Nina Nichols[1], Sanjit Kundu[1] and Tracy Bouvette[2]
[1]Resolution Research & Marketing, Inc.
[2]Bouvette Consulting

Abstract
An assessment instrument was developed to support collection of water use and storage data and water user opinion. The instrument needed to be comprehensive, easy-to-use and ultimately capable of capturing critical water information from each region of the state while also providing a vehicle to the State for strategic guidance on a myriad of drought and water issues. A properly crafted questionnaire, or instrument, not only had to allow for essential end analysis (including statistical testing and segmentation), but also had to maximize potential participation by being user friendly.

Instrument development included a combined effort of question development and review by a technical team, followed by a pilot testing period. A group of 28 representative water users drawn from public and private entities and water districts that reviewed the instrument development formed the pilot test group for the assessment. An overview of the development of the assessment instrument is provided in this chapter.

Contents:

Introduction

The Drought & Water Supply Assessment is the first statewide project to determine how prepared Colorado has been for drought and identify measures that will better prepare us for the next period of water scarcity, both locally and regionally. To this end, the assessment instrument was developed to provide a mechanism to obtain water use, carry-over storage, and opinion data from a large group of water users[1] representing all the major water user segments (i.e., municipal, industrial, agricultural, federal, state, power, etc.) from each of the State's seven major river basins.

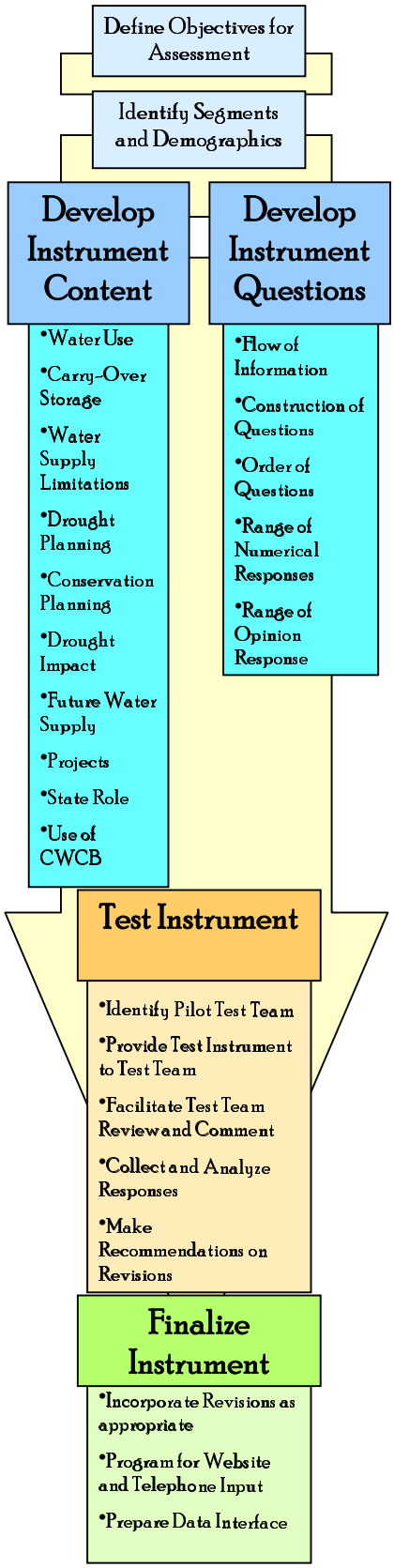
The process for developing the assessment instrument is highlighted in Figure 9-1. The process involved first, identifying the overall assessment objectives with the CWCB and DNR. Next, the group of water users that constitute the target participant list were identified through the characterization of state demography and water user segments to ensure that the messaging and structure of the assessment provided the opportunity to capture issues relevant to each segment of water use type. The assessment instrument was then developed and reviewed for content, clarity and effectiveness in gathering the requisite information and responses.

The instrument had to be comprehensive, easy-to-understand, capable of capturing critical water information from each region of

[1] Water users include those entities that provide, deliver and/or use raw and treated water for agricultural, municipal, industrial, recreational, and other uses.

the State, and ultimately had to provide a vehicle for strategic guidance on a myriad of drought and water issues. A properly crafted instrument not only had to allow for essential end analysis (including statistical testing and segmentation), but also had to maximize potential participation through ease of accessibility to all participants. The final instrument ultimately met CWCB goals and delivered statistically reliable results across the board. Below is a description of the instrument development process.

Figure 9-1: Process for Development of Assessment Instrument



Assessment Objectives

The assessment instrument was developed to allow the CWCB to gather statistically significant information regarding drought planning and preparedness, and potential drought mitigation measures. The assessment instrument therefore needed to collect information on the following topics:

- Current water use and carry-over storage (for purposes of differentiating water users by amount of water used and stored)
- Current limitations on water supply
- Drought and water conservation planning
- Drought impact
- Concerns in developing and meeting future water demands
- Structural and non-structural project needs for drought mitigation
- Funding needs
- Use of cooperative agreements
- State role in future drought planning and mitigation efforts

The assessment instrument also needed to collect information related to water user perceptions of the CWCB and the technical assistance offered by the CWCB to water users.

