conversations and iterative rounds of user testing.

***Institutional Resilience***

The Institutional Resilience information collection methodology follows principles from both deductive qualitative research and inductive Grounded Theory to achieve thematic “saturation” – the point at which additional collection is unlikely to yield new information (Hennink & Kaiser 2022). There is no standardized rule for optimal sample size to achieve saturation; however, common estimates range from 10-60 individuals, depending on research objectives and thematic complexity (Marshall et al., 2013). Our initial sampling universe was intentionally much larger in order to achieve an interview acceptance rate within this range. Participants were selected non-randomly and were not stratified for statistical purposes.

Unlike quantitative studies that are intended to collect samples that are representative of larger populations, the qualitative methods we used are intended to provide deeper understanding of concepts or phenomenon by accessing individuals with first-hand knowledge relevant to the research topic (Palinkas et al., 2015; Foley et al., 2021). The semi-structured interviews conducted under this ICR allow us to explore both emerging themes and previously documented aspects of institutional resilience by incorporating the tacit knowledge of participants with professional expertise in managing water or water-dependent resources. Because the data collected will consist of participants’ observations and lived experiences, standard measures of statistical accuracy cannot be applied. However, best practices for qualitative research such as establishing clarity of purpose, ensuring question quality and instrument internal consistency, and maintaining interviewer objectivity all help to ensure data quality (Charmaz and Thornberg 2021). In addition, using a short survey to screen individuals prior to interview help ensure the suitability and credibility of our participants.

**3. Describe methods to maximize response rates and to deal with issues of non-response. The accuracy and reliability of information collected must be shown to be adequate for intended uses. For collections based on sampling, a special justification must be provided for any collection that will not yield "reliable" data that can be generalized to the universe studied.**

***Data Delivery***

This ICR was originally approved as a one-year pilot study with an expiration date of 8/31/2023. During the past six months the Data Delivery online survey was deployed, and follow-up interviews conducted. Table 3 shows non-response rates for each instrument, to date. The most common protocol to maximize response rates for online surveys suggests following up initial solicitations with several reminders to non-responders over a 4-6 week period of time (Dillman et al. 2014). For this pilot study we faced an extremely compressed schedule for conducting data collection and analyzing the initial findings. This time constraint meant that follow-up reminders could not be sent systematically, although some were sent on an ad-hoc basis for individuals who volunteered to participate through outreach. A recent meta-analysis found that non-response rates for online surveys average approximately 55.9% (Wu et al., 2022). Our non-response rates within both non-federal participant groups (public and state/local/tribal) were slightly higher than average which we believe is primarily due to our inability to send systematic reminders – an issue we plan to rectify moving forward.

**Table 3.** Break-down of non-Federal actual response numbers and non-response rates by individual instrument and population for the Data Delivery objective.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Objective | Instrument | Population | Number Solicited | Actual Responses | Non-Response Rate† |
| Data Delivery | Survey | Public\* | 149 | 47 | 68% |
| Data Delivery | Interview | Public\* | 47†† | 12 | 74% |
| Data Delivery | Survey | State, local, tribal | 85 | 29 | 66% |
| Data Delivery | Interview | State, local, tribal | 29†† | 7 | 76% |

\*Public includes (for example) academic; nonprofit; community, watershed, or basin organizations; and water utilities

†Non-response rate = 1 – Response Rate for Pilot

††Interview participants are a subset of those who responded to the survey and thus, not additive when combined with the numbers provided for the survey instrument. Because the instruments were offered to participants sequentially (first survey, then interview) we considered the number of interviews solicited to be equal to the number of actual survey respondents in order to avoid inflating the interview non-response rate by including individuals who declined all participation at the survey stage.

Non-response rates for individual Data Delivery survey questions were calculated based on all survey respondents – both Federal and non-Federal. Two open-ended questions had high non-response rates compared to the rest of the survey: “What would make you more interested in model outputs?” (33%) and, “Is there anything else you would like us to know?” (81%). High non-response rates were also noted for several optional demographic questions including phone number (44%), name of organization (13.4%), and position/title (12%), as well as two additional questions about how users have interacted with USGS data in the past year (10% and 16%). Approximately 25% of the data delivery survey questions were answered by every respondent (non-response rate of 0%) and nearly three-quarters (74%) of the questions had a non-response rate less than 5%. For a complete list of questions and corresponding non-response rates for the Data Delivery survey, see Appendix A. None of the Data Delivery interview participants declined to answer any of our questions, making our non-response rate for every individual interview question zero.

