



# National Weather Service Customer Satisfaction Survey

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Hydrologic Services Program

Final Report 2008

**CFI** Group  
Claes Fornell International





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# Executive Summary

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## Executive Summary

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National Weather Service Hydrologic Services has conducted a satisfaction survey of their products and services users since 2004. The study has been conducted by CFI Group, a firm that specializes in the application of the ACSI methodology to individual organizations. This methodology measures quality, satisfaction and performance and links them to outcomes.

The 2008 survey was conducted during the period from August 21 through September 24. More than 1,900 responses were collected from the survey which was posted on the NWS website. The majority of respondents (43%) indicated that they used hydrologic information primarily for their personal use, followed by emergency management (22%) and recreation (5%). Most indicated several methods to receive NWS hydrologic information, and 95% access information through the website.

Overall, Flood Warnings, Watches and Statements are the most frequently used while drought information and water supply and/or reservoir information are least frequently used. Usage varies by type of customer. For example, Shippers and Water Resource managers indicate a much higher frequency of use for routine river forecasts and observed conditions than the average.

Communications/News indicate the most frequent usage of Flood Warnings, Watches and Information.

The Customer Satisfaction score for 2008 is 80 (on a 0 to 100 scale), representing a statistically significant 2-point improvement since the last measure in 2006. Customer satisfaction with NWS Hydrologic Services is explained by 7 major service areas: Customer Service, Data Services, Web Products, Water Supply/Reservoir Information, Drought Information, Routine River Forecasts/Conditions, and Flood Information. The survey contained specific questions for each of these areas. NWS is generally performing well in all these areas as scores range from 80 to 91.



## Executive Summary continued

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The 2008 results show Flood Information and Water Supply/Reservoir Information have the largest impact on satisfaction; Web Products, Routine River Forecasts/Conditions and Data Services have moderate impacts; and, Customer Service and Drought Information have relatively low impacts. Customer Satisfaction affects outcome measures such as the Confidence in NWS that improved 2 points since the last measure in 2006.

The significant improvement in Satisfaction and in three of its principal drivers is a result of NWS successfully implementing the recommendations from prior studies. Even so, the results point to opportunities for continued improvement:

- \* **Focus on resources** – Flood Information should have first priority followed by Water Supply/Reservoir Information and Web Products.
- \* **Improve Functionality and Visual Appeal of Graphics** – Visual representation remains important with users of all types with a need to have products that users can understand with minimal help from the NWS.
- \* **Target User Groups and Geographic Areas** – Shipping, Agriculture and Water Resources had lower scores in high impact areas with “timeliness of information” receiving the lowest scores.
- \* **Address Water Managers Preferences** – Water managers indicated a high usefulness of a Water Supply Volume Inflow Forecast Map and a Water Supply Volume Inflow Forecast Progression.



# Introduction

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## Introduction

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This report presents the results from the 2008 National Weather Service Hydrologic Services customer satisfaction survey. The results presented in this report serve as a decision tool for use in conjunction with other customer and management information available to the National Weather Service Hydrologic Services Program.

The “Research Summary” section provides a synopsis of the survey process and outlines the major findings from the analysis. The conclusions and recommendations in the Research Summary provide NWS managers with suggested action items based on these findings. Following these are sections including further detail on survey results, customer verbatim comments, and the questionnaire.

## Analysis Methodology

The analytical methodology used to evaluate the survey results is consistent with that used in the American Customer Satisfaction Index (ACSI). The ACSI ([www.theACSI.org](http://www.theACSI.org)), established in 1994, is a uniform, cross-industry measure of satisfaction with goods and services available to U.S. consumers, including both the private and public sectors. It is produced by the National Quality Research Center at the University of Michigan Business School under the direction of Dr. Claes Fornell.

CFI Group, a management consulting firm that specializes in the application of the ACSI methodology to individual organizations, uses the ACSI methodology to identify the causes of customer satisfaction and relates satisfaction to organizational performance measures such as the rate of customer complaints and customer confidence in the service they receive. The methodology measures quality, satisfaction, and performance, and links them within a structural equation model using a Partial Least Squares methodology. By using this system, CFI Group’s analysis overcomes customers’ inherent difficulty to precisely report the relative effects of the many factors influencing their satisfaction. Using CFI Group’s results, organizations like the National Weather Service can identify those factors that will most improve customer satisfaction and other measures of organizational performance.

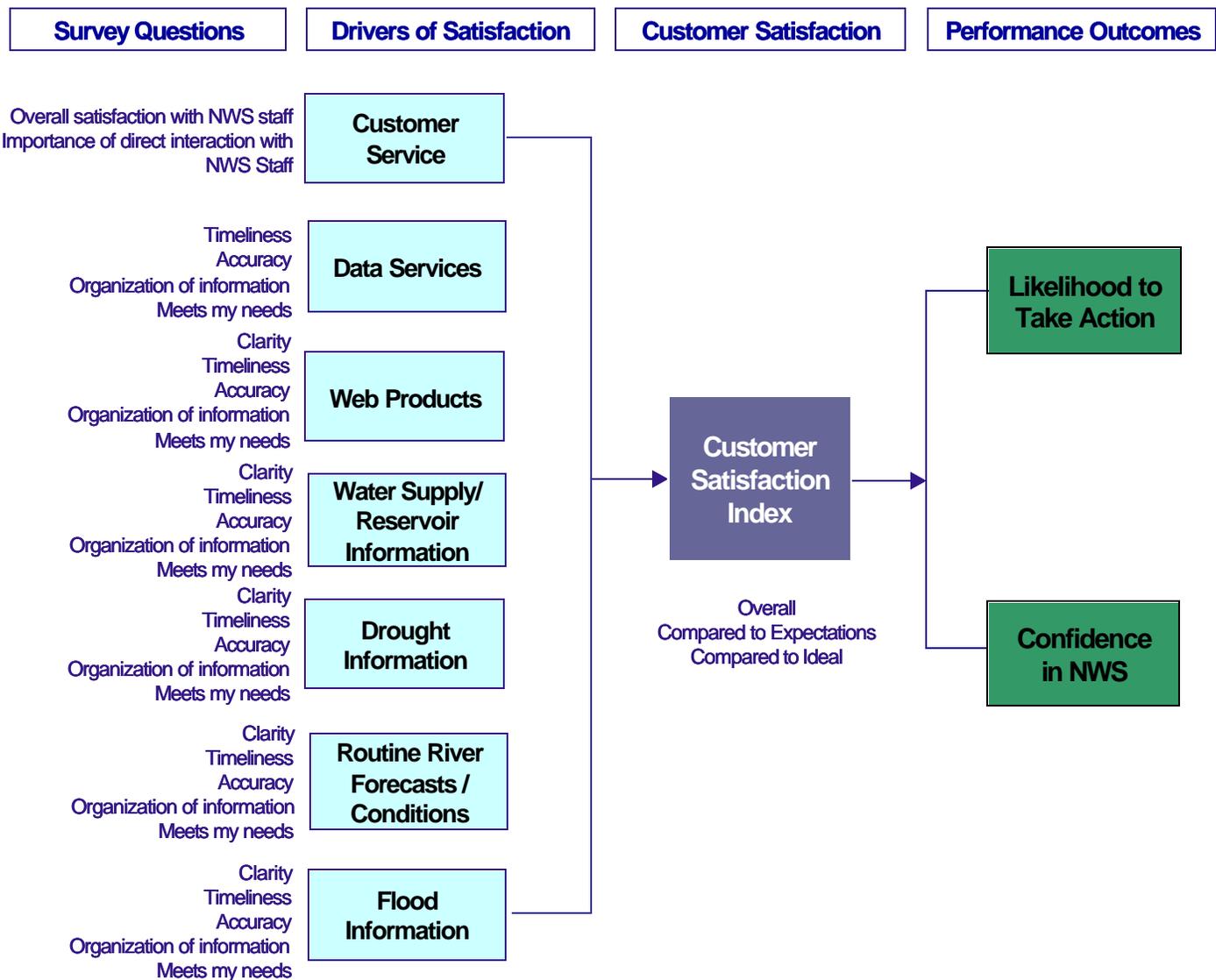
The core of the CFI Group methodology is the Customer Satisfaction Model, found on the next page. The model flows from left to right in a chain of cause-and-effect. On the far left side are **Attributes** - actual questions about various aspects of the NWS Hydrologic Services Program’s performance from the survey itself. These roll up into **Components** representing general areas of performance that drive **Customer Satisfaction**. The **Customer Satisfaction Index (CSI)** is measured separately by three questions - overall satisfaction, satisfaction compared to expectations, and satisfaction compared to an “ideal.” The CSI is a leading indicator of the organizational Performance Outcomes, which include respondents’ confidence that the NWS will do a



## Introduction continued

good job of providing forecasts, watches and warnings in the future, and their likelihood to take action based on the hydrologic information they receive from the National Weather Service.

The results presented in this report precisely quantify both current levels of performance on all the model elements, and the predicted impacts of quality and satisfaction improvements on performance outcomes. As the NWS Hydrologic Services Program improves its performance on Attributes and Components, the CSI will increase, resulting in improved outcomes. The analysis results help to pinpoint the areas of greatest leverage to drive these desirable outcomes, and thus serve as the springboard for NWS to develop successful and cost-effective strategies to continue to satisfy its customer base.





## Introduction continued

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### Key Words for Understanding this Report

Results from this analysis are presented through various discussions, charts, and tables provided in this report. To understand these clearly, refer to the following definitions:

**Attribute** – Attributes reflect different aspects or qualities of a component experienced by customers, which may contribute to satisfaction. Each attribute is captured by a specific scaled question from the questionnaire.

**Attribute Rating** – An attribute rating is the average of all responses to each question. Each rating has been converted to a 0-100 scale. In general, it indicates how negatively (low ratings) or positively (high ratings) customers perceive specific issues.

**Component** – Each component is defined by a set of attributes that are conceptually and empirically related to each other. For example, a component entitled “Flood Information” may include questions regarding “clarity” and “conciseness” of flood information.

**Component Score** (or simply “score”) – A component score represents that component’s “performance”. In general, they tell how negatively (low scores) or positively (high scores) customers feel about the organization’s performance in general areas. Quantitatively, the score is the weighted average of the attributes that define the component in the CFI Group model. These scores are standardized on a 0-100 scale.

**Component Impact** (or simply “impact”) – The impact of a component represents its ability to affect the customer’s satisfaction and future behavior. Components with higher impacts have greater leverage on measures of satisfaction and behavior than those with lower impacts. Quantitatively, a component’s impact represents the amount of change in Overall Satisfaction that would occur if that component’s score were to increase by 5 points.





# Research Summary

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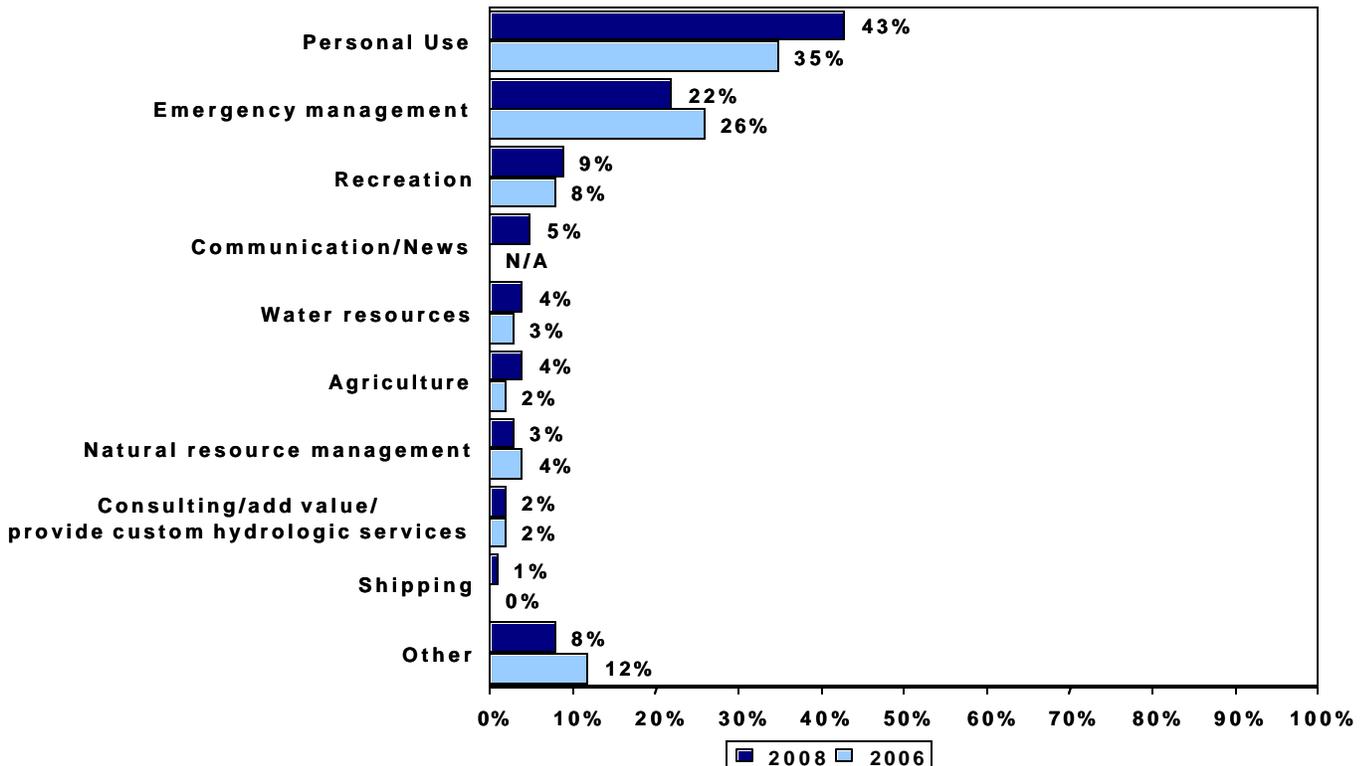
# Research Summary

## Background

The project began with discussions between CFI Group and members of the NWS Hydrologic Services Program to establish the goals of the survey and the subsequent analysis, and determine how these may or may not have differed versus prior years. The survey was conducted initially in 2004 to establish a baseline benchmark for customer satisfaction with the Hydrologic Services Program products and services. The 2006 survey measured progress versus 2004 to identify successes as well as opportunities for further improvement. The 2008 survey measured progress versus 2006 as well as an additional three sections that focus on products and features the NWS currently offers or may offer in the future. These three sections are Internet Services, Water Resources Services, and Data Services and they help gauge demand for product improvement as well as additional information types and formats.

The survey was conducted via the web, August 21 - September 24, 2008. The survey was posted on NWS web pages, allowing for anonymous response. During the survey period, 1,976 responses were collected (slightly more than in 2006). As was the case in 2006, respondents report using hydrologic information primarily for personal use or emergency management. The next page provides additional demographic information.

