

# **Information/Data Needs for Floodplain Management:**

## **The Red River Basin Workshop Report**

Jointly Sponsored by the  
International Joint Commission (IJC)  
and the  
Global Disaster Information Network (GDIN)

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Information/Data Needs for Floodplain Management

Red River Drainage Basin

For GDIN and IJC Task Force Review Only

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**Information/Data Needs for Floodplain Management:  
The Red River Basin  
Draft Report**

**PREFACE**

The Red River of the North drainage basin covers portions of North Dakota, Minnesota and Manitoba, and is a tremendously rich agricultural area. It is also a tremendously flat region that was once the bottom of an ancient lakebed. As a result, it is marked by periodic episodes of flooding. According to a report prepared by the Red River Water Resources Council, records indicate that major flooding of this watershed prevailed in 18 of the previous 120 years. The paradox presented by living in an agriculturally attractive area that is, at the same time, hazard-prone poses unique land management challenges.

The most recent flood event occurred in 1997, causing extensive damage throughout the Red River Valley. A binational task force was subsequently formed, under the direction of the International Joint Commission (IJC), to make recommendations for how to reduce future flood damages within the Red River Basin. One of the key recommendations that arose from the task force deliberations called for the development of a relevant information base that would allow for the integration of data and information in support of monitoring and alerting procedures.

At the same time that the IJC was crafting its comments, a separate initiative – the Global Disaster Information Network (GDIN) – was underway within the U.S. Federal Government. The aim of GDIN is to promote a more effective exchange of information and resources in support of disaster management. The concept of a relevant information base within the Red River was well suited to the goals laid out in the GDIN design.

Three workshops, jointly sponsored by the IJC and the GDIN program, were held within the Red River Basin to solicit feedback on the type of data and information needs that arise from resident stakeholder interests. This report synthesizes the results of those workshops and also provides the basis for framing an information network approach that has relevance to a widely disparate information user/provider community.

## 1. BACKGROUND

### 1.1 Summary of the 1997 Red River Flood

The Red River Basin originates in Minnesota and flows north, situated in the geographic center of North America. It forms the boundary between Minnesota and North Dakota and enters Canada at Emerson, Manitoba, reaching northward to Lake Winnipeg (**Figure 1.1**). It lies within a highly productive agricultural area serving local, regional and international food needs. The Red River flood of 1997 caused widespread damage throughout the Red River Valley.

The basin itself covers approximately 45,000 square miles (116,500 square kilometers) of which nearly 40,000 square miles are located within the United States. The remaining 5,000 square miles (13,000 square kilometers) are in Canada.

In the 20th century, major floods of the Red River basin occurred in 1950, 1966, 1979, 1996 and 1997. One common characteristic is "overland flow" during times of heavy runoff. Water overflows small streams and spreads overland, returning to those streams or other watercourses downstream. The International Joint Commission (IJC) Interim Task Force Report (*suggest we give the web site here*) states that existing monitoring and forecasting systems do not track these flows well, leading to unanticipated flooding.

The basin is extraordinarily flat, with an elevation difference of only 233 feet (71 meters) over a distance of approximately 545 river miles (872 kilometers). The slope of the river averages less than one-half foot per mile (0.15 meters per 1.6 kilometers). During major floods, the entire valley becomes the floodplain. In 1997, the Red River spread to a width of about 25 miles in Manitoba. The IJC reported that the flatness of the terrain limits the development of natural storage sties for water. While small dams have been constructed, opportunities for major flood control reservoirs do not exist.

About three-fourths of the basin's approximately 20 inches (50 centimeters) of annual precipitation occurs during April through September. Normally, the dry winter months with low snowfall do not create conditions for flooding. Most major floods occur following heavy precipitation the previous fall, hard and deep frost prior to snowfall, substantial snowfall, rapid thaws, and heavy rainfall or wet snow conditions during the spring breakup. It is important to note that the low absorptive capacity of the basin's clay soils is a contributing factor. Ice jams occasionally occur, often on tributaries, causing backwater flooding and exacerbating main stem flood conditions.

## 1.2 IJC Task Force Formation and Charter

In the aftermath of the RRN flood of 1997, the governments of Canada and the United States agreed that steps should be taken to reduce the impact of future flooding. In June 1997, they asked the IJC to analyze the cause and effects of the Red River flood of 1997 and to recommend ways to reduce the impact of future flood events.

Reaching back as far as 1929, the IJC has a long history of involvement in trans-boundary water issues in the Red River Valley. Since 1948, the IJC has had investigative responsibilities regarding requirements, further uses, appointment and planning for waters in the mid-western portion of the international boundary area, including the Red River Basin.

Specifically, the governments asked the IJC to provide an Interim report by December 31, 1997, and a Final report as soon as practicable. In September of 1997, the IJC announced appointment of the International Red River Basin Task Force to examine a range of alternatives to prevent or reduce future flood damage. The Task Force has made 40 recommendations on short-term measures that governments should consider to prepare for the possibility of a flood in 1998 or 1999. The Task Force, comprised of members from a variety of backgrounds in public policy and water resources management, will provide advice to the Commission on matters identified in the letters from governments.

The Task Force's studies aim to provide insights and advice for decision-makers on reducing or preventing devastation such as occurred during the 1997 flood. The Task Force's work will also provide useful data and tools for those who plan, design, and implement flood reduction policies, programs and projects. These data and tools will provide those with operational responsibilities a much greater ability to forecast flood events and to carry out efficiently emergency measures to save lives and property. The study will also address the question as to what collaborative and integrated problem solving mechanisms are required in the Red River basin. The aim is to enhance coordination and cooperation throughout the entire basin long after the Task Force has finished its assignment.