As previously mentioned (see question 1), we learned from our initial pilot that certain user groups were under-represented in our sample. In addition, it is possible that those who did respond were particularly motivated to participate in some way and therefore our preliminary results suffer from non-response bias. Both issues are being carefully investigated by the Data Delivery team to identify user groups that should be targeted for our second round of solicitation and to see if our first round of analysis indicates that those who responded disproportionately represented limited types of data users.

***Institutional Resilience***

This ICR was originally approved as a one-year pilot study with an expiration date of 8/31/2023. During the past six months the Institutional Resilience online survey was deployed, and follow-up interviews conducted. Table 4 shows non-response rates for each instrument, to date. Our non-response rates within both non-federal participant groups (public and state/local/tribal) were significantly higher than average (Wu et al., 2022). For this pilot study we faced an extremely compressed schedule for conducting data collection and analyzing the initial findings. This time constraint meant that follow-up reminders were not sent, and individuals who expressed interest in an interview but failed to respond to our scheduling request were not pursued aggressively. In addition, our geographic focus within the Upper Colorado and Delaware River Basins meant that we were sampling systems in which USGS is already actively engaged with partners on a wide range of water-related issues. In both basins, USGS leadership helped us minimize burden by vetting our final list of participants prior to our initial outreach, but they also cautioned us to be sensitive to potential stakeholder fatigue. Given the circumstances, we felt that forgoing multiple reminders was justifiable.

Moving forward, we plan to re-engage with USGS regional leadership to adopt a sampling strategy that includes at least one gentle reminder in an effort to improve our response rate. We will also have the opportunity to follow-up with the individuals who indicated on the survey they would like to participate in an interview but failed to respond to our initial scheduling request. Finally, our conversations in this initial interview round were extremely positive with many of our participants providing names of additional individuals they felt we should reach out to. We believe that the work we have conducted so far has laid fruitful groundwork for us to leverage those connections to continue collecting meaningful data in both basins.

**Table 4.** Break-down of non-Federal actual response numbers and non-response rates by individual instrument and population for the Institutional Resilience objective.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Objective | Instrument | Population | Number Solicited | Actual Responses | Non-Response Rate |
| Institutional Resilience | Survey | Public\* | 95 | 13 | 86% |
| Institutional Resilience | Interview | Public\* | 13† | 5† | 62% |
| Institutional Resilience | Survey | State, local, tribal | 173 | 18 | 90% |
| Institutional Resilience | Interview | State, local, tribal | 18† | 3† | 83% |

\*Public includes (for example) academic; nonprofit; community, watershed, or basin organizations; and water utilities

†Non-response rate = 1 – Response Rate for Pilot

††Interview participants are a subset of those who responded to the survey and thus, not additive when combined with the numbers provided for the survey instrument. Because the instruments were offered to participants sequentially (first survey, then interview) we considered the number of interviews solicited to be equal to the number of actual survey respondents in order to avoid inflating the interview non-response rate by including individuals who declined all participation at the survey stage.

Non-response rates for individual survey questions were calculated based on all survey respondents – both Federal and non-Federal. For the Institutional Resilience survey, the only question that a portion of respondents declined to answer was an optional, open-ended request for any additional information that respondents wished to share (29%). For a complete list of questions and corresponding non-response rates for the Institutional Resilience survey, see Appendix B. None of the Institutional Resilience interview participants declined to answer any of our questions, making our non-response rate for every individual interview question zero.

**4. Describe any tests of procedures or methods to be undertaken. Testing is encouraged as an effective means of refining collections of information to minimize burden and improve utility. Tests must be approved if they call for answers to identical questions from 10 or more respondents. A proposed test or set of tests may be submitted for approval separately or in combination with the main collection of information.**

***Data Delivery***

A draft of the Data Delivery survey and interview protocol was reviewed by subject matter experts, as noted in the SS-A for this request. Comments and suggestions from those individuals were incorporated into our final revised instruments and have been implemented for the past six months under and OMB pilot study authorization. This information collection will inform the development of the National Water Census – a new USGS delivery platform for modeled water data. Because this product has not previously existed, the information we collect will be unique and nonduplicative with any other USGS user-centered research. Our sampling methodology was informed by a previous, broad WMA effort to understand who the users of USGS data are and what kinds of decisions they need to make with the data we provide (Restrepo-Osorio et al., 2022). This allowed us to optimize our questions and sampling strategies in order to maximize our information gains. Responses collected during this initial pilot phase have aligned with our expectations for relevant and useful information, therefore no further tests or revisions are planned.