Figure 1: Primary Use





## Research Summary continued

Figure 2: Means by which Receive NWS Hydrologic Information

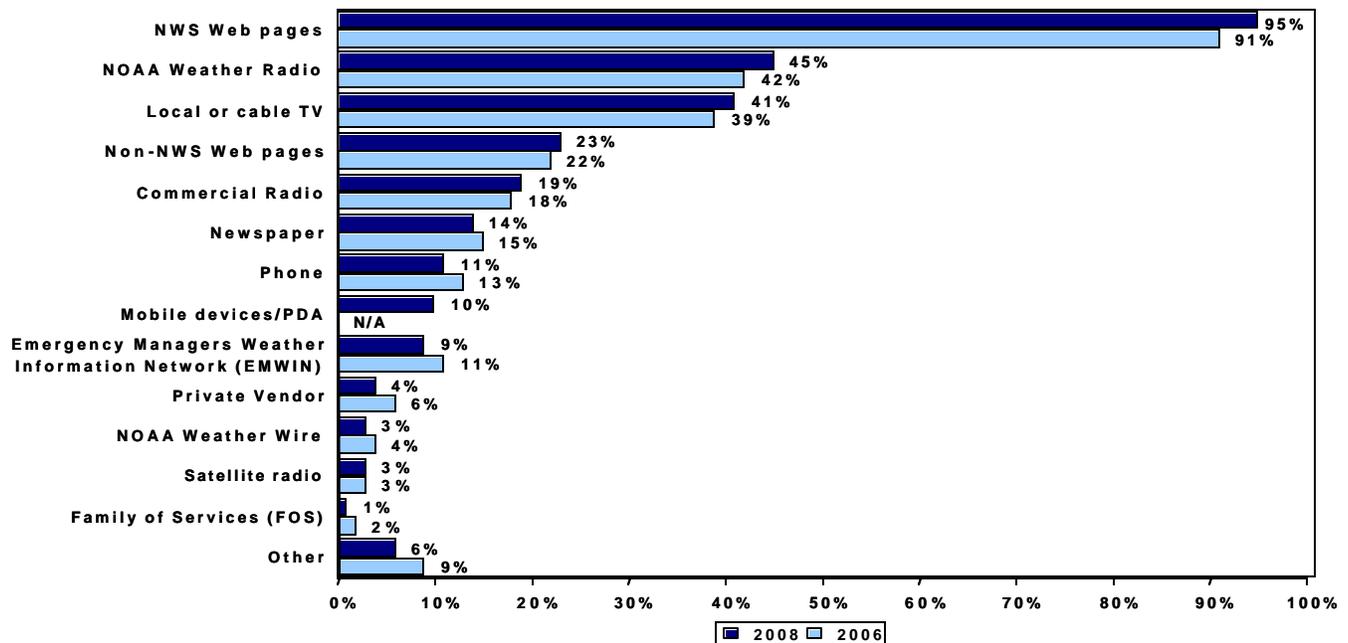


Figure 2 shows that respondents primarily receive information via the NWS Web pages, while many also receive it via NOAA Weather Radio and Local or cable TV. Note that multiple selections were allowed. Figure 3 illustrates that Flood Information is accessed most frequently by survey respondents.

Overall, Flood Warnings, Flood Watches and Flood Statements are the most frequently used while drought information and water supply and/or reservoir information is least frequently used. However, usage does vary by primary use. For example, Shippers and Water Resource managers indicate much higher frequency of use for routine river forecasts and observed conditions than the average. Similarly, Communications/News indicates the most frequent usage of Flood Warnings, Flood Watches and Flood Information.

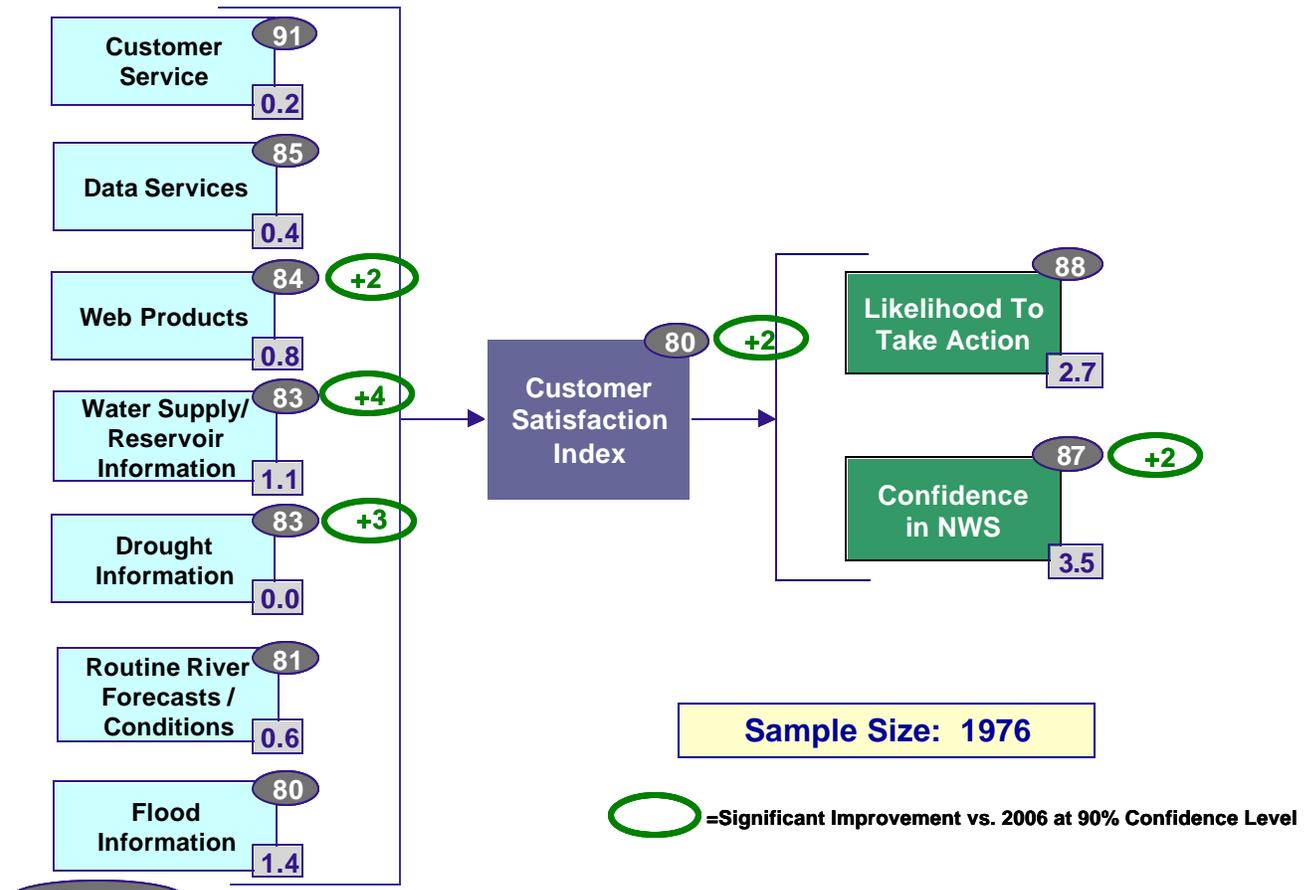
Figure 3: Frequency of Obtaining Text Information

	Several Times per Day	Once per Day	Once per Week	Once per Month	Do Not Use	Not Familiar with this Information
<b>Flood Warnings, Flood Watches, and Flood Statements (n=1976)</b>	51%	19%	6%	11%	10%	3%
Hydrologic Statements and Hydrologic Summaries providing <b>routine river forecasts and observed conditions</b> (n=1976)	17%	20%	20%	20%	17%	5%
Hydrologic Outlooks providing <b>drought information</b> (n=1970)	3%	8%	16%	23%	40%	10%
Hydrologic Outlooks providing information on <b>water supply and/or reservoir information</b> (n=1976)	3%	6%	9%	16%	51%	15%



# Research Summary continued

## Model Results



**Scores** The performance of each component on a 0 to 100 scale. Component scores are made up of the weighted average of the corresponding survey questions.

**Impacts** The change in target variable that results from a five point change in a component score. For example, a 5-point gain in Flood Information would yield a 1.4-point improvement in Satisfaction.

The figure above shows the complete satisfaction model for the Hydrologic Services Program. This is a cause-and-effect model where the components of the customer experience (**Flood Information**, the **Web Products**, etc.) influence the **Customer Satisfaction Index (CSI)**, which in turn drives changes in customer behaviors such as **Likelihood to Take Action**, and attitudes such as their **Confidence** that the NWS will do a good job of providing forecasts, watches and warnings in the future. Each component is comprised of a group of questions from the survey related to a particular area; for example, the **Flood Information** component is comprised of questions asking respondents to rate the flood information on “clarity,” “timeliness” and so on. Note that the Customer Satisfaction Index is measured independently of the quality components by three survey questions (overall satisfaction, satisfaction compared to expectations, and satisfaction compared to an “ideal”); it is not an average or an index of the scores for the model components themselves.



## Research Summary continued

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Improvements in any of the left-hand-side components will have a positive influence on customer satisfaction. These changes can be quantified by the component's *impact*, which indicates the amount by which satisfaction would increase if a component were to improve by 5 points. For example, if **Flood Information** were to improve from 80 to 85, the **CSI** would improve by 1.4 points (from 80 to 81.4), the predicted impact of **Flood Information**. Impacts represent the *independent* effect of each quality component on the CSI (i.e., the effect with "all else being equal"), and are also *additive* - that is, improvements in several components will cause the CSI to go up by the sum of their impacts.

Likewise, if the CSI were to rise 5 points, the model predicts that the scores for **Likelihood to Take Action** and **Confidence** would change by the amount of their impacts (2.7 and 3.5, respectively). The impact logic also operates on the downside: decreased levels of performance on any component will lead to lower satisfaction scores commensurate with their impacts.

The satisfaction model provides guidance about where to focus efforts to improve satisfaction. Those components with relatively high impact and low score should be the highest priority for improvement. Those with higher scores and lower impacts should assume lower priority. Assigning a particular area lower-priority does not mean that it is not *important*. Large changes in performance levels on any component (e.g., 10 points or more, either up or down) will likely affect the CSI score, even if the component(s) in question have an impact of 0.0.

While in 2006 **Flood Information** and **Routine River Forecasts / Conditions** had the greatest leverage on satisfaction, the 2008 results show **Flood Information** and **Water Supply/Reservoir Information** have the largest impact on satisfaction. These currently score very well, so maintaining current service levels and making any improvements possible are recommended. **Web Products**, Routine River Forecasts / Conditions, and Data Services are moderate impact areas, and certainly would impact satisfaction if improvements were made. **Customer Service** and **Drought Information** are relatively low impact areas, so the NWS should consider them third-tier priorities for improvement.

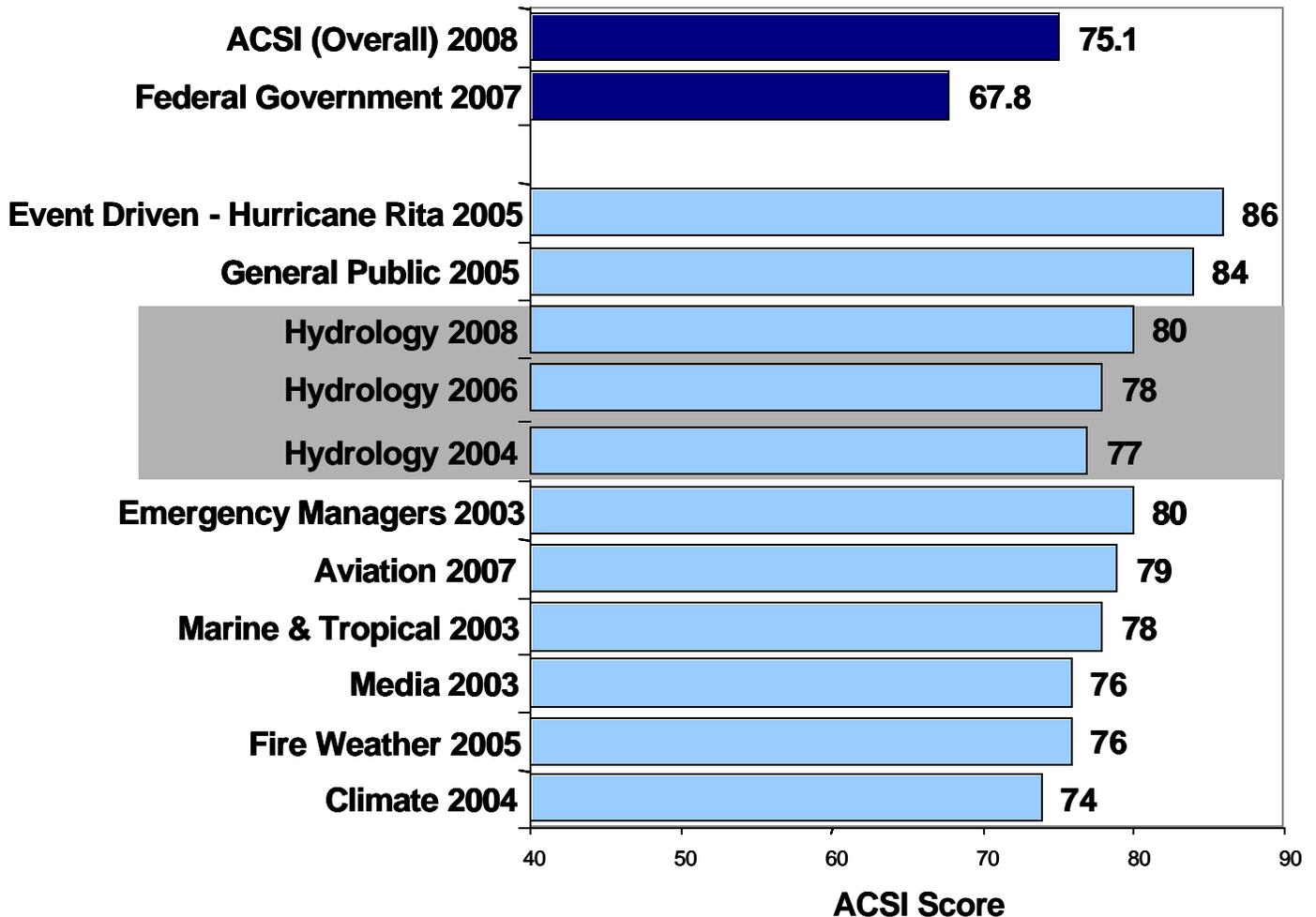


## Research Summary continued

### Benchmarks

The NWS Hydrologic Services Program continues to perform very well, as the overall customer satisfaction score is 80. The benchmarks provided in Figure 4 show that Hydrology scores better than the ACSI average, which includes all public and private industries measured (75.1). Hydrology also outperforms the Federal Government average of all agencies surveyed (67.8) and many of the other National Weather Service entities that have measured in the past. The Hydrologic Services Program should be very proud of their customer satisfaction scores.