In summary, the Task Force has defined specific objectives for its investigations as:

- Develop and recommend a range of alternatives to prevent or reduce future flood damages.
- Improve tools for planning and decision making.
- Facilitate integrated flood management in the basin.

The Task Force will define the required studies, coordinate the funding and scheduling, exercise quality control, provide oversight of subgroups, synthesize the findings, and prepare the recommendations for the final report to the IJC. The Task Force has established three subgroups— Database, Tools, and Strategies— to conduct or direct much of the data collection, model development, program evaluation, and to prepare preliminary recommendations. Each subgroup has subject matter experts from the United States and

Canada. The work will be accomplished directly by subgroup members or through contracts and work agreements with consultants, institutions, and agencies. The Task Force will coordinate and synthesize the work of the three subgroups.

A specific charge presented by the Task Force to the Database Subgroup is to evaluate, assemble, and collect data to “ensure that all [relevant] data area accessible to all users in order to provide support for all floodplain management activities. The task force recommendation to devise strategies to effectively integrate and manage disparate data and information types parallels the vision of the Global Disaster Information Network (GDIN). GDIN is a multi-agency initiative underway within the U.S. to promote cooperation between user and provider interests in support to disaster management. One way to reach that goal is to develop an information infrastructure that is relevant to a broad stakeholder community. Such a targeted integrative effort, along with supportive decision support capabilities, provides a means to leverage GDIN and IJC interests by developing a prototype capability in support to broad stakeholder needs.

### **1.3 Description of the Information Integration and Decision Support System Concept**

The IJC Red River Basin Task Force has been suggested as best qualified to serve as the catalyst to devise an optimum strategy for the integration and management of critically needed information to support the mission of floodplain management. Specifically, the Task Force has been working to devise a strategy to identify an information infrastructure for the area of interest, to promote this concept within the broadest possible stakeholder community, and to make recommendations for a sustainable virtual presence

The objective Decision Support System (DSS) is envisioned as allowing for automated floodplain management queries and analysis to be performed by authorized users across the community of stakeholders. The aim is to take advantage of existing technologies, such as distributed libraries (e.g., Master Environmental Library), that are relevant to the Red River needs. Cost-effective leveraging opportunities will be explored to meet the goal of a spring 1999 prototype capability. For instance, the US Army Corps of Engineers has already offered to modify its EngLink application, an interactive geographical information system (GIS) capability used to manage spatial data sets, for integration into the DSS.

The DSS has been discussed in terms of a virtual world wide web based service. It is envisaged as including, but not limited to, the following functional components and information services:

- Background/Introduction: explanation of the site and a roadmap of services.

- Who's Who in the Basin: descriptions of and links to the sponsoring organizations, points of contact and interactive mailing lists.
- Real-Time Conditions: snow cover, river/tributary heights, weather, etc.
- Data and Information Products: what's available, how to get it, automated queries of underlying information resources.
- User/Provider Forum: virtual chat opportunities (workshops, guest speakers, etc.).
- Recent and Planned Activities: information on what's going on.
- Past Flood Events: summaries, tables, maps related to previous floods in the area.
- Policies and Procedures: rules and regulations governing such things as levee permitting, environmental laws, state of emergencies, and so forth.
- Related Reports: available after-action reports (AARs), research reports, books and pamphlets.
- Education/Training: information on opportunities and various tips (e.g., pumping procedures, sandbagging, electrical hazards, forecast interpretations, warning procedures).
- Feedback: comments on web site improvements and information needs.

## 2. THE WORKSHOP

In July 1998, the IJC Task Force conducted a series of workshops in Minnesota, North Dakota, and Manitoba. A pre-workshop questionnaire was mailed to potential participants two weeks before the workshops (see Appendix A). The intent of this questionnaire was to help capture the data needs, critical communication links, and processing requirements necessary to perform emergency and floodplain management functions within the Red River drainage basin, and to provide the focus for the workshop discussions. A secondary goal was to find out which data and/or information "data providers" might be able to share with a broadened community (i.e., local, state, provincial, and federal levels). A workshop evaluation sheet was also available to each participant at the conclusion of each workshop.

It is the input from the questionnaires, workshop evaluations, and workshop discussions that will provide the basis for the development of new tools to allow a more systematic and timely sharing of data and information products within the basin. A broad spectrum of stakeholders clearly articulated unmet needs in information and data availability, management, and the need for sustaining information infrastructure to improve emergency response and floodplain

management. A list of the workshop attendees is provided as Appendix B.

## 2.1 Workshop Participants

The participants represented a broad spectrum of stakeholders in the Red River Basin. Included among these were the following:

- Federal: Environment Canada, Federal Emergency Management Agency, US Army Corps of Engineers, US Geological Survey, and the US National Weather Service.
- State/Provincial: Minnesota, North Dakota, South Dakota, and Manitoba.
- County/Local Municipalities.
- Red River Basin Board.
- Watershed Boards.
- First Nations/Native Americans.
- Volunteers (e.g., American Red Cross, Amateur Radio Operators).
- Consultants.
- Academicians.

## 2.2 Concerns and Recommendations

Workshop participants articulated a range of concerns and issues during the three workshop sessions. With respect to information and data needs, a summary of the findings would include the following:

- Lines of Authority: who is in charge? The Red River Basin Board was widely suggested as the appropriate lead organization on the information issue.
- Organization: it was recommend that a comprehensive, basin-wide strategy is urgently needed.
- Accessibility: what information is available and how can it be acquired?
- Maintenance: who will maintain the dat/information once a system is developed and deployed?
- Planning: coordinated contingency plans between communities within the RRB are urgently needed.