***Institutional Resilience***

A draft of the Institutional Resilience survey and interview protocol was reviewed by subject matter experts, as noted in the SS-A for this request. Comments and suggestions from those individuals were incorporated into our final revised instruments and have been implemented for the past six months under an OMB pilot study authorization. The sampling methodology for this information collection leans heavily on existing USGS relationships within the Upper Colorado and Delaware River Basins to carefully review current knowledge about the system and illuminate existing data gaps.

In addition, prior to initiating our collection we conducted a nonsystematic, scoping literature review of three general bodies of literature: water management, water resilience, and resilience engineering (RE). From initial search results, we performed forward and backward tracing (i.e., papers that cited them and papers they cited) to identify other foundational sources. This review enabled us to explore existing themes in the literature related to resilience, water management resilience, institutional resilience, and water management decision-making. We found extensive discussion of both the definition and application of resilience in social, ecological, and infrastructure contexts related to water management systems. However, the majority of these sources examine partial components of the total system. Identified metrics of resilience overwhelmingly relate to measurable hydrologic parameters, age or operation capacity of water delivery systems, community demographic data, ecological indicators, or hydropower generation and revenue. A critical gap in our understanding of system resilience remains a lack of operational or organizational metrics, and a clear connection between those metrics and decision-making. Specifically, there is little attention given to the role of tacit knowledge on how decision-makers define resilience within water management institutions, how those implicit definitions inform decision-making for water and water-related resources, and how those decisions then enhance or impair an organization’s ability to maintain critical functions while adapting to changing conditions. This information collection has been designed to fill that gap and add substantial value to the existing body of knowledge by improving our understanding of how to measure and operationalize the concept of resilience. Responses collected during this initial pilot phase have aligned with our expectations for relevant and useful information, therefore no further tests or revisions are planned.

**5. Provide the names and telephone numbers of individuals consulted on statistical aspects of the design and the name of the agency unit, contractor(s), grantee(s), or other person(s) who will actually collect and/or analyze the information for the agency.**

Consultation about the statistical aspects of these collections included conversations with Melissa Braybrooks, Economist in the Office of Policy Analysis for the U.S. Department of Interior ([Melissa\_Braybrooks@ios.doi.gov](mailto:Melissa_Braybrooks@ios.doi.gov)). In addition, collections were reviewed by five senior scientists in USGS Ecosystems and Water Mission Areas, and no scientific concerns were identified. Specific agency and position information for all reviewers can be found in the SS-A for this collection request.

Collection and analysis will be conducted by:

Decision Support Branch

Integrated Information Dissemination Division

USGS Water Resources Mission Area

Madison, WI

[OMB-OIRA has produced a number of documents that may serve as useful reference material for completing Supporting Statement B. These can be found at: <https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/pmc_survey_guidance_2006.pdf>]

**References:**

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Wu, M.J., Zhao, K., and Fils-Aime, F. (2022) Response Rates of Online Surveys in Published Research: A Meta-Analysis, *Computers in Human Behavior Reports*, 7:100206, DOI” 10.1016/j.chbr.2022.100206.

Appendix A: Complete list of questions and corresponding non-response rates for the Data Delivery survey; “Conditional” column indicates whether or not a question is offered to a participant based on their answer to a previous question.