Figure 4: ACSI & Federal Government Benchmarks



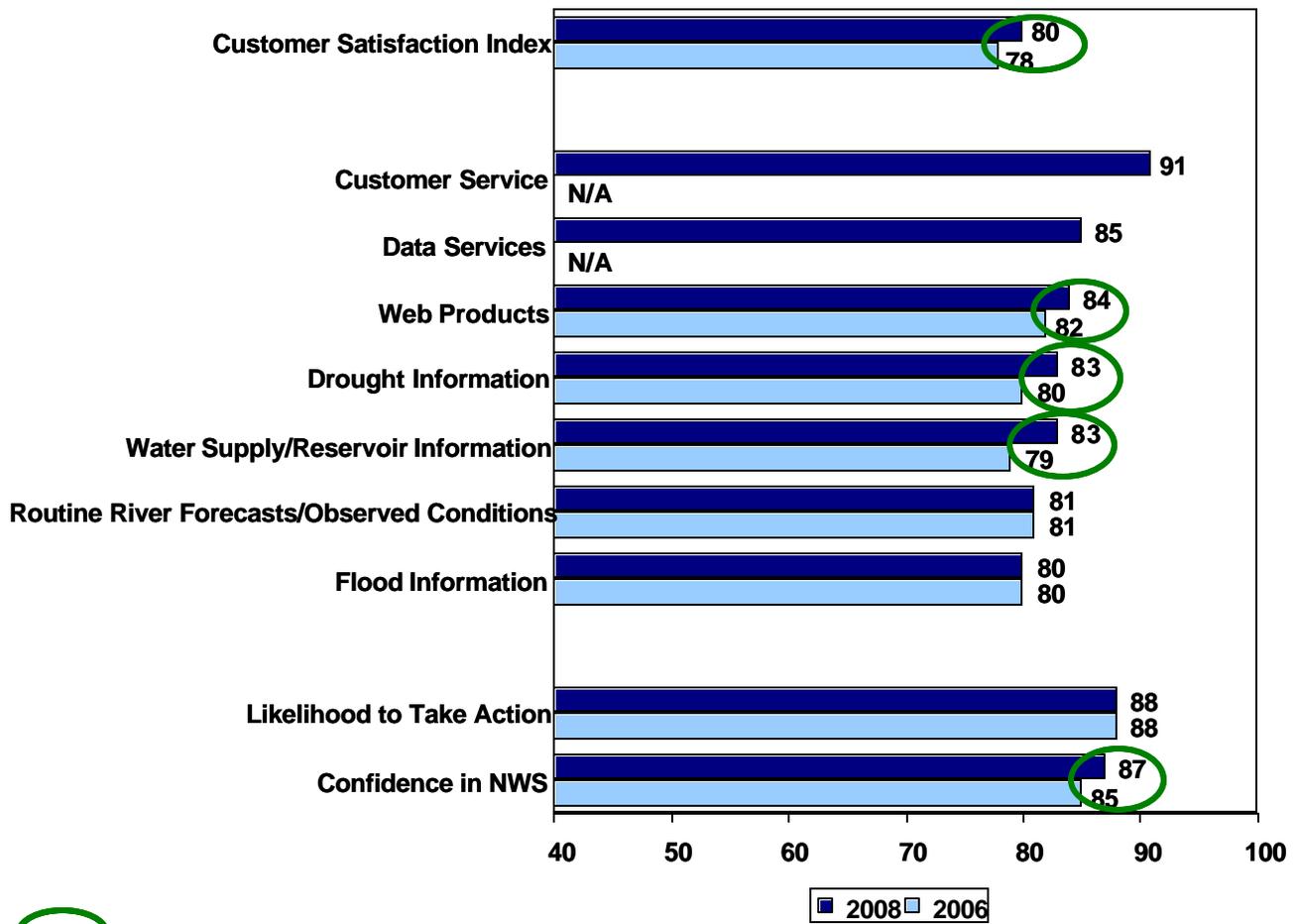


# Research Summary continued

## Score Comparisons 2008 vs. 2006

Overall, there are significant differences between various components of 2008 vs. 2006, including the CSI score. The score range is between 80 and 91 (Figure 5). Customers continue to view the information they receive from the NWS Hydrologic Services Program with a high degree of satisfaction. Web Products, Drought Information, and Water Supply/Reservoir Information have all had significant increases in score, and resulting from this is a significant increase in the Confidence in NWS.

Figure 5: Component Scores 2008 vs. 2006

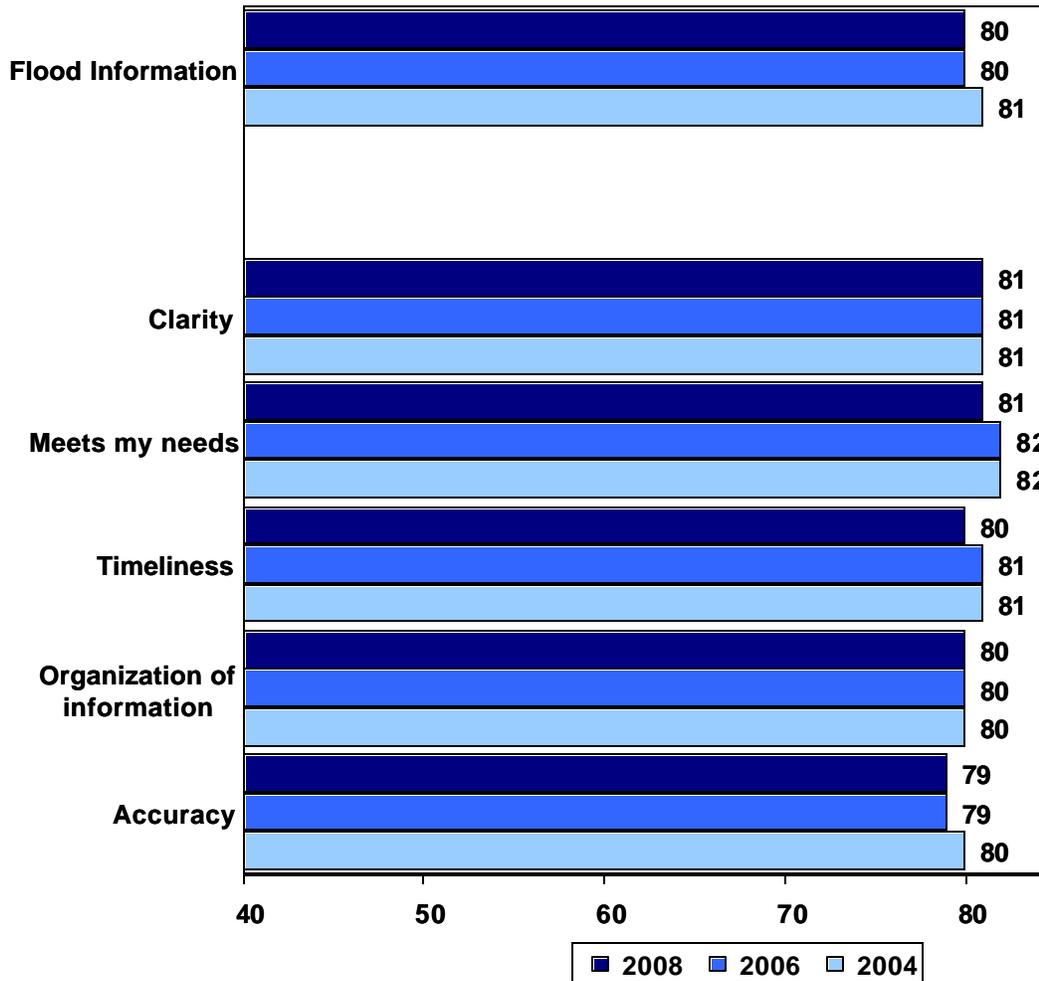




# Research Summary continued

## Flood Information

Figure 6: Flood Information component and attribute scores 2008 vs. 2006 and 2004



*For Flood events, if the rivers could be highlighted in the bright colors as you do counties now without indicating the whole county. I know the event is declared for the county but highlighting the whole county overstates the impact of the event.*

*During flood potential in my area, I need more frequent updates of river levels.*

*Every time we have severe thunder storms we usually get flash flood warnings. 90% it doesn't happen and some people don't take the warnings to seriously.*

*How about developing a Flood threat information scale!*

Flood Information performs very well with a score of 80 (the same as in 2006) and also has the highest impact on satisfaction (1.4). All attributes score very well (79-82). It is important to maintain current levels of service in this area and fine tune wherever possible. Verbatim comments such as those located next to Figure 6 offer other recommendations specific to flood information. A full listing of verbatim comments can be found later in the report.



## Research Summary continued

### Flood Information continued

10-11. What is the minimum amount of time you need to take effective precautionary actions against...

	Less than 30 minutes	Between 30 and 45 minutes	Between 45 and 60 minutes	Between 1 and 2 hours	More than 2 hours
Flash Flood Warnings	21%	24%	24%	21%	11%

	Less than 30 minutes	Between 30 and 60 minutes	Between 1 and 2 hours	Between 2 and 6 hours	More than 6 hours
Flood Warnings	16%	24%	27%	19%	14%

	Score
Importance of the disinclination between a flood warning and a flash flood warning	85

Communication/News had the largest percentage indicating “less than 30 minutes” as the minimum time needed to take precautionary actions against both Flash Flood Warnings and Flood Warnings (35% and 26%, respectively.)

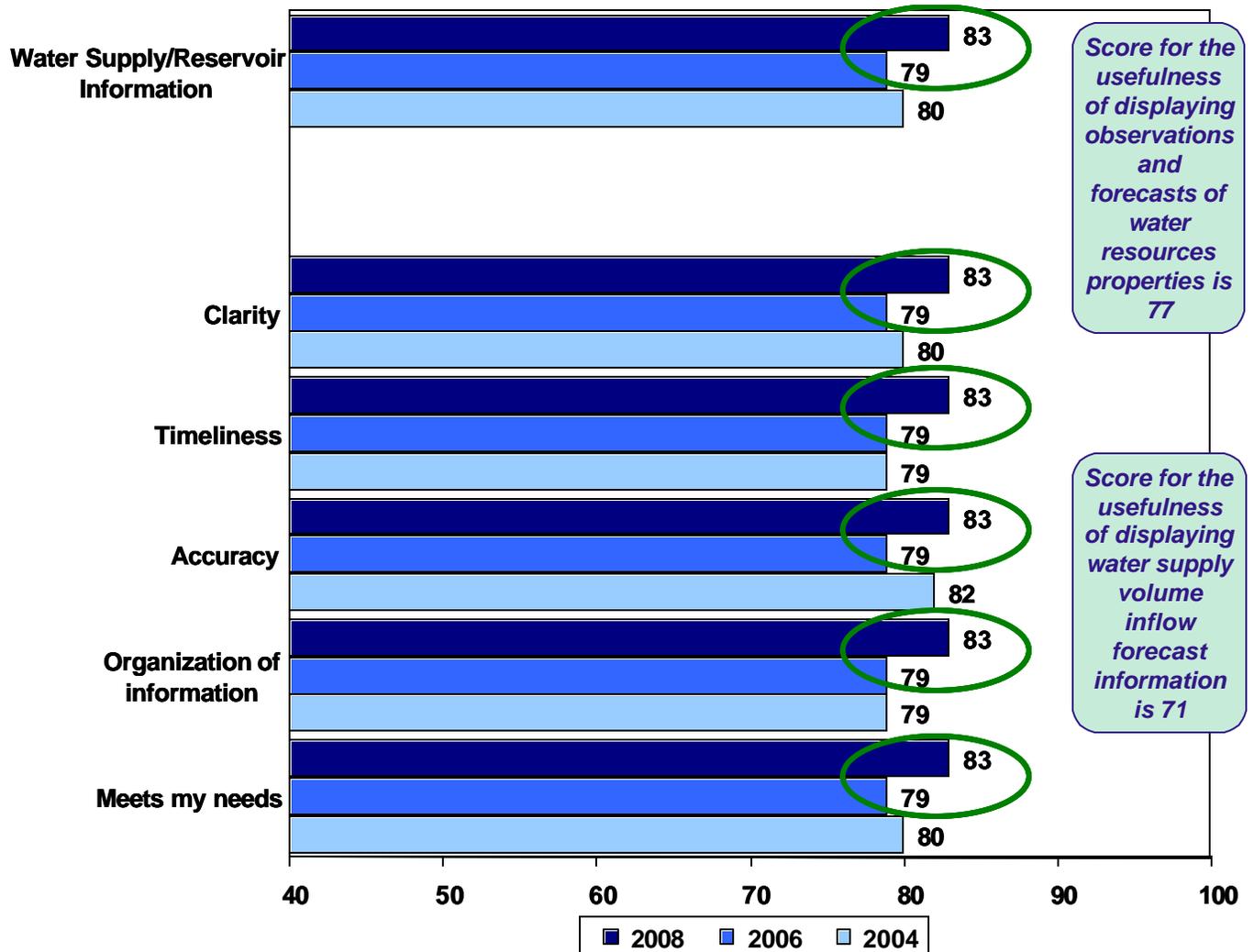


# Research Summary continued

## Water Supply/Reservoir Information

Water Supply/Reservoir Information scores significantly higher than in 2006, with a very strong score of 83. This is also a high impact area (1.1), demonstrating the critical nature of providing this information, and the importance of providing it in the most user-friendly manner possible. Usefulness was asked for displaying both observations and forecasts of water resources properties and water supply volume inflow forecast information. Respondents score the usefulness of displaying observations and forecasts of water resources properties higher (77 to 71).

Figure 7: Water Supply/Reservoir Information component and attribute scores 2008 vs. 2006



=Significant Improvement vs. 2006 at 90% Confidence Level



# Research Summary continued

## High Satisfaction Driver Segmentation

Figure 8: Flood Information and Water Supply/Reservoir Information Scores by Region