- Information Clearinghouse: there is a need for one-stop shopping.
- Sustainability: how many times will this be repeated?
- Funding: lack of funding and most effective use of what is available.
- Security: who needs what information and in what formats? There is concern with potential misuse of information.

## 2.3 From Workshop to Results

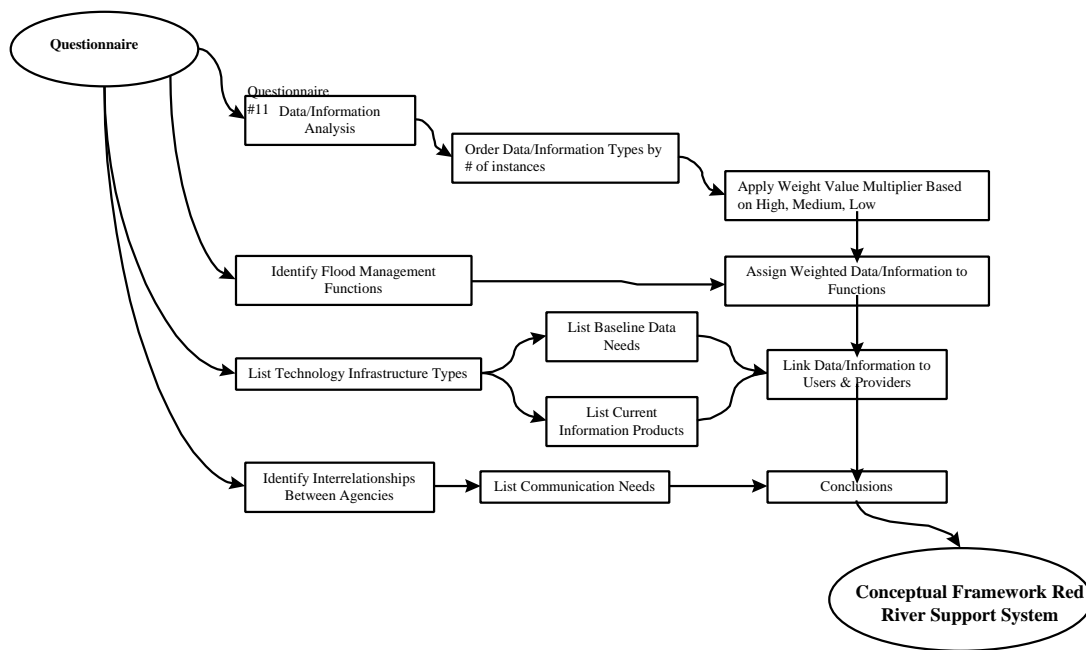
Under GDIN funding, a team was established to analyze the workshop results in order to develop a fundamental understanding of the needs of the Red River Basin community of interest. A survey analysis approach was developed and is described in this section. This approach, or process, was designed to lead toward a clear definition of the information infrastructure solutions demanded by the stakeholders. Among the key findings of stakeholder need were:

- make full use of the Internet
- need access to all the data we can get our hands on
- local groups (city, cnty, watersheds) have data that isn't being shared at all
- local groups need access to more data
- accuracy and timeliness are critical
- use and integrate data from all providers
- need to update "old" data
- data needs to be in digital format
- why can't we share data better?
- historic data needs to be made available
- need to standardize on one datum for stage reporting
- not just an urban problem - remember the rural people too
- tools must be user-friendly - keep it simple!
- concern over conflicting data.

**Figure 2-1** illustrates the overall process that has been pursued to generate the resulting user information needs. The activity is a classic survey analysis approach, initiated by the completion of the focused questionnaires (reference **Appendix B**) that were disseminated to workshop participants. The survey data were aggregated and analyzed to develop priorities of respondent needs. A weighted value multiplier, based on the respondent's designation of "high", "medium", or "low" value was then applied to each data/information type. The weighted values were then scored and the priority needs were delineated.

The needs were then clustered around functional groupings consistent with a proven emergency response/crisis management model of functionality, responsive to flood management operational tasks. This functional grouping is useful to match the needs with user constituencies whose operational missions may differ from one another (civic leadership, emergency managers, hydrologists, etc.).

The survey analysis contributes to the development of the conceptual framework for the Red River Basin Decision Support System or other information infrastructure solutions that would be responsive to the needs expressed in the workshops.



**Figure 2-1. Overall Process Chart**

### 3. THE USER AND PROVIDER COMMUNITY

#### 3.1 The Mixture of Information Users and Providers

The problems encountered in the administration of floodplain management have been mounting steadily in recent years. Flooding in the Red River Basin will likely continue to take a heavy toll on the region's economy. It is estimated that one out of every four people in the basin is employed directly or indirectly in agriculture. Despite the effort and dedication of talented professionals, it is engulfed by the sheer magnitude of flooding in the basin. The added burden of massive flooding over such a large region is made even more complex by the very nature of floodplain management: a single process whose principal participants are organizationally separate and geographically located across two nations. Each of the individual agencies in floodplain management has responsibilities unique to its particular function. Yet these agencies cannot and do not operate in isolation. The July 1998 workshops identified common themes that agencies must exchange and share information in order to accomplish their own individual objectives.

The effective operation of the total floodplain management process is determined by how well the various agencies are coordinated as they perform their individual tasks. Many respondents made comments to the effect that their represented agencies, while they are independent entities in their operation, are interdependent insofar as their information needs are concerned. Each may at one time be an information user, while at another time, they may be an information provider in order to successfully complete their own duties.