|  |  |  |  |
| --- | --- | --- | --- |
| **Question Number** | **Non-response %** | **Conditional?** | **Question** |
| Q1 | 0.0 | No | Q1 *(Required)* First name |
| Q2 | 0.0 | No | Q2 *(Required)* Last name |
| Q3 | 0.7 | No | Q3 *(Required)* Email address |
| Q4 | 44.4 | No | Q4 Phone number |
| Q5 | 0.0 | No | Q5 *(Required)* State in which you live, work, and / or are most interested in water issues |
| Q6 | 13.4 | No | Q6 Name of organization you are affiliated with or employed by |
| Q7 | 4.9 | No | Q7 Type of organization you are affiliated with or employed by |
| Q8 | 12.0 | No | Q8 Your position or role at the above organization |
| Q9 | 3.5 | No | Q9 Role at the above organization that most closely matches yours |
| Q10 | 3.5 | No | Q10 The sector that you are most closely associated with or interested in |
| Q11 | 4.2 | No | Q11 Are you employed by the USGS? |
| Q11A\_1 | 0.0 | Yes | Q11A\_1 Select the area of USGS you are employed by. |
| Q11A\_1A\_1 | 6.3 | Yes | Q11A\_1A\_1 Select the USGS Mission Area you are employed by. |
| Q11A\_1B\_1 | 0.0 | Yes | Q11A\_1B\_1 Specify the USGS Science Center you are employed by. |
| Q11A\_1C\_1 | 0.0 | Yes | Q11A\_1C\_1 Select the USGS Region you are employed by. |
| Q12 | 4.2 | No | Q12 Have you accessed or viewed USGS water data in the past year? |
| Q12A\_1 | 10.0 | Yes | Q12A\_1 Select all the way in which you have accessed or viewed USGS water data in the past year. |
| Q12A\_2 | 16.2 | Yes | Q12A\_2 Approximately how often have you accessed or viewed USGS water data in the past year? |
| Q13 | 5.6 | No | Q13 *(Required)* The National Water Census will serve the following new modeled (as opposed to measured) variables and computed trends. Select all that would be useful to you. |
| Q13ABCDE\_1 | 7.4 | Yes | Q13ABCDE\_1 Select all the professional ways in which you would use NWC information. |
| Q13ABCDE\_2 | 9.6 | Yes | Q13ABCDE\_2 Select all the personal ways in which you would use NWC information. |
| Q13ABCDE\_3 | 7.4 | Yes | Q13ABCDE\_3 How would you prefer to access, visualize, and / or download NWC data? Select all that apply. |
| Q13ABCDE\_4 | 8.1 | Yes | Q13ABCDE\_4 With what regularity would you visit the NWC delivery system or use code / web services to obtain NWC data? |
| Q13A\_1 | 0.0 | Yes | Q13A\_1 For modeled variables and computed trends related to **water quantity**, select the specific variables that would be useful to you. |
| Q13A\_2 | 0.9 | Yes | Q13A\_2 For model outputs related to **water quantity**, what scenarios would be useful to you? Select all that apply. |
| Q13A\_3 | 0.9 | Yes | Q13A\_3 For model outputs related to **water quantity**, what would be the ideal update frequency? |
| Q13A\_4 | 0.9 | Yes | Q13A\_4 For model outputs related to **water quantity**, what spatial resolutions would be useful to you? Select all that apply. |
| Q13A\_5 | 0.9 | Yes | Q13A\_5 If your chosen **water quantity** model outputs were available to you in a way that meets your needs (including having the necessary resolutions, extents, data formats, and access methods), how likely are you to incorporate them in your current workflows? |
| Q13B\_1 | 2.7 | Yes | Q13B\_1 Select the specific **water quality** categories that would be useful to you. (You will be able to choose even more specific variables within each selected category after this question.) |
| Q13B\_1A\_1 | 0.0 | Yes | Q13B\_1A\_1 Select the specific **modeled groundwater quality concentrations** that would be useful to you. |
| Q13B\_1B\_1 | 0.0 | Yes | Q13B\_1B\_1 Select the specific **modeled surface water quality concentrations or loads** that would be useful to you. |
| Q13B\_1C\_1 | 5.1 | Yes | Q13B\_1C\_1 Select the specific **calculated historical trends in groundwater quality concentrations (based on monitoring well locations)** that would be useful to you. |
| Q13B\_1D\_1 | 3.4 | Yes | Q13B\_1D\_1 Select the specific **calculated historical trends in surface water quality concentrations or loads (based on monitoring locations)** that would be useful to you |
| Q13B\_2 | 0.0 | Yes | Q13B\_2 For model outputs related to **water quality**, what scenarios would be useful to you? Select all that apply. |
| Q13B\_3 | 1.4 | Yes | Q13B\_3 For model outputs related to **water quality**, what would be the ideal update frequency? |
| Q13B\_4 | 1.4 | Yes | Q13B\_4 For model outputs related to **water quality**, what spatial resolutions would be useful to you? Select all that apply |
| Q13B\_5 | 1.4 | Yes | Q13B\_5 If your chosen **water quality** model outputs were available to you in a way that meets your needs (including having the necessary resolutions, extents, data formats, and access methods), how likely are you to incorporate them in your current workflows? |
| Q13C\_1 | 2.2 | Yes | Q13C\_1 Select the specific **water use** variables that would be useful to you. |
| Q13C\_2 | 2.2 | Yes | Q13C\_2 For model outputs related to **water use**, what scenarios would be useful to you? Select all that apply. |
| Q13C\_3 | 2.2 | Yes | Q13C\_3 For model outputs related to **water use**, what would be the ideal update frequency? |
| Q13C\_4 | 2.2 | Yes | Q13C\_4 For model outputs related to **water use**, what spatial resolutions would be useful to you? Select all that apply |
| Q13C\_5 | 3.4 | Yes | Q13C\_5 If your chosen **water use** model outputs were available to you in a way that meets your needs (including having the necessary resolutions, extents, data formats, and access methods), how likely are you to incorporate them in your current workflows? |
| Q13D\_1 | 3.6 | Yes | Q13D\_1 Select the specific **water availability** variables that would be useful to you. |
| Q13D\_2 | 3.6 | Yes | Q13D\_2 For model outputs related to **water availability**, what scenarios would be useful to you? Select all that apply. |
| Q13D\_3 | 3.6 | Yes | Q13D\_3 For model outputs related to **water availability**, what would be the ideal update frequency? |
| Q13D\_4 | 3.6 | Yes | Q13D\_4 For model outputs related to **water availability**, what spatial resolutions would be useful to you? Select all that apply. |
| Q13D\_5 | 3.6 | Yes | Q13D\_5 If your chosen **water availability** model outputs were available to you in a way that meets your needs (including having the necessary resolutions, extents, data formats, and access methods), how likely are you to incorporate them in your current workflows? |
| Q13E\_1 | 1.4 | Yes | Q13E\_1 Select the specific **aquatic ecosystem** variables that would be useful to you. |
| Q13E\_2 | 0.0 | Yes | Q13E\_2 For model outputs related to **aquatic ecosystems**, what scenarios would be useful to you? Select all that apply. |
| Q13E\_3 | 0.0 | Yes | Q13E\_3 For model outputs related to **aquatic ecosystems**, what would be the ideal update frequency? |
| Q13E\_4 | 1.4 | Yes | Q13E\_4 For model outputs related to **aquatic ecosystems**, what spatial resolutions would be useful to you? Select all that apply. |
| Q13E\_5 | 1.4 | Yes | Q13E\_5 If your chosen **aquatic ecosystems** model outputs were available to you in a way that meets your needs (including having the necessary resolutions, extents, data formats, and access methods), how likely are you to incorporate them in your current workflows? |
| Q13F\_1 | 0.0 | Yes | Q13F\_1 Are you interested in modeled outputs other than those just listed? |
| Q13F\_1A\_1 | 0.0 | Yes | Q13F\_1A\_1 List the modeled outputs and / or variables you are interested in (separated by commas). |
| Q13F\_1B\_1 | 33.3 | Yes | Q13F\_1B\_1 What would make you more interested in modeled outputs? |
| Q14 | 7.7 | No | Q14 Would you be willing to participate in a virtual interview to share more information and ideas? The interview will last about 1 hour and help us learn more about your thoughts on the National Water Census and potential needs of yours that the NWC could fulfill. If yes, we will follow up with you via email to schedule a time. |
| Q15 | 81.0 | No | Q15 Is there anything else you would like us to know? |