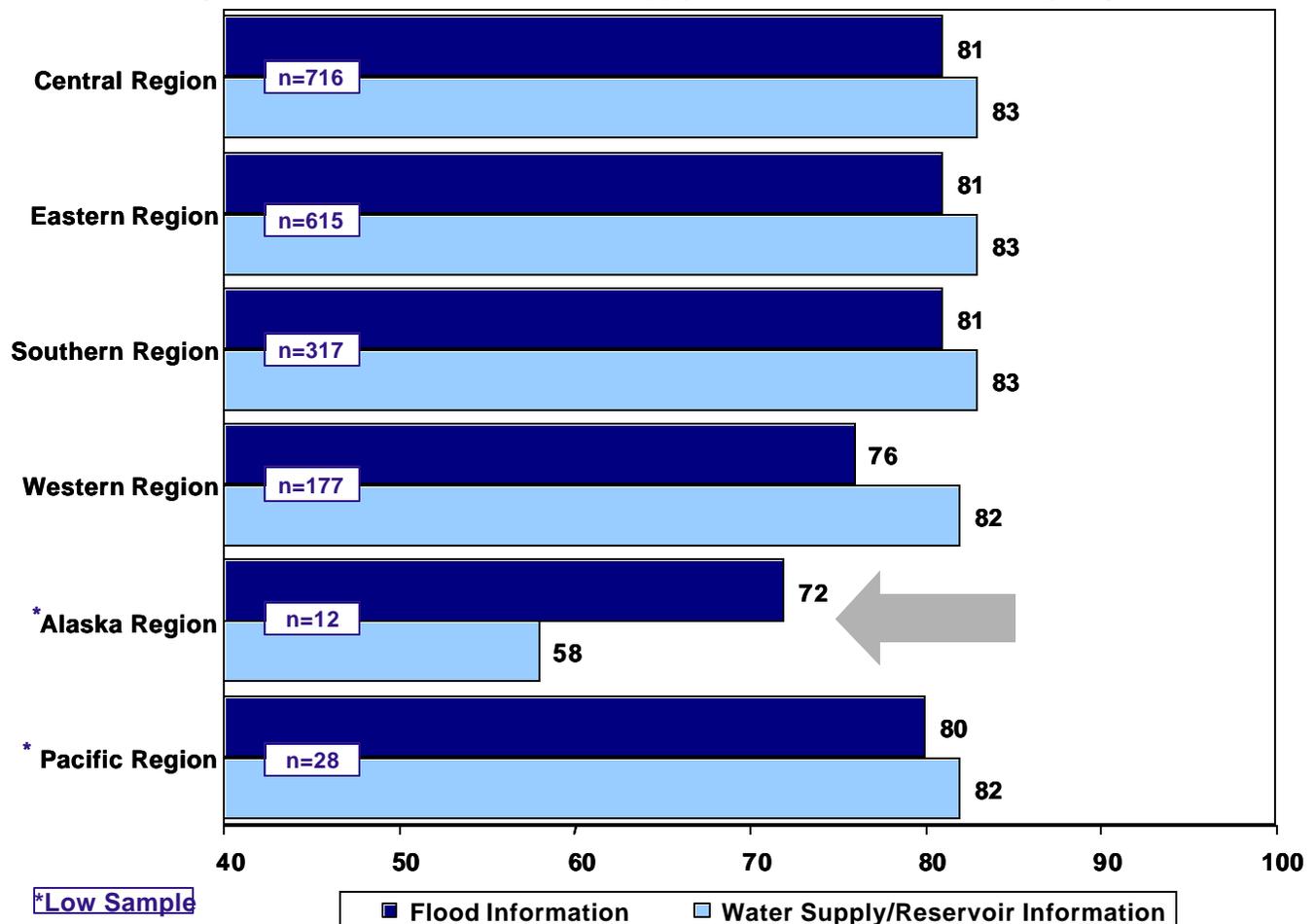


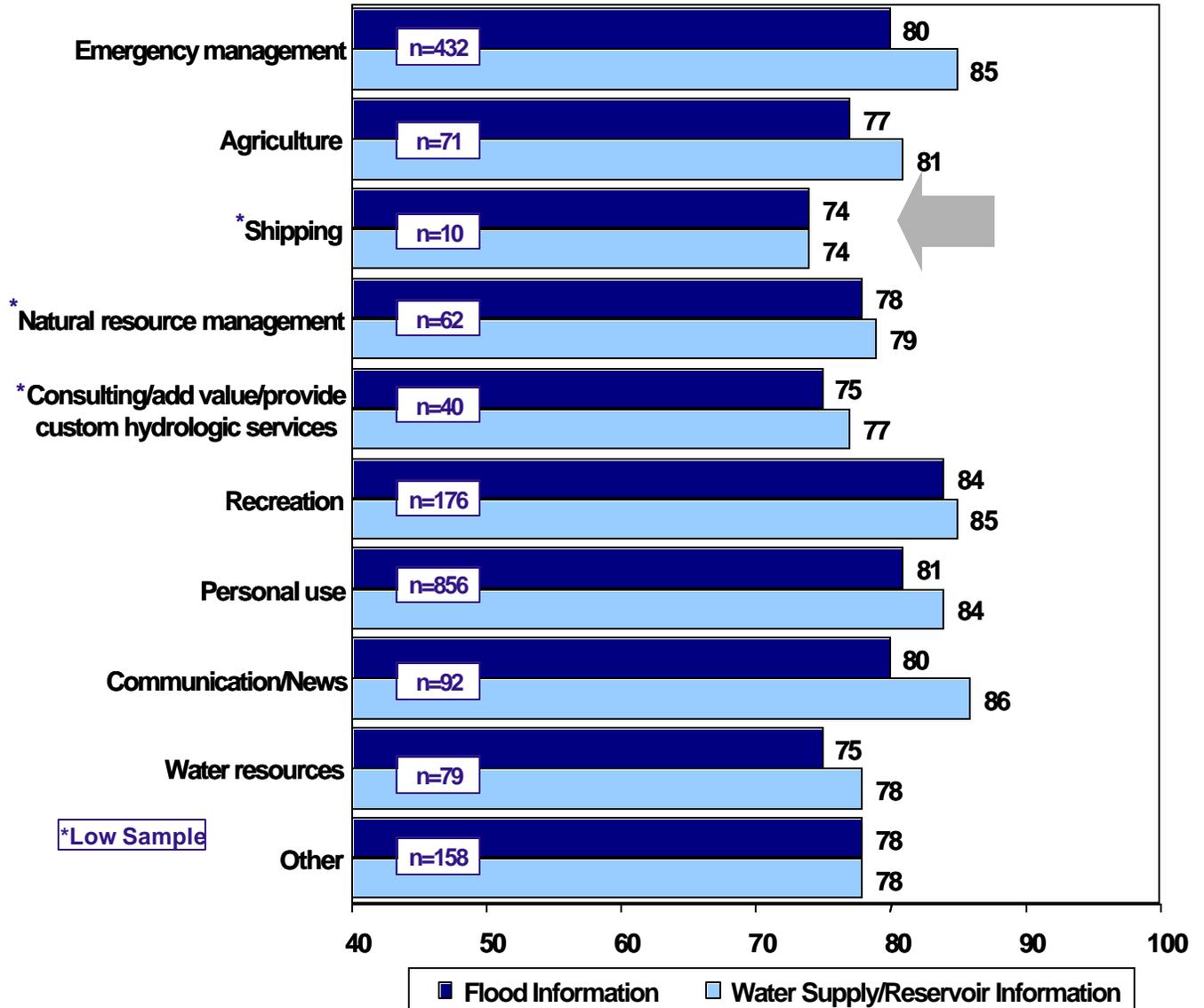
Figure 8 compares scores for the top two drivers of satisfaction (Flood Information and Water Supply/Reservoir Information) by region. While all regions score well in these areas, the Alaska Region scores slightly lower, however it is also lower in sample size. In looking for opportunities to fine-tune scores for these drivers of satisfaction, the Alaska Region could lend insight.

Figure 9 shown on the next page shows the scores by Primary Use of information. Again, the caveat is that for some of these groups, the sample size is low. Nevertheless, Shipping and Consulting score comparatively lower. The NWS should consider reaching out to these groups for further improvement opportunities, if that falls in line with current priorities. Beyond the scores, the verbatim comments provided on the bottom of the following page shows customer commentary that lends further support that the NWS Hydrologic information successfully suits a range of customer needs.



## Research Summary continued

Figure 9: Flood Information and Water Supply Reservoir Information Scores by Primary Use



*I'm a retired newsman and research info to let local outlets know what the long or short term problems are that might be coming our way and I enjoy all the info.*

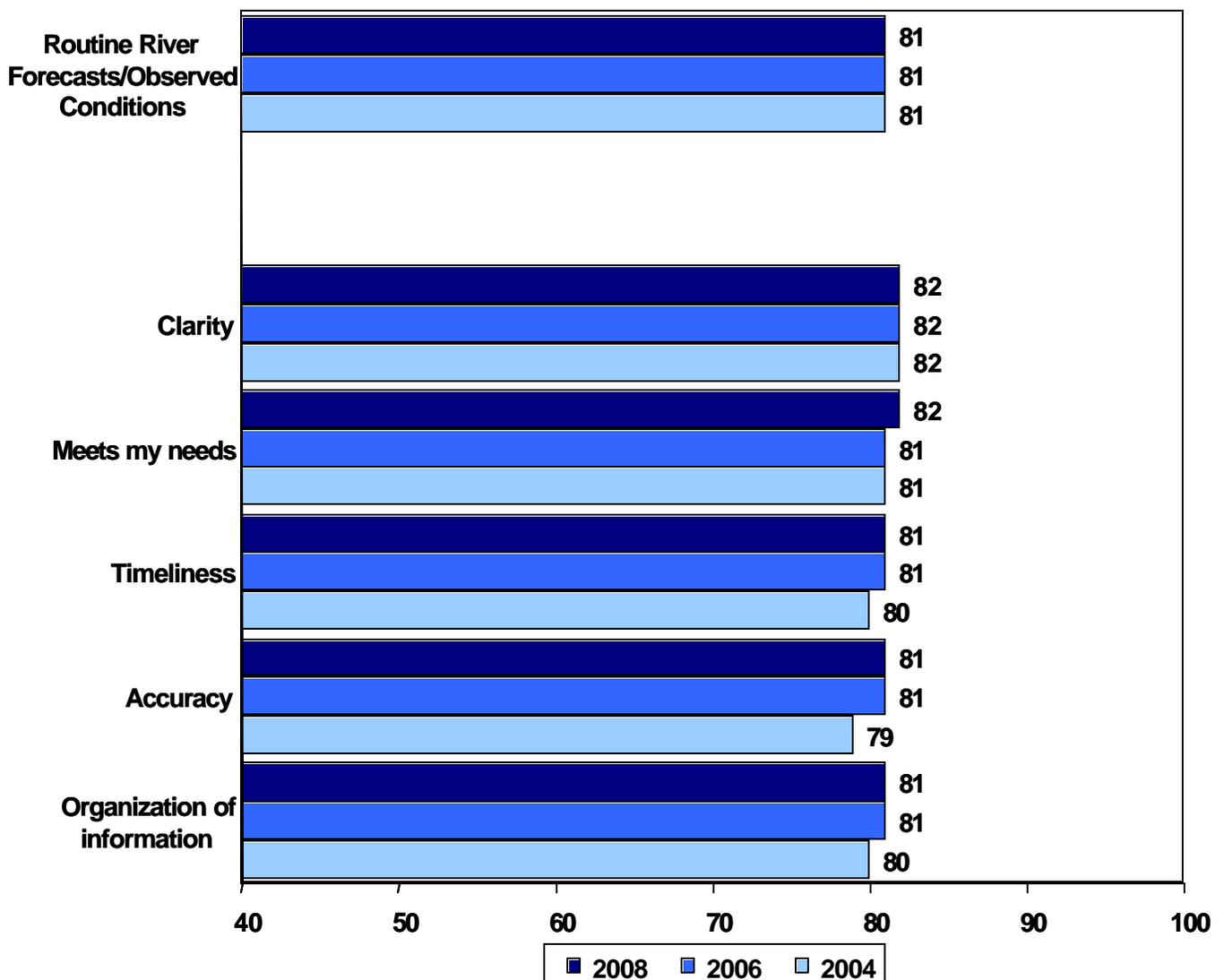


## Research Summary continued

### Routine River Forecasts/Conditions

The Routine River Forecasts/Conditions component scores the same as 2006, very strong (81) with an impact of 0.6. The attributes making up Routine River Forecasts/Conditions also score well, between 81-82, with most scores holding from 2006. This component has a decreased impact on satisfaction (0.6) compared to 2006 (1.1).

Figure 10: Routine River Forecasts/Conditions component and attribute scores 2008 - 2004



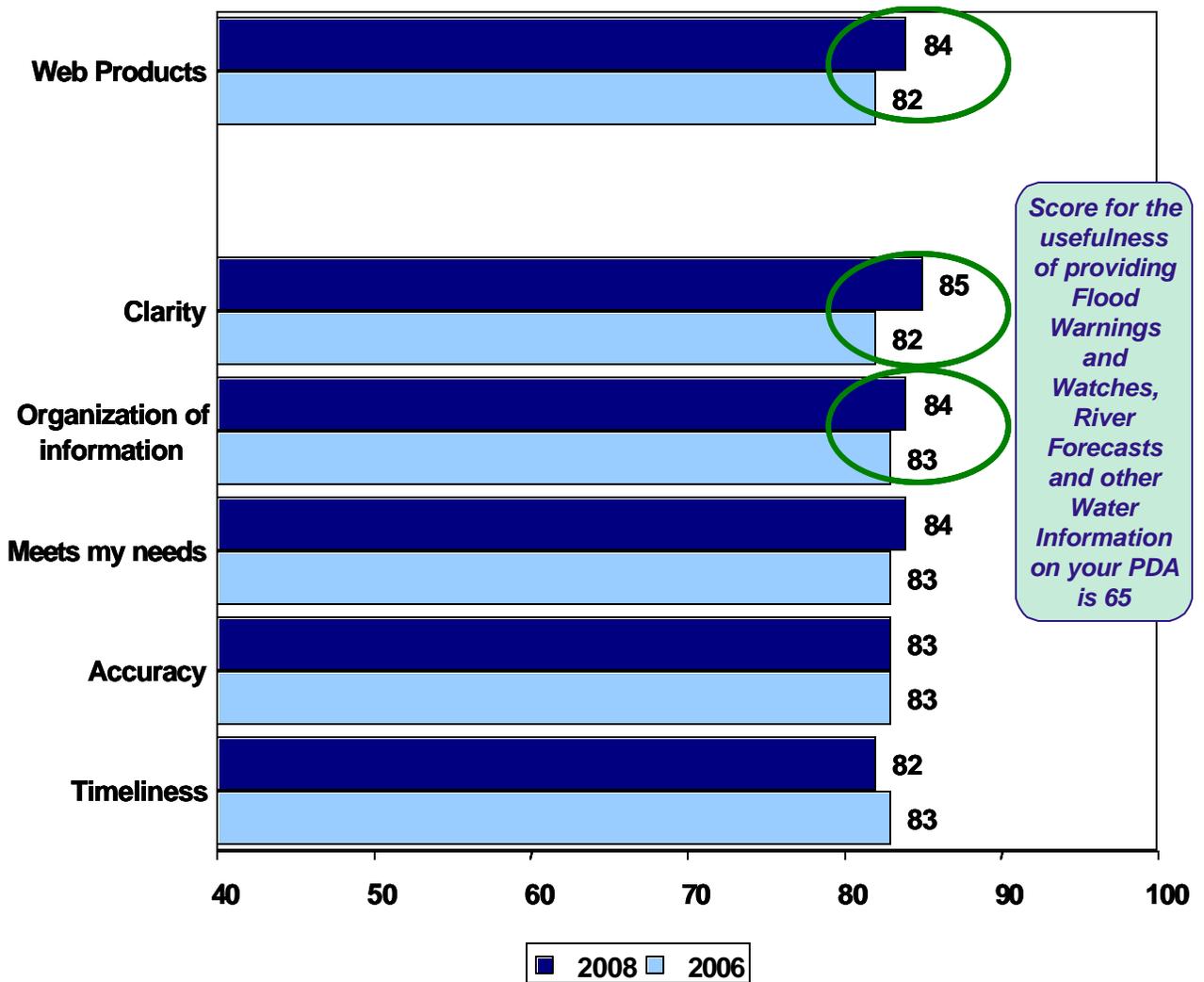


## Research Summary continued

### Web Products

Web Products scored significant higher than in 2006, with a strong score of 84 and an impact of 0.8. Clarity and organization of information also scored significant higher than in 2006. Respondents were also asked to score the usefulness of providing Flood Warnings and Watches, River Forecasts and other Water Information on their PDA, and the resulting score of 65 shows this is not a priority for many respondents.

Figure 11: Web Products component and attribute scores 2008 vs. 2006



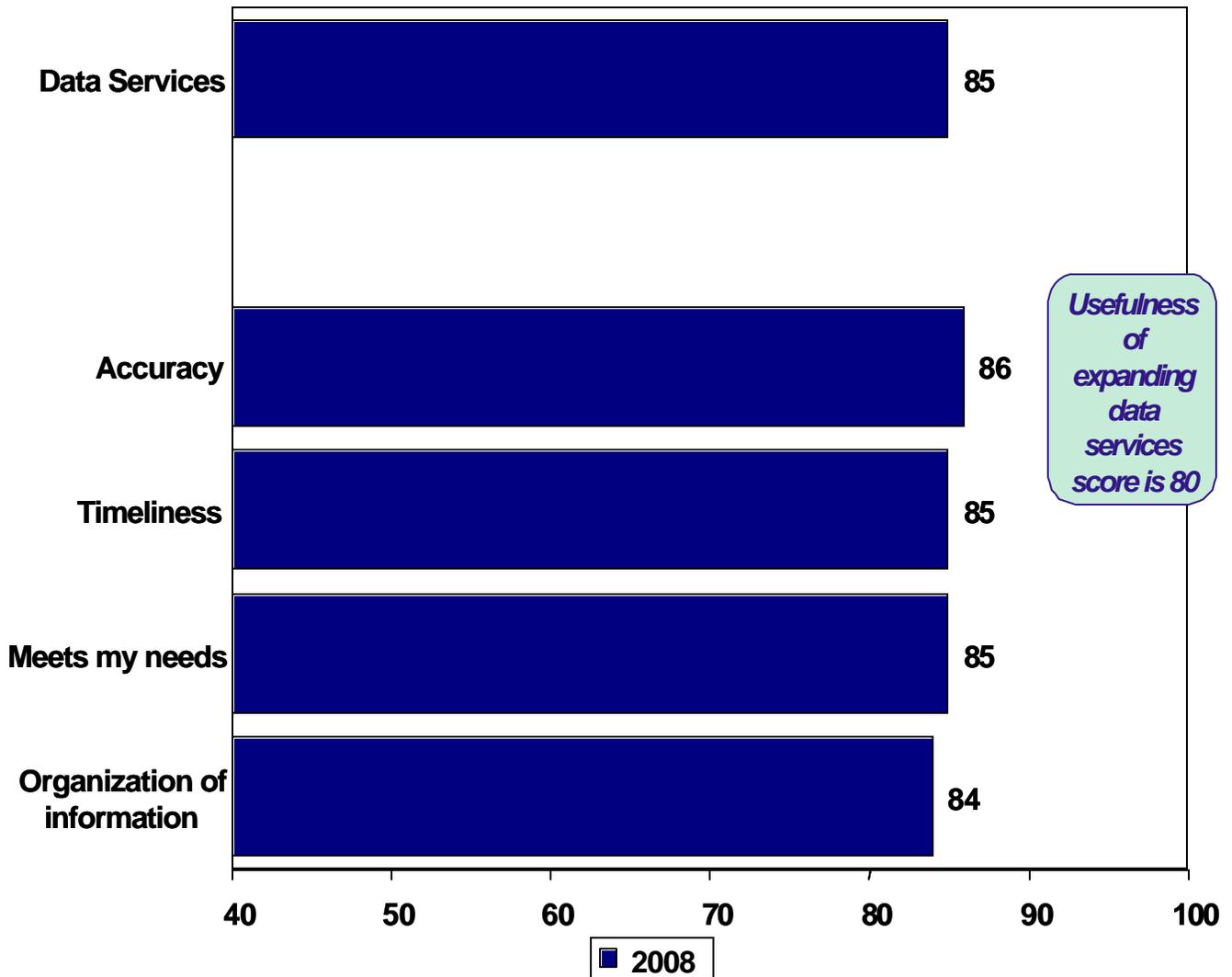
=Significant Improvement vs. 2006 at 90% Confidence Level



# Research Summary continued

## Data Services

Figure 12: Data Services component and attribute scores 2008 vs. 2006



Data Services scores well, 85, and has an impact of 0.4. Respondents were also asked to score the usefulness of expanding data services, and this also scored well (80).