Of the 70 respondents to the Questionnaire on Information/Data Needs for Floodplain Management 52% said that they both use and provide information. 35% of the respondents said they were users while 8% consider themselves as providers of information. Workshop attendees that completed the questionnaire represented the following sectors:

City/County Water Management Engineers	18
City/County Emergency Officials	14
Elected/Appointed Officials	8
Other Government Agency Officials	5
Forest/Biologist / or Fish and Wildlife Managers	5
City/County Highway Engineers	3
Homeowner/Landowners	2
Health Services Officials	2
Geographic Information Systems (GIS) Specialists	1
Historian	1

Fire Official	1
Planner	1

### 3.2 Technology Infrastructure within the Basin: What Information Tools are Being Used at the Various Level

A significant number of responders expressed the need to access information spatially from maps, topographical surveys, or geographic information systems (GIS). Many specifically stated they needed access to maps, or GIS, with elevation detail to the foot. There was some consensus that the ideal system should be available on the Internet. It was also stated that the system should take advantage of the fact that since much of the information is used by more than one agency, it should be available to all authorized users under a common, accessible, and easy to use format. Currently, many organizations use maps for floodplain data/information. Only a small number of organizations use GIS or any other computing technology to access or interpret spatial information. The efficient implementation of such a GIS system, using integrating technologies such as Internet-based GIS, will be determined to a large extent by how well the separate but related efforts of the various agencies are coordinated and synchronized. The current technological tool-set used by a majority of the respondents are listed below;

Internet (e-mail, Web)	37%
Fax	30%
Telephone (Land/Cellular)	26%
Radio	4%
Cable TV	2%

It is noteworthy that while only 37% of respondents reported their current use of the Internet, there was strong consensus that this is the delivery system of choice and needs to be developed, although not exclusive of other communications methods.

## 4. DATA AND INFORMATION CAPABILITIES

Information is the principal resource of almost any government agency, and that is particularly true with agencies involved in floodplain management. Problems caused by the inaccessibility, incompleteness, inaccuracy, or untimeliness of the information can severely limit flood management personnel in meeting their objectives in the most productive and effective manner. There was consensus from the comment section of the questionnaires that the lack of ready access to updated floodplain information can potentially result in a waste of

time that can significantly impact an organization's ability to respond and mitigate the further loss of property or life.

Many respondents believe that most of their information needs already exist within other agency databases. This information has been acquired by each of these organizations in the course of gathering their own mandated data needs. This is especially true for data that can be spatially reviewed on a map – seen as critical information by many respondents – yet almost always is generated by a handful of other agencies. Most respondents that listed the need for map data had access only to paper maps and do not have a capability to electronically access or exchange map data with other organizations. Because most organizations rely on paper maps, there is a very limited, or possibly non-existent, ability to exchange or integrate electronically generated map data from several sources and then to display operational information (i.e., symbols, text, polygons, voice, pictures, or video) from the various floodplain organizations. Floodplain management personnel predominately exchange almost all of their operational data via a telephony service (e-mail, voice, or fax). There were no comments about telephony service interruptions or other issues for secure telephony services or infrastructure in the basin area.

## **5. DATA AND INFORMATION NEEDS**

Many respondents believe that similar information needs are common for many of the floodplain management agencies. It was expressed that it would be desirable if participating organizations could have access to one current source of information. The concept is that all essential information is stored in electronic format (typically a database), where it is available to all authorized individuals for creating, updating, or reviewing. Workshop participants identified three areas for Data/Information: 1) Data/Information Needs, 2) Data Standards, and 3) Data Quality.

### **5.1 Data/Information Needs**

While the information requirements for floodplain management organizations are numerous and complex, the concept addressing these requirements is not. Despite the diversity of organizations, their major information needs can be described as administrative, management and statistical, and operational. Based on workshop comments, many organizations must exchange, receive, or share information in order to accomplish their objectives. In the operational area, respondents identified many common information requirements that are the basic link between organizations. These information requirements include basic geographical data as well as operational data. In almost all of the comments, there was an express desire to have immediate access to accurate maps and also to display current operational data on them.

**Table 5-1. Priority of Data/Information Types**

Data/Information Type	Priority Level (62 Respondents)			Points for Each	
	High	Medium	Low	High (6pts)	Med. (3 pts)
Snowmelt Prediction	41	11	4	246	33
Aerial Photo	35	18	1	210	54
Levees - Elevation and Alignment	38	11	3	228	33
High Water Marks - Flood Extent	34	17	2	204	51
Emergency Plans & Emergency Org. Charts	33	10	8	198	30
Elevation Discharge Data	34	9	2	204	27
Bridge and Culvert Openings	30	9	8	180	27
Roads - Elevation and Alignment	26	16	7	156	48
Discharge-Frequency Data	28	11	5	168	33
Floodway Alignment	27	10	6	162	30
Hydrologic Models	26	13	2	156	39
Impoundments - Size, Sill elevation, location	27	8	9	162	24
Critical Facilities	27	8	7	162	24
Potential Spill Sources (Hazardous Materials)	25	11	8	150	33

Data/Information Type	Priority Level (62 Respondents)			Points for Each	
	High	Medium	Low	High (6pts)	Med. (3 pts)
Digital Terrain Data	25	10	6	150	30
Drains-Dimensions and Alignment	23	14	5	138	42
Hydrometric and Meteorological Real-Time Data	21	17	6	126	51
Land Use - Current and Historic	19	18	6	114	54
Water Quality Data	21	15	3	126	45
Satellite Images (Current and Historic)	20	16	5	120	48
Storm Drain Networks	19	15	12	114	45
Wetlands & Drained Basins	20	10	11	120	30
Health and Medical Services	20	9	10	120	27
Available Volunteers	20	7	10	120	21
Bathymetry (Cross Sections)	15	17	7	90	51
Stage Damage Data	15	12	10	90	36
Railroads - Elevation and Alignment	12	16	12	72	48
Soils	9	18	14	54	54
Wells - Active and Abandoned	13	11	10	78	33
Zoning	13	9	16	78	27