Appendix B: Complete list of questions and corresponding non-response rates for the Institutional Resilience survey

|  |  |  |
| --- | --- | --- |
| **Question Number** | **Non-response %** | **Question** |
| Q1 | 0 | Name |
| Q2 | 0 | Email |
| Q3 | 0 | Name of Organization |
| Q4 | 0 | My water-related decisions focus primarily on locations or resources within |
| Q5 | 0 | Job Title |
| Q6 | 0 | In your own words, briefly describe your roles and responsibilities within your organization. |
| Q7 | Indicate your level of agreement with each of the statements below that complete the following sentence: *The decisions I make most frequently in the normal course of my job…* | |
| Q7A | 0 | Have outcomes that can be observed or recorded immediately (in or near real-time) |
| Q7B | 0 | Are in response to data collected for the purpose of understanding the current state of the hydrologic system |
| Q7C | 0 | Depend on long-term trends or forecasts |
| Q7D | 0 | Impact an individual or group's legal or negotiated access to water |
| Q7E | 0 | Rely on metrics or thresholds that have been pre-determined |
| Q7F | 0 | Require rapid communication to the public to inform them of changes to current water quality or quantity |
| Q7G | 0 | Involve responding to acute hazard events impacting water supply or urgent threats to public safety |
| Q7H | 0 | Are aimed at proactively evaluating system processes |
| Q7I | 0 | Are aimed at ensuring long-term system sustainability |
| Q7J | 0 | Are intended to uphold a law or treaty |
| Q7K | 0 | Can be described as adjustments or actions due to short-term, observed system changes (i.e., normal system fluctuations or unexpected events) |
| *End of Rating Scale Questions* | | |
| Q8 | 29% | Is there anything else you would like to share about the kinds of water resource management decisions you make? |
| Q9 | 0 | Would you be willing to participate in a 60-90 minute interview on the topic of water resource management? |