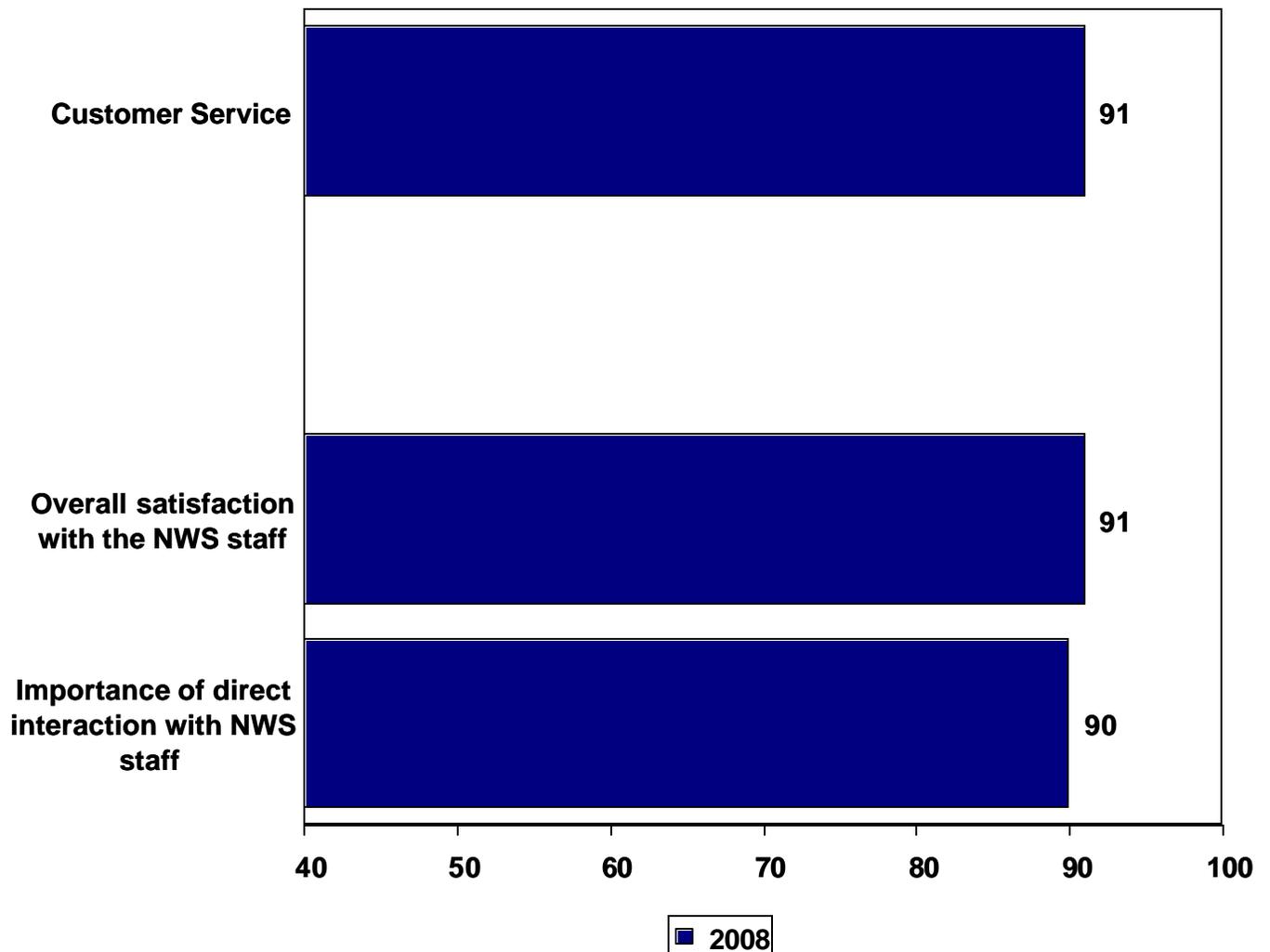


## Research Summary continued

### Customer Service

Customer Service was the highest scoring component, with a score of 91. The impact of Customer Service on Satisfaction is 0.2.

Figure 13: Customer Service component and attribute scores 2008 vs. 2006





## Research Summary *continued*

### Customer Service *continued*

About one fourth of all respondents have directly interacted with NWS staff in the past 6 months. However, Water Resources and Emergency Management report the largest percentage with direct interaction (61% and 57%, respectively). Shipping has the largest percentage (33%) indicating more than 25 hours of direct interaction in a typical year followed by Water Resources (27%). “Getting more information from the forecaster than available in existing products” was the most frequently mentioned reason for interaction with NWS staff regardless of primary use.

<b>Number of Hours Spent Directly Interacting with NWS Staff during a Typical Year</b>	<b>%</b>
Less than 5 hours	50%
5 to 10 hours	24%
11 to 25 hours	14%
More than 25 hours	12%

<b>Purpose of Direct Interaction with NWS Staff*</b>	<b>%</b>
Explanation or interpretation of available forecast products	55%
Gain an understanding of forecaster confidence in forecast products	50%
Synthesize available forecast products and information for your specific needs	56%
Get more information from forecaster than available in existing products	64%

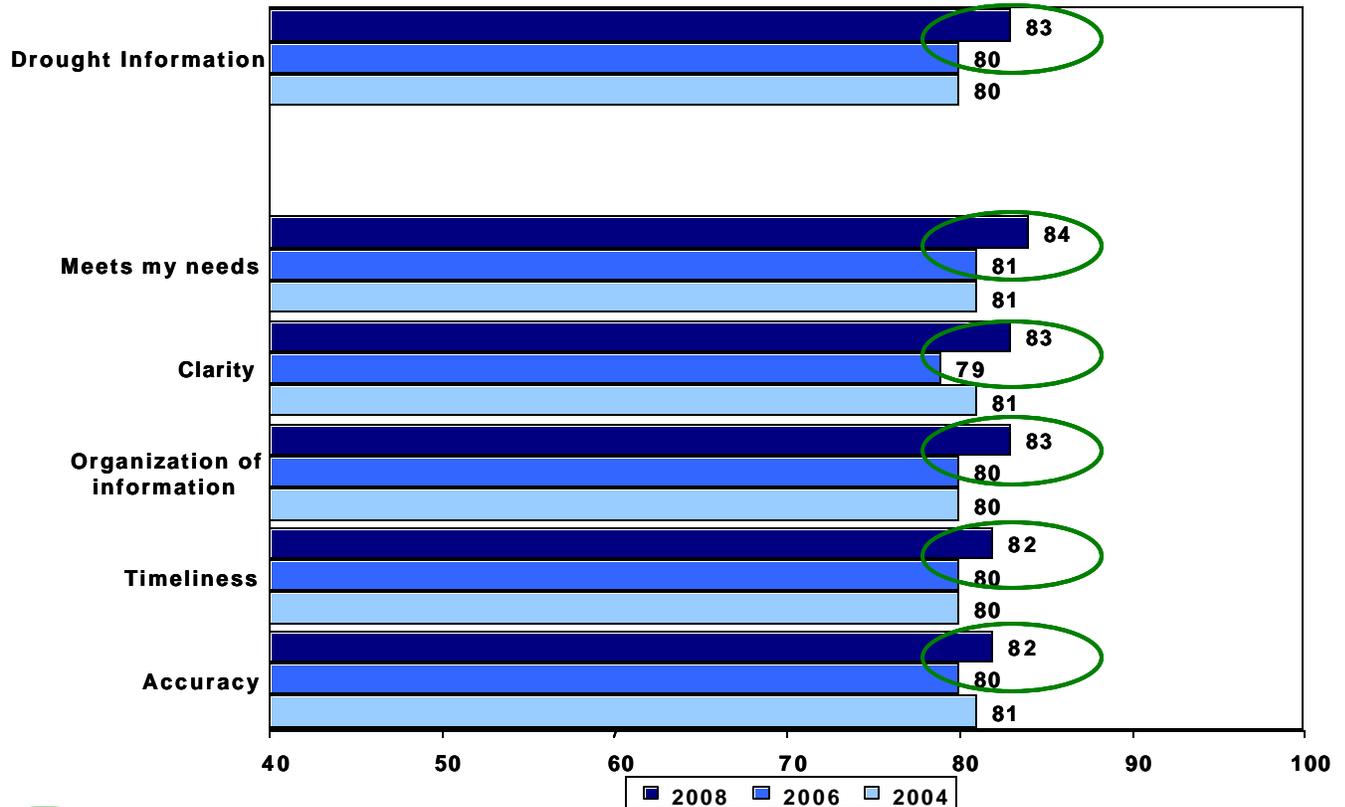
*26% of respondents have directly interacted with NWS staff in the past 6 months*



# Research Summary continued

## Drought Information

Figure 14: Drought Information component and attribute scores 2008 vs. 2006



=Significant Improvement vs. 2006 at 90% Confidence Level

Drought Information scored significantly higher compared to 2006, with a satisfaction score of 88. This component has an impact on satisfaction of 0.0. All of the attributes that comprise Drought Information also had significant increases in score vs. 2006. When comparing Drought Scores by Region for 2008 vs. 2006, most regions showed consistent scores, with the exception of Alaska, which had a large drop in score.

<u>Drought Scores by Region</u>	
Central:	83 (79 in 2006)
Eastern:	83 (83 in 2006)
Southern:	82 (83 in 2006)
Western:	82 (76 in 2006)
Alaska:	50* (95 in 2006)
Pacific:	85* (64 in 2006)