Data/Information Type	Priority Level (62 Respondents)			Points for Each	
	High	Medium	Low	High (6pts)	Med. (3 pts)
Short and Long Term Climate Trends	9	17	10	54	51
Power Lines	12	10	12	72	30
Agriculture & Chemical use in basin	10	15	8	60	45
Raised Pads - Location and Elevation	11	9	18	66	27
Census (Demographic) Data	10	12	12	60	36
Law Enforcement Data	8	16	12	48	48
Critical Aquatic and Wildlife Habitat	11	8	11	66	24
Status of Restoration Projects	8	11	16	48	33
Threatened and Endangered Species	7	6	15	42	18
Animal Protection Information	5	11	11	30	33
Ice Data	2	14	6	12	42
Archeological Sites	1	7	19	6	21



## 5.2 Data Standards

Data standards correlate to sharing similar information requirements between organizations under an agreed set of policies or standards – a process of data administration (DA). Data administration is defined as a multiple step process of ensuring the utility of data (both operational and geographical). Data administration activities include the following steps: 1) define data policies and standards; 2) plan for the efficient use of data; 3) coordinate design of data structures; 4) perform logical database designs; and define GIS standards; 5) build compliant databases, and 5) establish DA users oversight/stewardship groups. The following comments represent workshop participant's expectations on data standards for floodplain management:

- Develop standardized and simplified information
- Identify common information requirements
- Develop common alert protocols accepted by all organizations
- Develop a common terminology – currently 3 different ways to measure crests within the Basin (e.g., gage elevation, height above datum, height above sea level)
- Adopt common numbering conventions between states and between United States and Canada.

## 5.3 Data Quality

Data quality relates to accuracy, currency or availability of data. Respondents, especially those with engineering responsibilities, identified a common requirement for more detailed geographical data – especially elevation datasets. Listed below are data quality comments extracted from the questionnaires.

- USGS needs to get their data on sea level elevation
- Stream gauge data for both the tributaries and mainstream needs to be more accurate
- Floodplain data and the delineations were developed before 1985 and are dated
- Need for updated hydrology and mapping
- Need for better data reliability/completeness/compatibility

- Need to eliminate data redundancy and releases of consolidated information (e.g., CD-ROMS) would be helpful.
- Importance of data updates/maintenance
- Need to evaluate significance of data
- Inability to derive detailed information from 1"=2000' Q3 FEMA data

## 6. COMMUNICATIONS WITHIN THE BASIN

The need for good communication between individuals and organizations involved in floodplain management of the Red River Basin is essential. With the floodplain involving organizations from different states as well as different countries it is even more critical to establish clear channels of communication and points of contact for the collection, management and dissemination of data.

### 6.1 Interrelationships between the Federal, State, provincial, and local interests during the various disaster stages

Appendix G contains the compilation of responses from Item 12 on the Questionnaire. The respondents range from local/city officials to state, and Federal organizations. A summary of the types of organizations interacted with is as follows:

<b>Federal</b>	<b>State/County</b>	<b>Local/City</b>
Federal Emergency Mgmt Agency (FEMA)	Dept. of Natural Resources (DNR)	City Council
Corps of Engineers (COE)	Emergency Management Organization. (EMO)	Mayor's Office
National Weather Service (NWS)	Engineers	Law Enforcement
US Geological Survey (USGS)	National Guard	Medical Services
National Guard	Watersheds	Planning and Zoning
Red Cross		Volunteers

As would be expected, the representatives of local and city organizations work primarily with other local and city officials or organizations in the flood and floodplain management planning stage. To a lesser extent, local officials work with State and Federal agencies, such as FEMA, the National Guard and the Corps of Engineers during the planning phases of floodplain management. State representatives who responded work primarily with local governments during the floodplain management phase.

Many U.S. respondents indicated Federal organizations, such as FEMA and the Corps of Engineers, are interacted primarily during the flood fighting and flood recovery stages with less involvement during the planning stages.

## **6.2 Communication Needs**

A significant number of respondents emphasized the need for better coordination and communication between the Federal, State and local governments. In addition, some respondents felt that at the local level, agencies need to communicate more and share information. It was also mentioned that there should be a central authority for disseminating data products. One respondent suggested the organization of a multi-agency flood-planning group.

The predominant methods of communication are telephones and faxes and, as mentioned in Section 3.2, thirty-seven percent of respondents use the Internet (e-mail, world wide web) to communicate and share information. Only 10% of respondents said they would not use the Internet due to the lack of availability (no computer w/ access). Should the trend of data access and communications migrate towards the Internet, the people that do not have this capability will need to acquire it or some other means must be made available for these people to access the information contained on the Internet.

It is clear from the responses that there needs to exist a better organization of data access and communications within the Red River Basin. The interest in a single point of contact where users can go for data and information is clear.

## **7. CONCEPTUAL FRAMEWORK FOR A RED RIVER BASIN DECISION SUPPORT SYSTEM**

### **7.1 Separation of Powers, Authority, and Mandate**

The value of a decision support system is the ability to integrate or exchange data among floodplain management organizations to better meet the needs of vulnerable community members and property that are at risk. The primary purpose of the decision support system is to therefore provide the means for collecting, storing, accessing, and making available basic information required to manage floodplain management activities. It is the

access of information from different organizations that allows decision support software to be developed to assist floodplain management personnel to make better decisions.

Currently, existing information systems in the Red River Basin have been designed by each of the individual agencies to address their individual problems and requirements. Interagency communications is handled by existing telephony services: e-mail, fax, and voice communications. This was a logical approach, since most of the organizations are separate entities in organization and function. However, these are standalone systems causing 'Islands of Automation' and can no longer fully meet the individual or collective needs of the community.