Developing Water Users Segments

For the assessment to be statistically significant – meaning that the results accurately represent the opinions of Colorado's water users as a whole and within each of the major river basins – the list of participants needed to:

- Have adequate representation within each of the major river basins;
- Include entities from all major segments of Colorado water use; and
- Include entities that represent at least 80% of the water diverted and/or delivered on an average year within the State's boundaries.

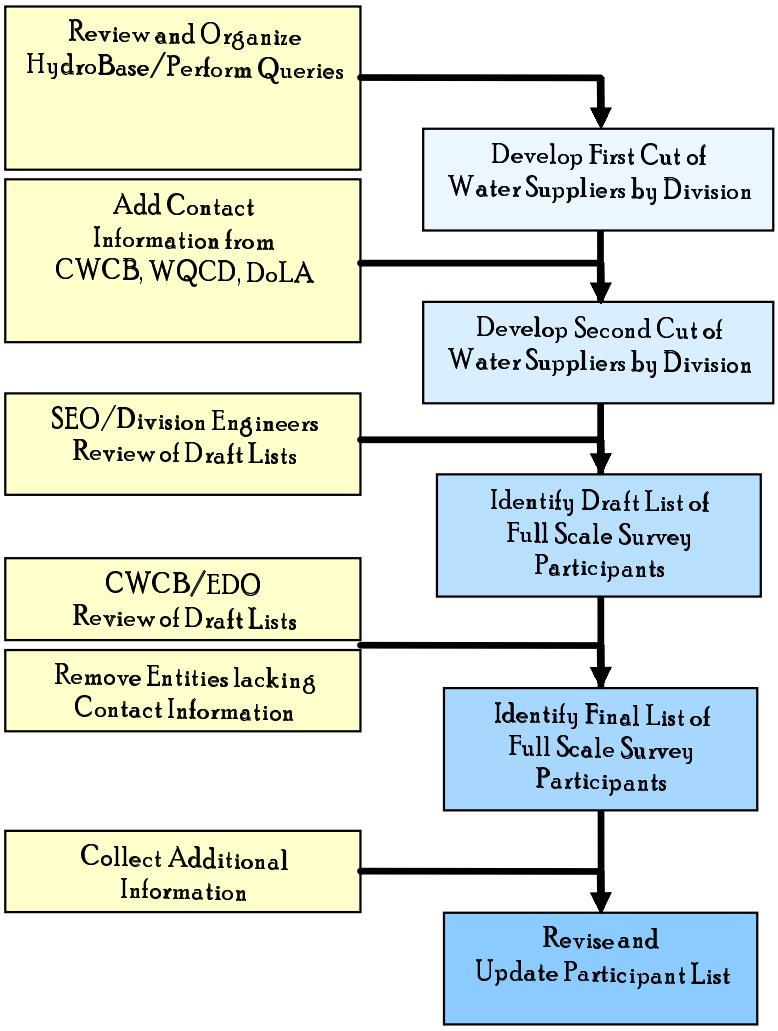
Having participation from water users that met these "participation criteria" would ensure that the CWCB and other State water planning

entities could rely on the results of the assessment as the basis of future water policy development and implementation.

To identify the water users that the project team needed to contact to achieve the specified participation criteria, a process was developed and followed, as indicated in Figure 9-2. The State Engineers Office (SEO) water rights accounting database, HydroBase, was used to identify the owners of the structures that either stored or diverted the most water in the State within each river basin. This listing was then embellished to include entity contact information such as address, telephone, and contact name using information made available by the CWCB, the Water Quality Control Division (WQCD) and the Department of Local Affairs (DoLA).

Lists were then generated for each of the seven major river basins and forwarded to the SEO and the division engineer field offices to be reviewed. The Division Engineers provided comments and guidance on water users, based on their unique knowledge of their divisions and water use in their basin. Additional contact information, especially for agricultural entities were developed through this process.

Figure 9-2: Process for Development of Assessment Participants



A final review of the participant lists were completed upon receipt of comments from the Division Engineers, including the removal of entities that lacked adequate or accurate contact information. The CWCB and the Executive Directors Office (EDO) provided a final review of the participant list to identify key omissions that needed to be added.

The final participant list included the following breakdown of water users is presented in Table 9-1.