\*Low Sample

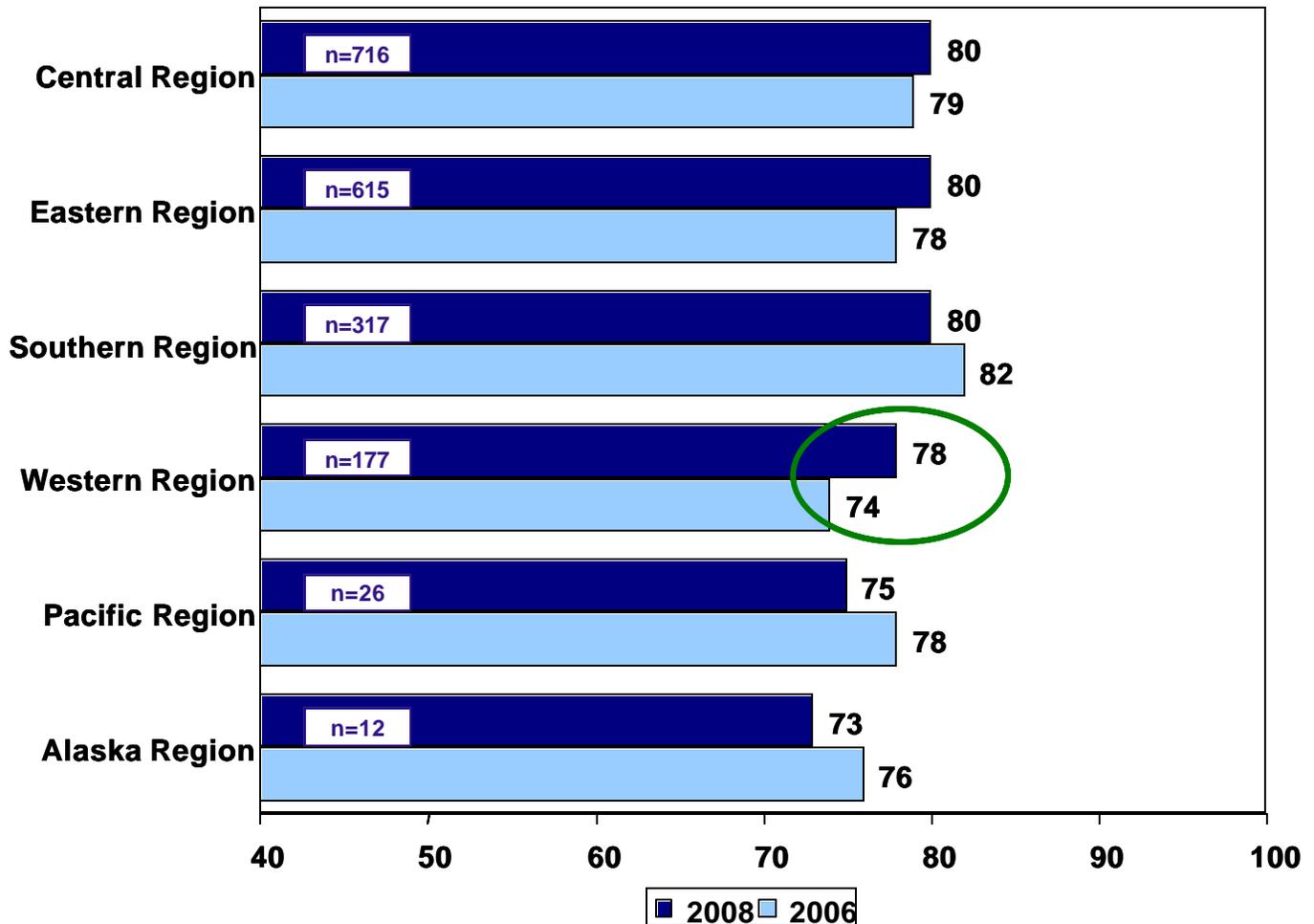


# Research Summary continued

## Segment Analysis

### Region

Figure 15: CSI Scores by Region 2008 vs. 2006



 =Significant Improvement vs. 2006 at 90% Confidence Level

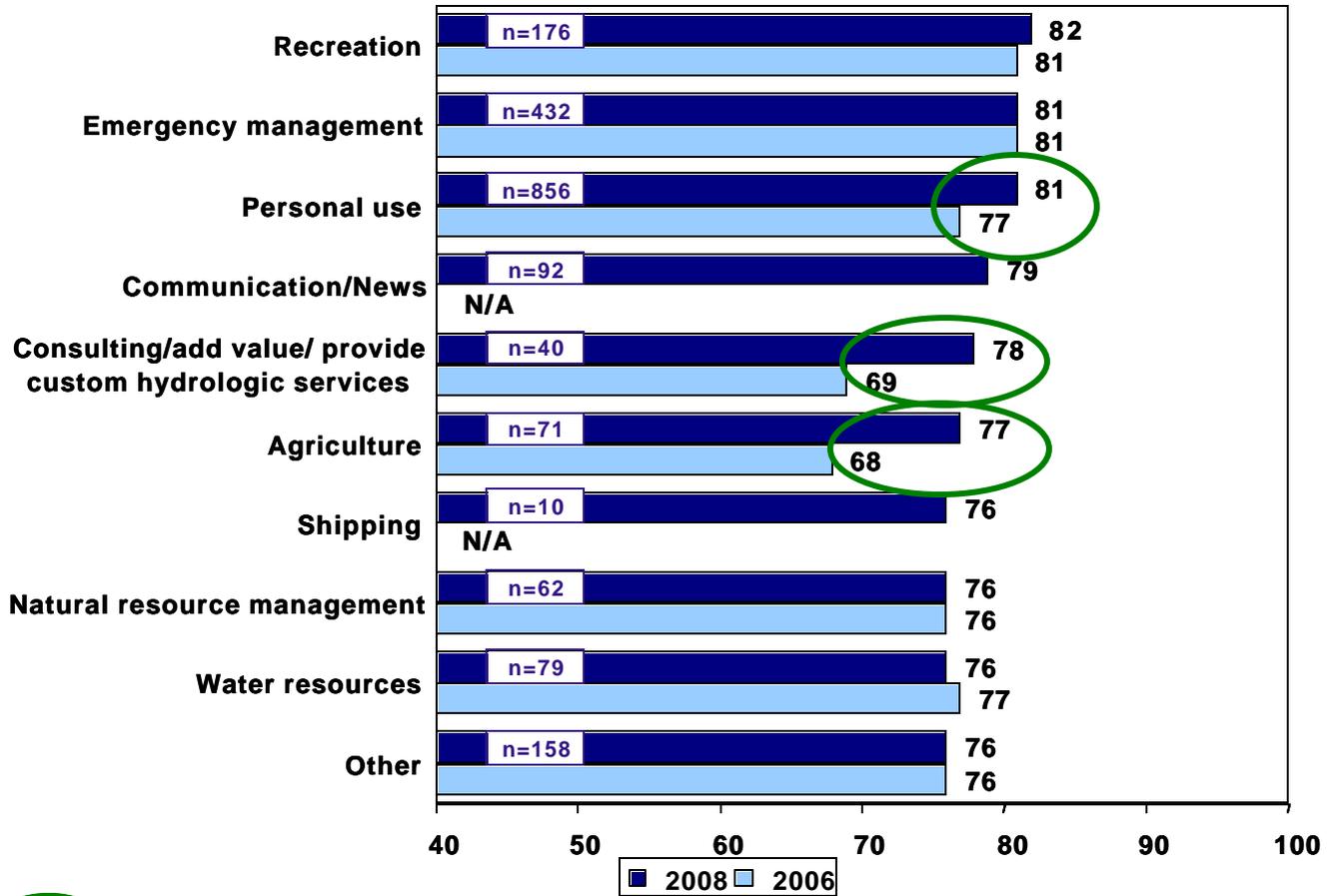
Region customer satisfaction scores range from 73 to 80, and show mixed improvement and decreases. Note the low samples for the Pacific and Alaska region. The Central, Western, and Southern regions score better than the others, with the Alaska region scoring on the low end of the range. While a 73 is still a good score, the Alaska region may want to reach out to its customers to pinpoint any opportunities to improve service.



# Research Summary continued

## Primary Use

Figure 16: CSI Scores by Primary Use 2008 vs. 2006



=Significant Improvement vs. 2006 at 90% Confidence Level

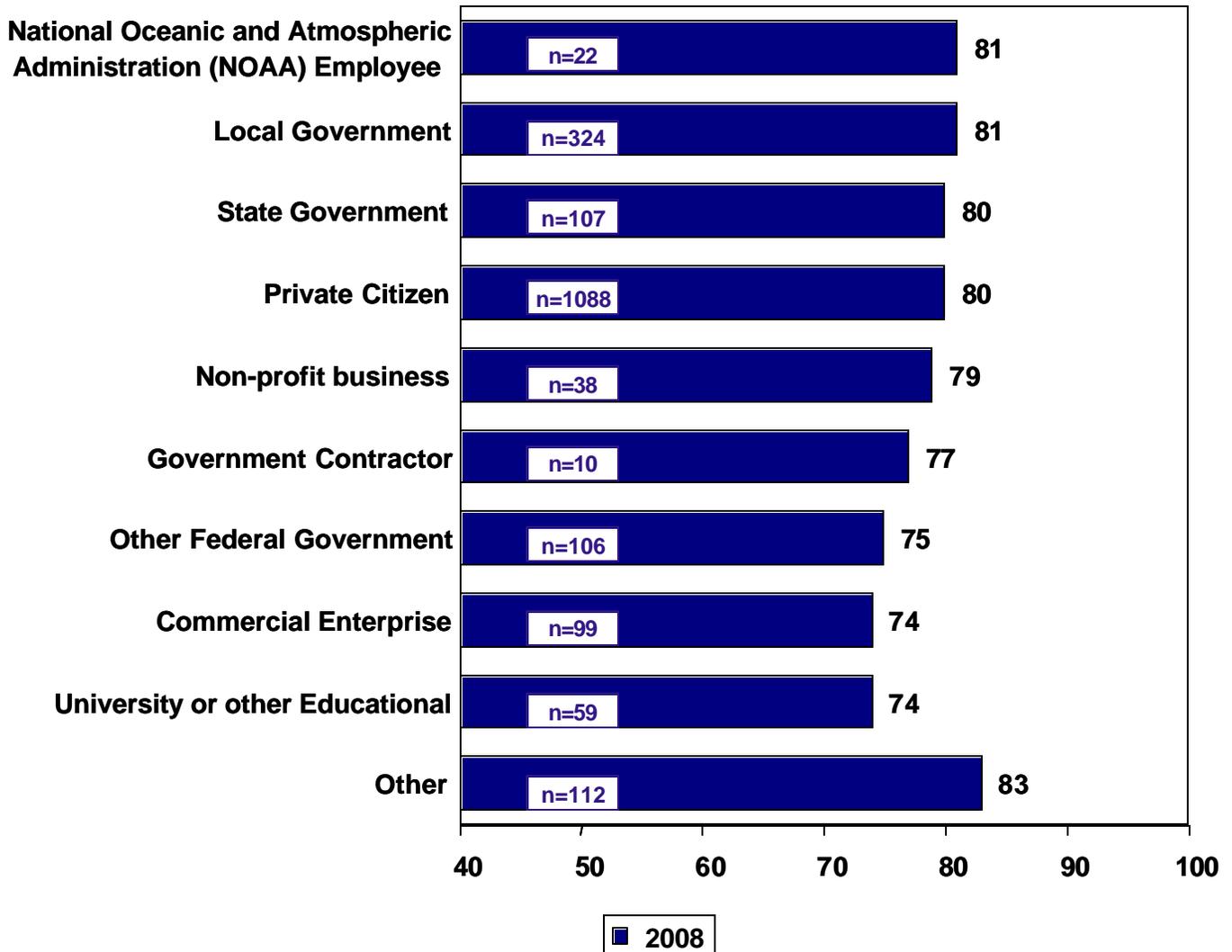
Many user groups show improvement over 2006, including Personal Use, the largest responding population. A number of the groups, Personal Use, Consulting, and Agriculture, showed significant improvement versus 2006. Shipping, Natural Resource Management, and Water Resources scored satisfaction lower than the other groups. Should the NWS resolve to determine how to better provide information by reaching out to specific groups, the opportunity exists within these three groups.



## Research Summary continued

### Primary Sector

Figure 17: CSI Scores by Primary Sector 2008 vs. 2006



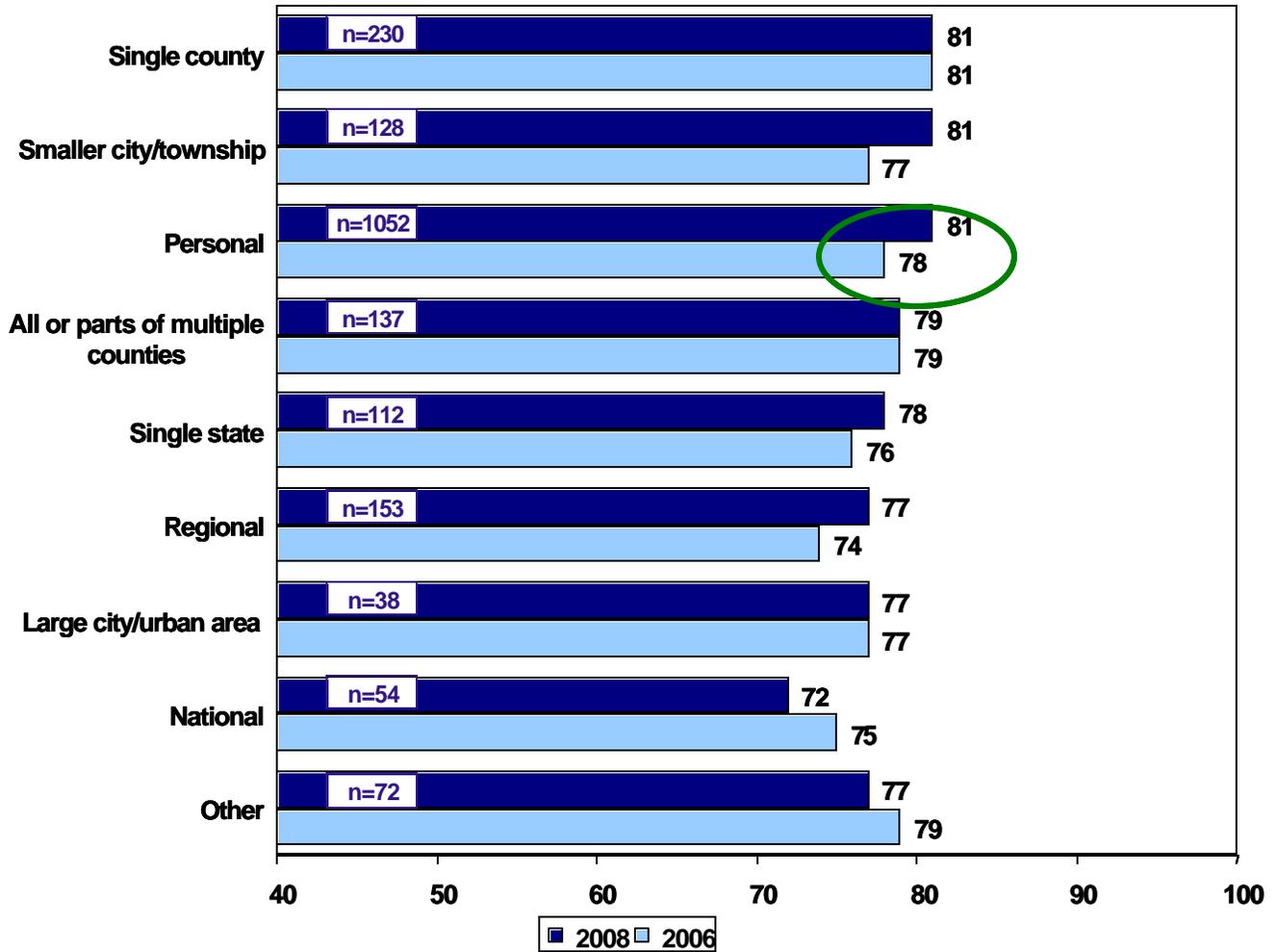
Primary Sector satisfaction scores range from 74 to 83. Satisfaction is highest among NOAA and Local Government employees, however the majority of the sample is Private Citizens. Those comprising the sectors of Commercial Enterprise and University or other Educational had the lowest satisfaction scores.



# Research Summary continued

## Primay Scope

Figure 18: CSI Scores by Primary Scope of Responsibility 2008 vs. 2006



 =Significant Improvement vs. 2006 at 90% Confidence Level

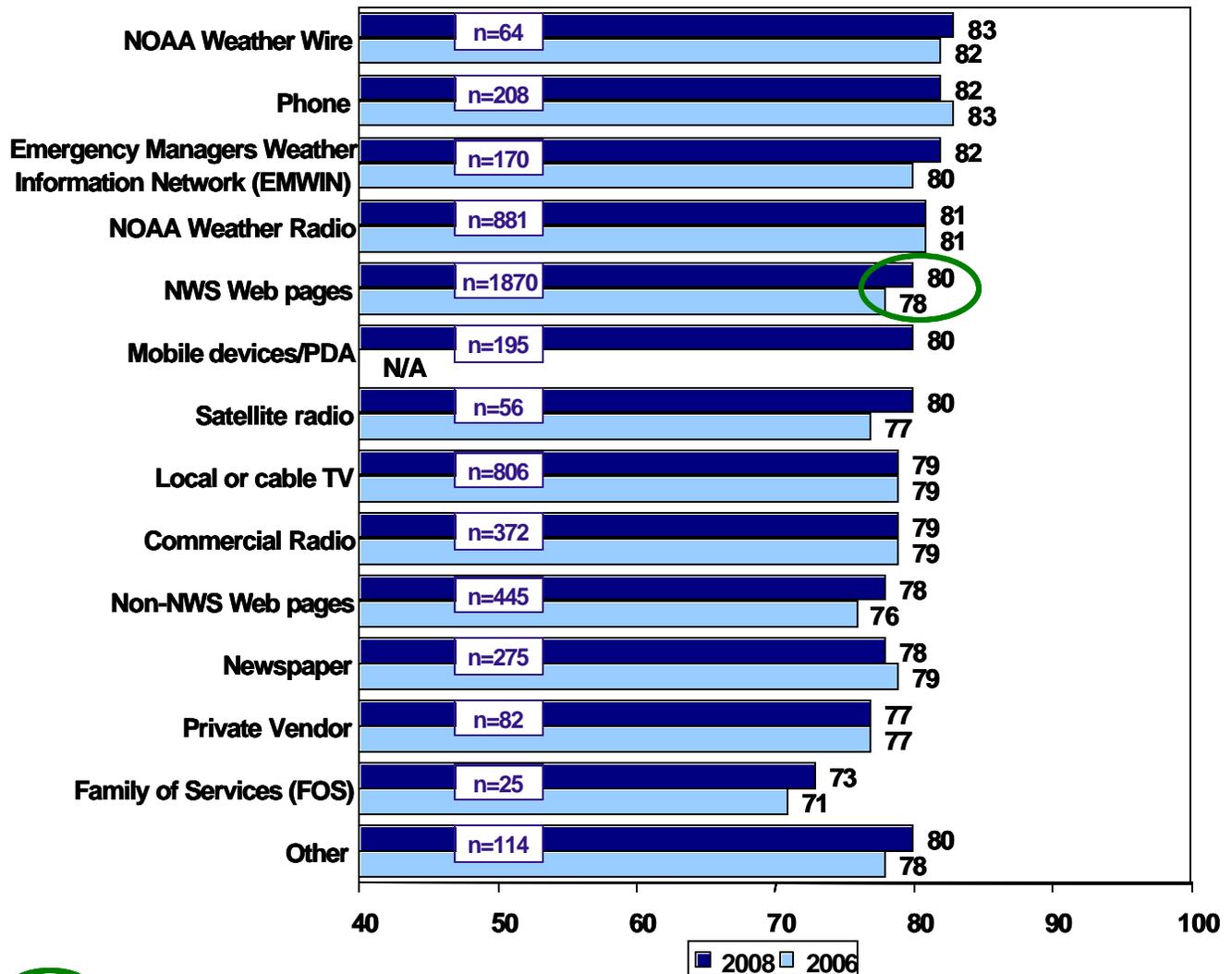
Satisfaction scores by Primary Scope of Responsibility range from 72 to 81, and for the most part show no change or improvement over 2006. Those whose Primary Scope of Responsibility is Personal showed a significant increase in satisfaction compared to 2006. The respondents that chose National as their Primary Scope of Responsibility scored satisfaction the lowest. The majority of respondents chose Personal as their Primary Scope.



# Research Summary continued

## Means of Receiving Hydrologic Information

Figure 19: CSI Scores by Means of Receiving Hydrological Information 2008 vs. 2006



=Significant Improvement vs. 2006 at 90% Confidence Level

Compared to 2006, the 2008 results show no change or increases in CSI among the majority of Means for Receiving Hydrological Information.



## Research Summary continued

### Additional Findings

After the core model questions, respondents were given the option to complete three additional survey segments. The information collected for Internet Services is included below, with Water Resources Services and Data Services information starting on pages 41 and 48 respectively.