Attempts to just build software bridges to connect these systems will likely become unmanageable as the number of bridges grow and the applications they connect to continue to evolve. Workshop participants stated their current frustration with both the inability to access other organization's data or, if they can access it, the incompatibility of the data with their application systems. A solution to simply connect these systems can result in potentially huge integration costs in order to assure consistency and completeness of the required data. Historically, it has been shown these bridging costs can exceed the sum of all the systems already in place and, additionally, create long-term, expensive application maintenance requirements.

What is needed is a decision support system built on a single data model for the integration of all data and applications. A fully integrated decision support system must be built around a structured data model that allows it to operate as a 'hub' for a data exchange network enabling data synchronization between independent systems. This technical architecture promotes fulfilling each of the information needs of the diverse organizations. The decision support system requires its own set of applications. Under a common data model, data generated at the 'hub' can be accessed or integrated into each individual organization based on their requirements – not the regional decision support system's requirements.

A decision support system in no way implies integration of the operation, administration, or management of the several agencies involved in floodplain management. They must maintain their independence for optimum effectiveness. Each organization is important and the needs of an agency cannot be subordinated to any other agency or group of agencies.

## **7.2 Cooperation vs. Consolidation**

What is needed is a set of tools to more effectively coordinate activities so that floodplain management will take place in an orderly, planned manner. The concept addressed in this section can provide that set of tools – a decision support system that, when implemented, can give coordinated and comprehensive services to each of the autonomous agencies

constituting the floodplain management community. The decision support system is a concept developed for treating each step in the total floodplain management process in an organized, planned manner. The responsibilities and needs of each agency are maintained. Where there is need for an agency to access information, that facility is provided. Through this integrated concept, each agency can also retrieve the information it needs to perform its required tasks quickly and more responsively. As a decision support system, the system itself can assume an active role in the process by performing the following:

- Receiving operational inputs from various agencies,
- Suggesting key tasks and when approved,
- Notifying the responsible agency of a task assigned to it, and
- Watching for an indication that it has been accomplished.

### **7.3 Conceptual Design**

The decision support system approach to floodplain management is possible principally for two reasons. One, it has to do with common information requirements, both operational and geographical, of the various agencies. Since much of the information required is identical, it is logical to design a system to retrieve information from several agency sources and maintain that information “virtually” as though it is from one source available to all agencies. The other factor relates to improved computer technology and similar improvements in GIS applications, as well as the widespread availability of the Internet to be the communications network to support the information and decision making base. Because of these reasons, individual floodplain organizations, either in the United States or Canada, can keep their independence because of their access to commonly designed databases, common geographical data, mutually agreed to decision support criteria, and a relatively low-cost Internet accessibility.

The ultimate decision support system envisioned is total in its scope – encompassing all floodplain management organizations. The system should be planned to be modular in design, so that implementation can occur gradually, according to the desires and needs of a particular flood management system.

The primary purpose of the floodplain decision control system is twofold: First, to provide the means for accessing, collecting, storing and making available operational and geographic data and; Second, it is a decision support asset that enables the floodplain management personnel to develop total situation awareness of an event. It provides a composite picture with enough detail and timely status information to facilitate the decision-making process in response, recovery, or preparedness. It is important to note that the system is not designed to replace personnel. The floodplain management managers and their staffs must have the capability to provide foresight into potential

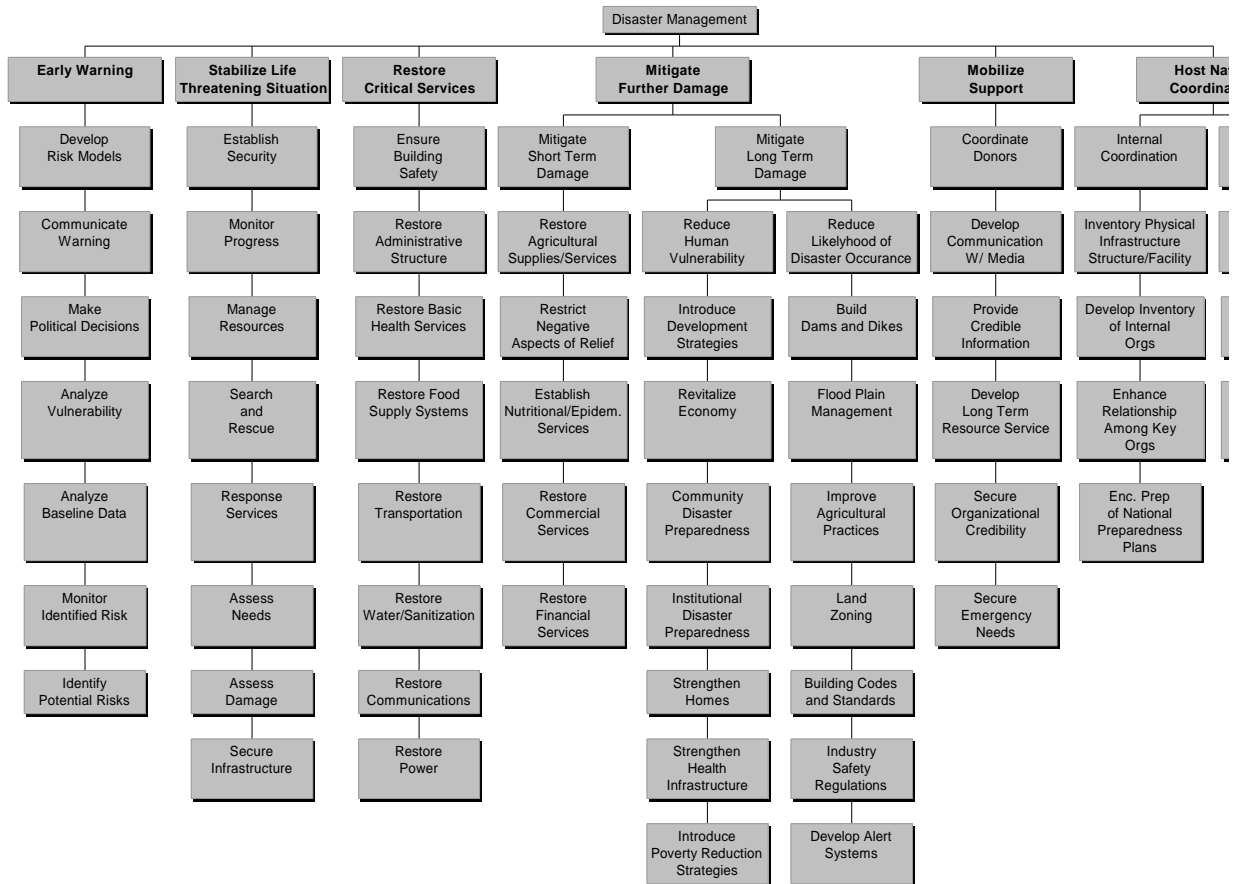
flooding situations, and must have insight into the expected and actual impacts of flooding in the basin.