Table 9-1: Summary of Survey Participants

	Water Division							
Segment	**Division 1**	**Division 2**	**Division 3**	**Division 4**	**Division 5**	**Division 6**	**Division 7**	**Total**
Power	0	2	0	0	0	3	0	**5**
Federal	2	1	4	5	6	7	5	**14**
State	3	4	3	3	4	6	4	**9**
Municipal	97	50	16	18	25	16	19	**241**
Agriculture	43	15	15	35	14	60	30	**204**
WCD*	2	1	5	3	4	6	6	**25**
Industry	2	4	0	4	2	5	0	**16**
Other**	5	6	0	2	5	3	3	**23**
Total	154	83	43	70	60	106	67	537

*WCD is Water Conservancy or Conservation District.
**Other: a collection of twenty-three entities, ranging from tribes, to home owners associations (HOA's), etc., not fitting into any of the other described entities of Federal, State, Agriculture, Municipal, Power, Industry, or Water Conservation Districts.
Please note that when adding responses across segment and division, the total exceeds the survey response total of 537. This is because some respondents are located across more than one division, thus they are counted in all appropriate divisions. A list of participants is provided in Appendix B.

Assessment Instrument Design, Review and Testing

Design of the assessment instrument was initiated using a long list of drought-related topics, which were organized to ensure that the concerns of all segments and water basins were properly covered to address the State's significant water issues. The instrument's design had to consider how to reach every entity regardless of difficulty. Not only was the instrument developed to encourage participation by a wide range of entities, it also was crafted to capture the unique responses that each party, segment and water division may express. To streamline the interview process, if a specific issue did not apply to a particular segment or water division, survey branching patterns were prepared to avoid unnecessary questioning. For example, if an entity's water system did not have storage capacity, the entity was not asked to define the volume of storage in the system. Furthermore, questions had to provide data that was ultimately sound, reliable, far-reaching, and in the end, comprehensive enough for critical analysis that would provide direction for the State in its decision-making efforts. Taking all of these necessary factors into account, the instrument had to follow sound statistical methodologies.

The instrument had to also be worded in such a manner as to encourage participation and minimize confusion. For these reasons, the CWCB, the SEO and the DoLA provided review and guidance during the development of the assessment instrument.

Once the content of the instrument was resolved, and the organization of the questions was defined, the means to collect statistically significant information from the questions was added to the instrument. The Likert Scale, a 5-point low to high scale, was used throughout the instrument for ease of answer comparison amongst all participants. Conversely, open-ended questions were seldom used except when necessary to capture information that would not typically be elicited through the more structured format. This design assured that all respondents were exposed to the same questions, ratings, and concepts, and ultimately provided for the facilitation of straightforward segmentation and examination. This resultant instrument included hundreds of questions covering the breadth and depth of the subject matter.

After weeks of significant input, design, communiqués, rewrites and internal testing, the instrument was finalized with the approval of the CWCB, SEO and DoLA. Net external testing of the instrument was needed to verify that the instrument functioned appropriately and provided a means to collect the requisite information. In addition, the external testing would provide a mechanism to allow the trial interviewers to hone their telephone interview methods using the actual instrument.

A pilot group of 28 participants from 27 entities was selected by the CWCB, for their diversity, water wisdom, and willingness to participate in the pilot testing effort. This pilot group (see Table 9-2) represented public and private entities of all sizes and from various state geographies.

Table 9-2: Participants in Pilot Group

- Arkansas Groundwater Users Association
- Aurora
- Breckenridge
- Centennial Water and Sanitation District
- Central Colorado Water Conservancy District (CCWCD)
- Colorado Springs Utilities
- Colorado Water Conservation Board
- Crested Butte
- Denver Water
- Dolores Water Conservancy District
- Durango West Metro District #2
- Fountain
- Groundwater Appropriators of the South Platte
- Grand Junction
- Greeley
- Lower Arkansas Water Management
- Meeker
- Northwest Colorado Council of Governments
- Parker Water and Sanitation District
- Pine River Irrigation District
- Pueblo, Board of Water Works
- Steamboat River District
- Uncompahgre Valley Water Users Association
- United States Forest Service, Rocky Mountain Region
- Upper Gunnison River Water Conservancy District
- Ute Water Conservancy District

Concurrently, project researchers were educated on the intricacies of Colorado water terminology and issues while receiving intensive survey training. Finally, the instrument was programmed into a computer-assisted-telephone-interview (CATI) system so as to initiate contact with the pilot group. Interviews were scheduled as needed to conduct the survey. Resulting data was captured and manipulated via a pre-programmed system. Following the post-test interaction, input and review of the survey amongst the parties and pilot group, final modifications were made to the instrument. The CWCB approved the final instrument that was placed into the field in mid-January of 2003.

To provide an incentive for comprehensive participation, the survey design was conceived so as to be conducted via several methodologies including telephone, mail or fax. In addition, as the collection process progressed and to facilitate participation of those who could not respond via telephone, the same instrument was

seamlessly integrated to an online Internet survey hosted on the CWCB website 24-hours a day. All such data was collected on the CATI system and all related tables and reports produced for the assessment were prepared using this system.

To view the instrument in its entirety, see Appendix A.