#### Survey Part II: Internet Services

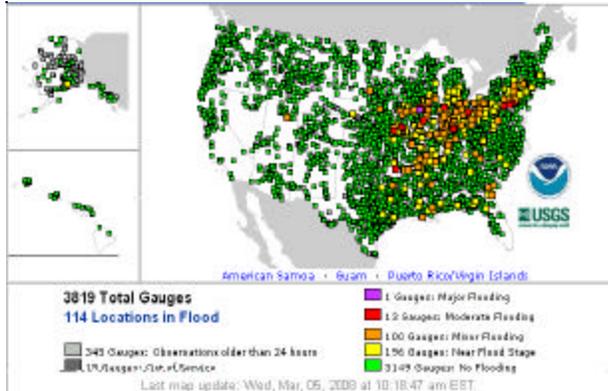
The first of the three voluntary sections is Internet Services. This section contains questions regarding current and proposed graphical formats that exhibit hydrological information. There were a total of 488 respondents to the Internet Services section, with the majority of these respondents primarily using hydrological information for either personal use or emergency management.

<b>Number of Completes for Internet Services by Primary Use</b>	<b>n</b>
Personal use	187
Emergency Management	120
Recreation	37
Water resources	29
Natural Resource Management	20
Agriculture	14
Communication/news	14
Consulting/add value/provide custom hydrologic services	12
Shipping	0
Other	55



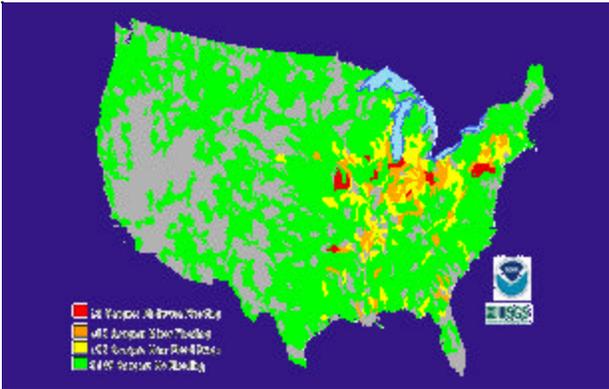
# Research Summary continued

## Survey Part II: Internet Services continued



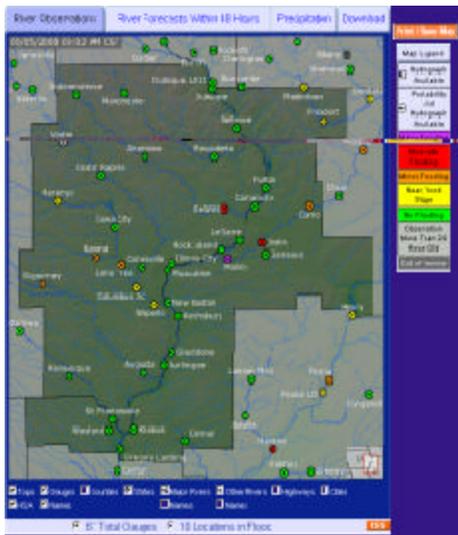
**River Conditions Map**

**Average: 76**  
**73: Visual Appeal**  
**77: Ease of Understanding**  
**78: Tells me what I need to know**



**General River Basins**

**Average: 70**  
**67: Visual Appeal**  
**72: Ease of Understanding**  
**70: Tells me what I need to know**



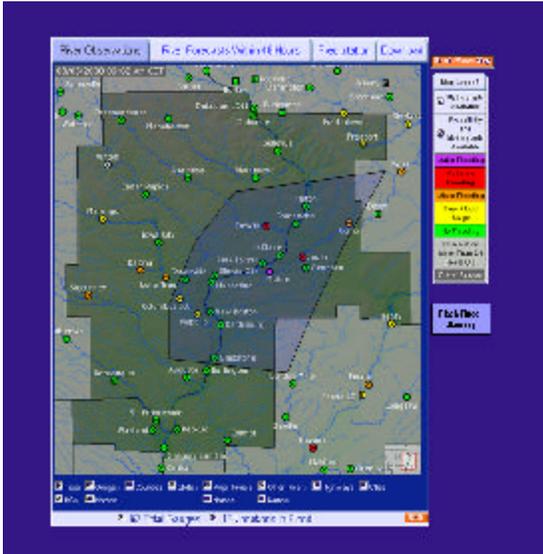
**River Conditions Regional Map**

**Average: 87**  
**86: Visual Appeal**  
**88: Ease of Understanding**  
**86: Tells me what I need to know**



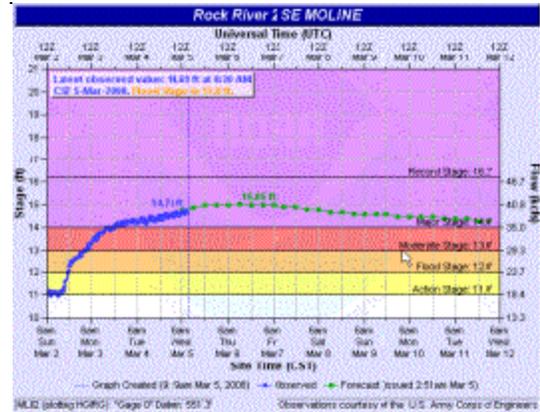
# Research Summary continued

## Survey Part II: Internet Services continued



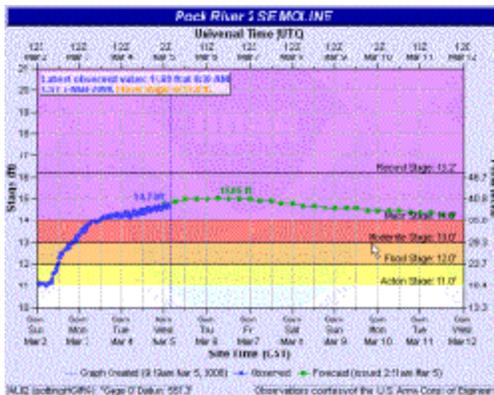
**Current Flood Conditions**

**Average: 86**  
**85: Visual Appeal**  
**86: Ease of Understanding**  
**86: Tells me what I need to know**



**Hydrograph Flood Severity**

**Average: 87**  
**87: Visual Appeal**  
**88: Ease of Understanding**  
**87: Tells me what I need to know**



**Hydrograph Level/Flow**

**Average: 87**  
**86: Visual Appeal**  
**88: Ease of Understanding**  
**88: Tells me what I need to know**



# Research Summary continued

## Survey Part II: Internet Services continued



### Hydrograph Low Flow Threshold

- Average: 83**
- 83: Visual Appeal**
- 84: Ease of Understanding**
- 83: Tells me what I need to know**
- 82: Usefulness of hydrograph when making decisions during periods of low flow**

Inundation where river is 18 feet above flood



### Flood Depth Map

- Average: 86**
- 85: Visual Appeal**
- 84: Ease of Understanding**
- 86: Tells me what I need to know**
- 89: Usefulness of areal extent and depth of floodwaters in decision making process**

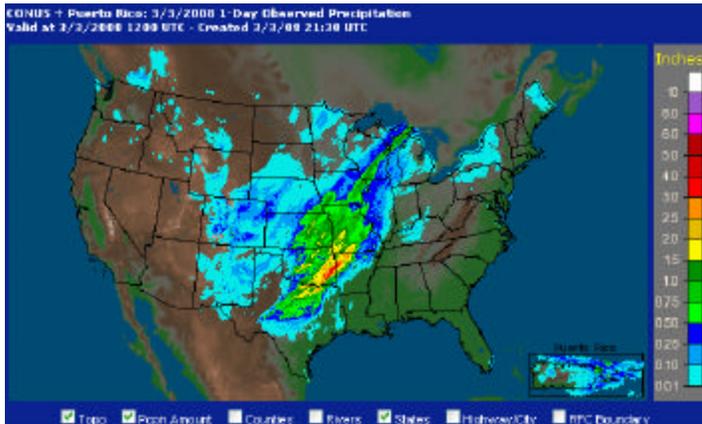
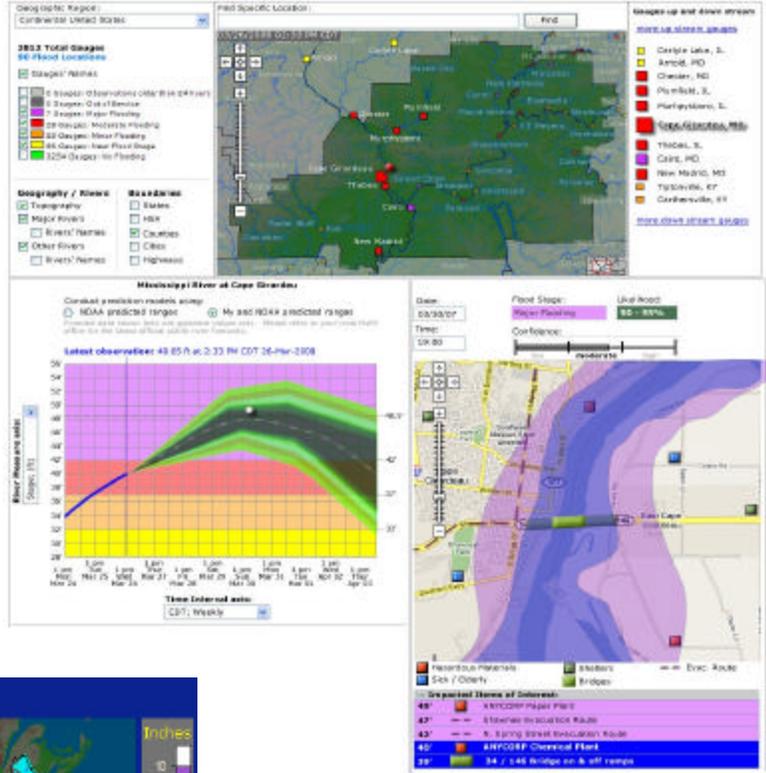


# Research Summary continued

## Survey Part II: Internet Services continued

### Geographic Region Map

**Average: 84**  
**85: Visual Appeal**  
**82: Ease of Understanding**  
**86: Tells me what I need to know**



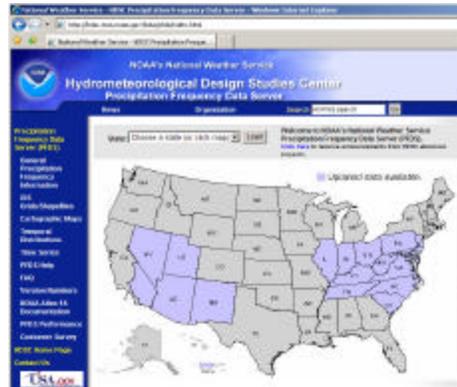
### High-resolution Precipitation Estimates Map

**Average: 89**  
**90: Visual Appeal**  
**90: Ease of Understanding**  
**88: Tells me what I need to know**



## Research Summary continued

### Survey Part II: Internet Services continued



Usage	Yes	No
Use precipitation frequency estimates	51%	49%
Use PMP estimates	32%	68%

Web Pages	Yes	No
Familiar with Precipitation Frequency Data Server web page	55%	45%
Familiar with Hydrometeorological Reports web page	54%	46%

*Score for usefulness of having updated guidelines for PMP estimates is 91*

*Score for usefulness of having updated precipitation frequency updates is 85*



## Research Summary continued

### Survey Part III: Water Resources Services

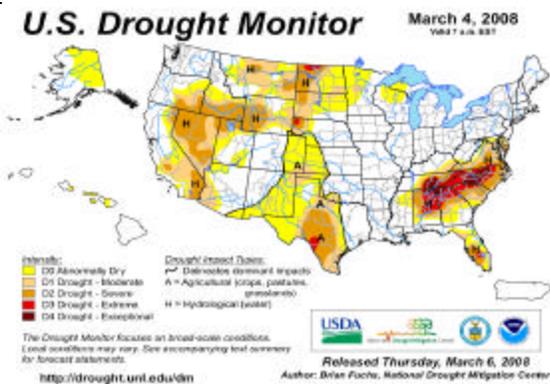
The second of the voluntary sections is Water Resources Services. This section contains questions concerning drought, snow, water temperature, soil depths, and a section of questions for water managers. There were a total of 270 respondents for this section. Forty percent of these respondents continued on to the Water Manager questions that were at the end of the section. Of the 270 respondents, more than half primarily used hydrological information for either primary use or emergency management.

<b>Number of Completes for Water Resources Services by Primary Use</b>	<b>n</b>
Personal use	91
Emergency Management	55
Water resources	29
Natural Resource Management	24
Agriculture	16
Recreation	12
Communication/news	9
Consulting/add value/provide custom hydrologic services	6
Shipping	1
Other	27



# Research Summary continued

## Survey Part III: Water Resources Services continued

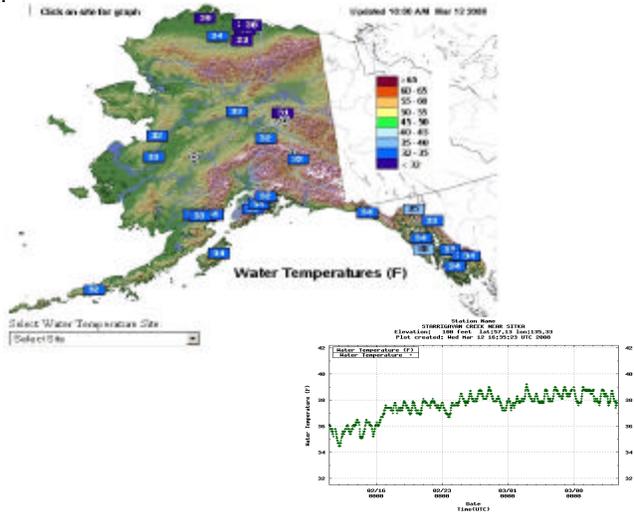


### Observed Drought Conditions Map

**Average: 88**  
90: Visual Appeal  
90: Ease of Understanding  
88: Tells me what I need to know  
83: Usefulness of observed drought conditions in decision making process

### Drought Trends Map

**Average: 87**  
89: Visual Appeal  
89: Ease of Understanding  
87: Tells me what I need to know  
81: Usefulness of trends for drought over next three months in decision making process



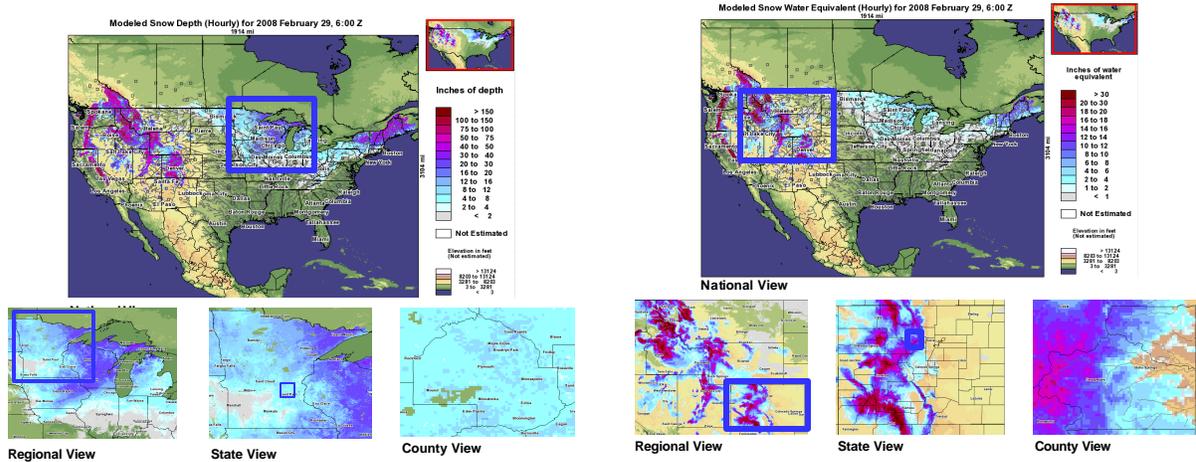
### Observed Water Temperatures Map

**Average: 82**  
87: Visual Appeal  
88: Ease of Understanding  
87: Tells me what I need to know  
70: Usefulness of observed water temperatures in decision making process  
76: Usefulness of receiving water temperatures forecasts for river, streams and lakes for the next five days