## 7.4 Functional Area Context

In 1992 a United Nations agency (now the Office for the Coordination of Humanitarian Affairs) and the United States Agency for International Development sponsored an international workshop to create a design for a global readiness and response information system. One of the deliverables was the identification of functions describing a set of activities that collectively accomplish the mission of emergency readiness and response. (See **Figure 7-1**)

These functions have proven to be long-standing and apply to the mission of floodplain management. Our approach to the survey data was to weight the respondents data needs as seen in Table 5-1 and to organize the prioritized information needs around functional areas (see **Table 7-1**) described below. A decision support system should be designed to support key floodplain management objectives based on the following key functions:

- **Early Warning** Forecasts the probability of a flood event and identifies the decision or warning points where it may have to be handled as a disaster. This is consistent with the comprehensive emergency management phase of **preparedness**. (See **Figure 7-2**)
- **Stabilize Situation** Establishes an information base and decision points to assess, monitor, and manage a flood event. This is consistent with the comprehensive emergency management phase of **response**. (See **Figure 7-3**)
- **Restore Services** Establishes an information base and coordinated management tools to restore critical infrastructures, manage temporary shelter operations, and insure public safety. This is consistent with the comprehensive emergency management phase of **recovery**. (See **Figure 7-4**)
- **Mitigate Damage** Addresses both the operational aspects of restoring key services as well as the predicative aspects for mitigating or reducing the likelihood of a flood event or damage from a flood event. This is consistent with the comprehensive emergency management phase of **mitigation**. (See **Figure 7-5**)
- **Mobilize Support** Manages the effort to secure resources, communicate with the media, and coordinate with donors. This is consistent with the comprehensive emergency management phases of **response and recovery**. (See **Figure 7-6**)
- **Agency Coordination** Develop and manage the standards, procedures, and protocols to facilitate cooperation in the Basin area for floodplain management activities. This is consistent with the comprehensive emergency management phases of **preparedness and mitigation**. (See **Figure 7-7**)



**Figure 7-1. International Emergency Readiness/Response Information System Functionality**

**Table 7-1. Information Types Sorted by Function**

<b>FUNCTION</b>	<b>INFORMATION TYPE</b>	<b>HIGH</b>	<b>MEDIUM</b>	<b>LOW</b>	<b>W HIGH</b>	<b>W MEI</b>
<b>1. Mitigate Damage</b>	Snowmelt Prediction	41	11	4	246	33
	Aerial Photo	35	18	1	210	54
	Levees - Elevation and Alignment	38	11	3	228	33
	High Water Marks - Flood Extent	34	17	2	204	57
	Emergency Plans & Emergency Org. Charts	33	10	8	198	30
	Elevation Discharge Data	34	9	2	204	27
	Bridge and Culvert Openings	30	9	8	180	27
	Discharge-Frequency Data	28	11	5	168	33
	Floodway Alignment	27	10	6	162	30
	Hydrologic Models	26	13	2	156	36
	Impoundments - Size, Sill elevation, location	27	8	9	162	24
	Potential Spill Sources (Hazardous Materials)	25	11	8	150	33
	Digital Terrain Data	25	10	6	150	30
	Drains-Dimensions and Alignment	23	14	5	138	42
	Hydrometric and Meteorological Real-Time Data	21	17	6	126	57

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Information/Data Ne  
 Red R  
 For Internal GDIN ar

<b>FUNCTION</b>	<b>INFORMATION TYPE</b>	<b>HIGH</b>	<b>MEDIUM</b>	<b>LOW</b>	<b>W HIGH</b>	<b>W MEI</b>
	Land Use - Current and Historic	19	18	6	114	54
	Water Quality Data	21	15	3	126	45
	Satellite Images (Current and Historic)	20	16	5	120	48
	Storm Drain Networks	19	15	12	114	45
	Wetlands & Drained Basins	20	10	11	120	30
	Bathymetry (Cross Sections)	15	17	7	90	51
	Stage Damage Data	15	12	10	90	36
	Soils	9	18	14	54	54
	Short and Long Term Climate Trends	9	17	10	54	51
	Raised Pads - Location and Elevation	11	9	18	66	27
	Critical Aquatic and Wildlife Habitat	11	8	11	66	24
	Status of Restoration Projects	8	11	16	48	33
	Threatened and Endangered Species	7	6	15	42	18
	Animal Protection Information	5	11	11	30	33
	Ice Data	2	14	6	12	42
	Archeological Sites	1	7	19	6	21