# Research Summary continued

## Survey Part III: Water Resources Services continued

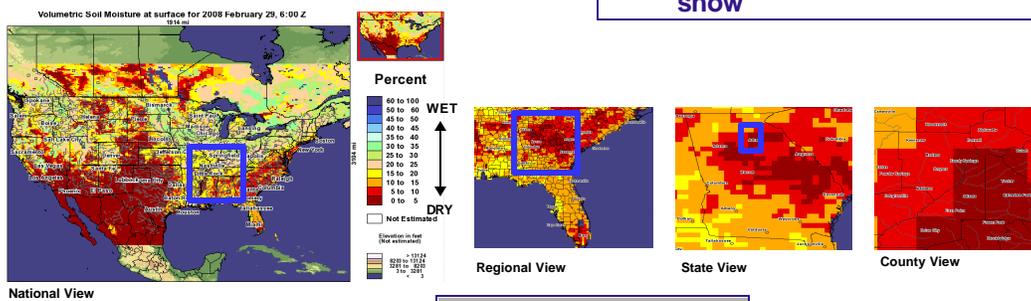


### Snow Depth Map

**Average: 89**  
**90: Visual Appeal**  
**90: Ease of Understanding**  
**90: Tells me what I need to know**  
**84: Usefulness of snow depth map in decision making process**

### National Analysis of the Amount of Water Contained in Snow

**Average: 87**  
**89: Visual Appeal**  
**89: Ease of Understanding**  
**88: Tells me what I need to know**  
**83: Usefulness of estimates of amount of water contained in snow**



### Soil Moisture Map

**Average: 86**  
**88: Visual Appeal**  
**88: Ease of Understanding**  
**88: Tells me what I need to know**  
**80: Usefulness of soil moisture in decision making**



## Research Summary continued

### Survey Part III: Water Resources Services continued

Soil Depth where Soil Moisture is Important*	%
Surface and near-surface	73%
Sub-surface, including typical rooting zone depths (e.g., 20-50 cm to 100-150 cm)	65%
Deeper sub-surface, down to 2-3 meters	29%

Usefulness of Water Resources Properties Forecast	Score
Usefulness of water resources properties forecast for current conditions	90
Usefulness of water resources properties forecast for 48-72 hours	84
Usefulness of water resources properties forecast for 3-5 days	77
Usefulness of water resources properties forecast for 5-7 days	73
Usefulness of water resources properties forecast for more than 1 week to 1 month	65
Usefulness of water resources properties forecast for more than 1 month	60

***57% of respondents say soil moisture at multiple discrete levels is of more value to them; 43% feel that a single value describing bulk soil moisture is more valuable***

**\*Select all that apply**



## Research Summary continued

### Survey Part III: Water Resources Services continued

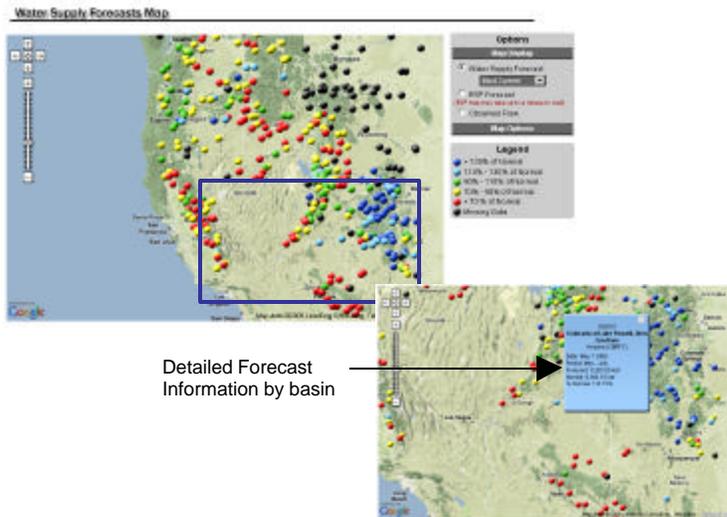
<b>Spatial Scale Describing the Extent of Coverage for which Information would be Important in your Organization</b>	<b>%</b>
National	10%
Regional	29%
Group(s) of watersheds within a large river basin	30%
Single watershed	21%
Sub-watershed	10%

***Score for usefulness of receiving analytical products calculated from water resources data sets and metadata to make the information more relevant is 81***



# Research Summary continued

## Survey Part III: Water Resources Services Water Manager Questions



### Water Supply Volume Inflow Forecast Map

- Average: 86
- 88: Visual Appeal
- 88: Ease of Understanding
- 86: Tells me what I need to know
- 81: Usefulness of water supply volume inflow forecast map
- 89: Usefulness of water supply volume inflow forecast map for the entire United States



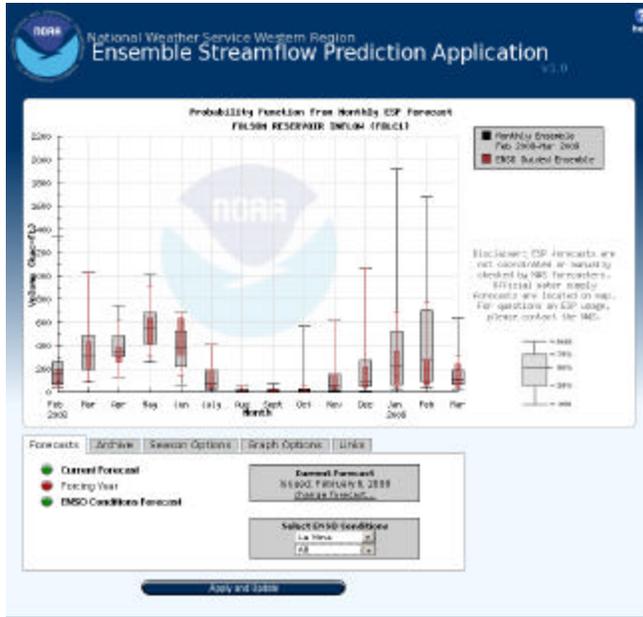
### Water Supply Volume Inflow Forecast Progression

- Average: 87
- 88: Visual Appeal
- 86: Ease of Understanding
- 90: Tells me what I need to know
- 82: Usefulness of water supply volume inflow forecast uncertainty



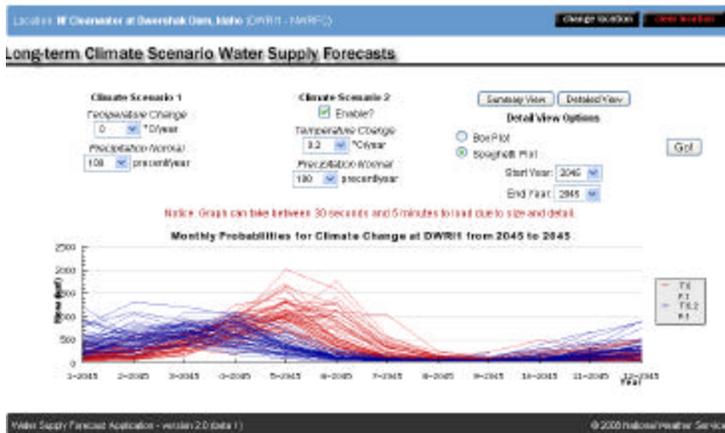
# Research Summary continued

## Survey Part III: Water Resources Services Water Manager Questions continued



### Monthly Ensemble Volume Forecast

**Average: 83**  
**85: Visual Appeal**  
**83: Ease of Understanding**  
**86: Tells me what I need to know**  
**79: Usefulness of monthly ensemble volume forecasts**



### Climate Sensitivity Study

**Average: 76**  
**78: Visual Appeal**  
**76: Ease of Understanding**  
**79: Tells me what I need to know**  
**72: Usefulness of climate sensitivity studies**



## Research Summary continued

### Survey Part IV: Data Services

The final voluntary section is Data Services. There were a total 235 respondents that completed this section, and more than half primarily used hydrological information for personal use or emergency management. This section contains questions regarding both the usefulness of various data methods and the number of tools that can be used for digital information.

Number of Completes for Data Services by Primary Use	n
Personal use	78
Emergency Management	59
Water resources	23
Natural Resource Management	13
Communication/news	10
Consulting/add value/provide custom hydrologic services	10
Recreation	8
Agriculture	6
Shipping	0
Other	28



## Research Summary continued

### Survey Part IV: Data Services continued

<b>Usefulness of Having Access to Flood Watches and Warnings</b>	<b>Score</b>
Usefulness of having access to Flood Watches and Warnings as text	87
Usefulness of having access to Flood Watches and Warnings in XML, including CAP	75
Usefulness of having access to Polygons specifying the area covered by Flood Watches and Warnings	86

<b>Usefulness of Having Access to Hydrologic Model Data</b>	<b>Score</b>
Basin boundaries	82
Historical data used to calibrate models (e.g., Mean Areal Precipitation)	78
Hydrologic model parameters (e.g., soil moisture accounting parameters)	72
Hydrologic model states (e.g., current soil moisture accounting contents)	71
Unit Hydrograph parameters	74
Routing parameters (e.g., lag parameters, attenuation parameters)	72
Rating Curve	74

<b>Usefulness of Having Access to Hydrologic Model Outputs</b>	<b>Score</b>
Raw ensemble streamflow prediction traces	72
Climate forecast adjusted ensemble streamflow prediction traces	73
Statistical water supply forecast	74
Flash flood guidance	86



## Research Summary continued

### Survey Part IV: Data Services continued

Observations	Score
Precipitation	96
Snow accumulation	88
Snow water equivalent	82
River stage/flow	90
Soil moisture	76
Air temperature	87
Dew point	81
Wind speed	84
Atmospheric freezing level	70
Potential evaporation	72
Soil frost depth	66
Forecast	Score
Precipitation	95
Temperature	90
Instantaneous streamflow/stage	86
Streamflow or stage forecast uncertainty information	83
Cumulative streamflow	78
Atmospheric freezing level	68



## Research Summary continued

### Survey Part IV: Data Services continued

<i>Text</i>	<i>Score</i>
ASCII	84
XML (eXtended Markup Language), including CAP (Common Alerting Protocol)	79
<i>Point Data</i>	<i>Score</i>
ASCII text	82
XML, including GML (Geographic Markup Language)	80
SHEF (Standard Hydrologic Exchange Format)	64
Shapefile	75
KML (Keyhole Markup Language)	68
<i>Lines, Vectors, Contours</i>	<i>Score</i>
ASCII text	75
XML, including GML	76
Shapefile	78
KML (Keyhole Markup Language)	70
<i>Grids, Arrays, Rasters</i>	<i>Score</i>
ASCII text	74
Shapefile	77
KML (Keyhole Markup Language)	68
GeoTIFF	78
Bit-mapped graphics (e.g., .png) + Wordfile	74
NetCDF (Network Common Data Form)	63
GRIB (GRidded Binary, versions I and II)	59
BUFR (Binary Universal Form for the Representation of meteorological data)	58



## Research Summary continued

### Survey Part IV: Data Services continued

<b>Usefulness of Various Digital Information Methods</b>	<b>Score</b>
Download (e.g., ftp)	88
Web map service	91
Web feature service	90
Web coverage service	89
RSS (Real Simple Syndication)	79
WAP (Wireless Application Protocol)	76
Usefulness of metadata	82
Usefulness of NWS consistently adhering to Open Geospatial Consortium standards	81



## Research Summary continued

### Survey Part IV: Data Services continued

<b>GIS-Commercial</b>	<b>%</b>
ESRI	38%
Custom Application	19%
Autodesk	12%
Intergraph	7%
Erdas Imagine	4%
ENVI	4%
Idrisi	3%
Other (e.g., Excel, MapInfo, Global Mapper, WDSSII, etc)	9%

<b>GIS-Open Source</b>	<b>%</b>
Geotools	18%
Custom Application	17%
GRASS	9%
ILWIS (GNU)	5%
SAGA	5%
Other (e.g., maps, Geomedia, Spreadsheets, GDAL, etc)	9%



## Research Summary continued

### Survey Part IV: Data Services continued

Scientific Data Analysis, Modeling and Visualization	%
Custom Application	17%
NCAR Graphics/NCL	11%
AWIPS	10%
MatLab	10%
GEMPAK	6%
IDL	6%
CrADS	4%
PV-Wave	4%
AVS5	3%
Vis5D	3%
Other (e.g., HEC products, Excel, GeoMedia, WDSS II)	9%

Other Categories	%
Keyhole Markup Language viewers	37%
GPS/Navigation	31%
Image Processing/Computer Graphics	31%
TV/Media Groups	26%
CAD Tools	17%
Geo-aware Databases	11%
Specialized Spatial Information Services	5%
Other (e.g., HTML, JavaScript, MarPlot)	5%



## Research Summary continued

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### Conclusions & Recommendations

The performance of the National Weather Service Hydrologic Services Program showed significant improvement in Satisfaction in its third year of measurement. With a customer satisfaction score of 80, the NWS performs among the highest of federal government agencies. Several components that drive satisfaction also showed significant improvements compared to 2006 - Web Products, Water Supply/Reservoir Information and Drought Information. One of the outcomes of CSI Confidence in NWS, also improved significantly. As was found in prior studies, NWS is appreciated for the services they provide.

### Recommendations

The significant improvement in Satisfaction and in three of its principal drivers is a result of NWS successfully implementing the recommendations from prior studies. In particular, NWS has focused on understanding the needs of different primary users - such as emergency management, water resources, agriculture, shipping, communications, recreation, and personal use – and revising and developing specific products to meet their needs. The results of this study indicate that, even with significant progress, there are opportunities for continued improvement.

The areas below are recommended for improvement based on the results of the 2008 study.

#### Focus of Resources

Flood Information continues to have high impact but scores lower (relative to the other components) and should be the first priority in any improvement efforts. However, Water Supply/Reservoir Information and Web Products are second and third, respectively, in impact on Satisfaction. While both are high scoring, NWS must keep resources focused on maintaining the current level of performance in these areas.

#### Improve Functionality and Visual Appeal of Graphics

Visual representation remains important with users of all types, and about 95% get products via the Internet and “visual appeal” and “ease of understanding” are critical. It is important to have products that users can understand with minimal help from NWS since a large percentage of users indicate personal use as their primary need. NWS should work with government and business users (e.g., emergency managers, water resource managers, shippers, etc.) to provide training or tutorials if necessary to help meet their needs.



## Research Summary continued

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Respondents rated a number of existing and proposed new products in the three voluntary sections at the conclusion of the survey: Internet, Water Resources, and Data Services. Among existing products, respondents rated the following maps above 85 on all areas (visual appeal, ease of understanding and tells me what I need to know): River Conditions Regional Map, Hydrograph Flood Severity, Hydrograph Level/Flow, and High-resolution Precipitation Estimates. Among proposed products, the Flood Depth Map and Water Supply Volume Inflow Forecast Map were rated above 85 in usefulness.

### **Target User Groups and Geographic Areas**

Shipping, Agriculture and Water Resources had lower scores than other user groups for the high impact areas of Flood and Water Supply/Reservoir Information. For all groups, timeliness of information had the lowest scores and might be the one area to focus on initially. Respondents from the Alaska Region also had lower scores for Flood and Water Supply/Reservoir Information as well as Drought Information. All attributes in these areas scored far below the average for other regions. Follow up with NWS personnel familiar with the Alaska Region might provide insight into why these three areas in particular have low scores.

### **Address Water Managers Preferences**

Water managers indicated a high usefulness of a Water Supply Volume Inflow Forecast Map and a Water Supply Volume Inflow Forecast Progression. On the other hand, they indicated somewhat less usefulness for a Monthly Ensemble Volume Forecast and Climate Sensitivity Studies.