## 2. Early Warning

	Snowmelt Prediction	41	11	4	246	33
	Aerial Photo	35	18	1	210	54

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Information/Data Ne  
Red R  
For Internal GDIN ar

<b>FUNCTION</b>	<b>INFORMATION TYPE</b>	<b>HIGH</b>	<b>MEDIUM</b>	<b>LOW</b>	<b>W HIGH</b>	<b>W MEI</b>
	Levees - Elevation and Alignment	38	11	3	228	33
	High Water Marks - Flood Extent	34	17	2	204	51
	Emergency Plans & Emergency Org. Charts	33	10	8	198	30
	Discharge-Frequency Data	28	11	5	168	33
	Floodway Alignment	27	10	6	162	30
	Hydrologic Models	26	13	2	156	39
	Potential Spill Sources (Hazardous Materials)	25	11	8	150	33
	Digital Terrain Data	25	10	6	150	30
	Drains-Dimensions and Alignment	23	14	5	138	42
	Hydrometric and Meteorological Real-Time Data	21	17	6	126	51
	Land Use - Current and Historic	19	18	6	114	54
	Satellite Images (Current and Historic)	20	16	5	120	48
	Storm Drain Networks	19	15	12	114	48
	Wetlands & Drained Basins	20	10	11	120	30
	Bathymetry (Cross Sections)	15	17	7	90	51
	Soils	9	18	14	54	54
	Agriculture & Chemical use in basin	10	15	8	60	48
	Ice Data	2	14	6	12	42

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Information/Data Ne  
Red R  
For Internal GDIN ar

FUNCTION	INFORMATION TYPE	HIGH	MEDIUM	LOW	W HIGH	W MEI
<b>3. Restore Services</b>						
	Aerial Photo	35	18	1	210	54
	Emergency Plans & Emergency Org. Charts	33	10	8	198	30
	Bridge and Culvert Openings	30	9	8	180	27
	Roads - Elevation and Alignment	26	16	7	156	48
	Critical Facilities	27	8	7	162	24
	Digital Terrain Data	25	10	6	150	30
	Land Use - Current and Historic	19	18	6	114	54
	Water Quality Data	21	15	3	126	48
	Satellite Images (Current and Historic)	20	16	5	120	48
	Wetlands & Drained Basins	20	10	11	120	30
	Stage Damage Data	15	12	10	90	30
	Railroads - Elevation and Alignment	12	16	12	72	48
	Wells - Active and Abandoned	13	11	10	78	30
	Power Lines	12	10	12	72	30
<b>4. Stabilize Situation</b>						
	Aerial Photo	35	18	1	210	54
	Levees - Elevation and Alignment	38	11	3	228	30
	Emergency Plans & Emergency Org. Charts	33	10	8	198	30

FUNCTION	INFORMATION TYPE	HIGH	MEDIUM	LOW	W HIGH	W MEI
	Digital Terrain Data	25	10	6	150	30
	Land Use - Current and Historic	19	18	6	114	54
	Water Quality Data	21	15	3	126	45
	Satellite Images (Current and Historic)	20	16	5	120	48
	Health and Medical Services	20	9	10	120	27
	Wells - Active and Abandoned	13	11	10	78	33
	Census (Demographic) Data	10	12	12	60	36

### 5. Mobilize Support

	Aerial Photo	35	18	1	210	54
	Emergency Plans & Emergency Org. Charts	33	10	8	198	30
	Roads - Elevation and Alignment	26	16	7	156	48
	Digital Terrain Data	25	10	6	150	30
	Land Use - Current and Historic	19	18	6	114	54
	Satellite Images (Current and Historic)	20	16	5	120	48
	Health and Medical Services	20	9	10	120	27
	Available Volunteers	20	7	10	120	27
	Railroads - Elevation and Alignment	12	16	12	72	48

### 6. Agency Coordination

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Information/Data Ne  
Red R  
For Internal GDIN ar

<b>FUNCTION</b>	<b>INFORMATION TYPE</b>	<b>HIGH</b>	<b>MEDIUM</b>	<b>LOW</b>	<b>W HIGH</b>	<b>W MEI</b>
	Aerial Photo	35	18	1	210	54
	Emergency Plans & Emergency Org. Charts	33	10	8	198	30
	Digital Terrain Data	25	10	6	150	30
	Land Use - Current and Historic	19	18	6	114	54
	Satellite Images (Current and Historic)	20	16	5	120	48
	Health and Medical Services	20	9	10	120	27
	Available Volunteers	20	7	10	120	27
	Zoning	13	9	16	78	27
	Law Enforcement Data	8	16	12	48	48

# Early Warning

Functions	Information Types	Organizations
Identify Potential Flood Risk Monitor Identified Flood Risk Analyze Baseline Hydrological Data Analyze Vulnerability Make Operation Decisions Communicate Warning Develop Floodplain Risk Models	Snowmelt Prediction Aerial Photo Levees - Elevation and Alignment High Water Marks - Flood Extent Emergency Plans & Emergency Org. Charts Elevation Discharge Data Bridge and Culvert Openings Discharge-Frequency Data Floodway Alignment Hydrologic Models Impoundments - Size, Sill elevation, location Potential Spill Sources (Hazardous Materials) Digital Terrain Data Drains-Dimensions and Alignment Hydrometric and Meteorological Real-Time Data Land Use - Current and Historic Water Quality Data Satellite Images (Current and Historic) Storm Drain Networks Wetlands & Drained Basins Bathymetry (Cross Sections) Stage Damage Data Soils Short and Long Term Climate Trends Raised Pads - Location and Elevation Critical Aquatic and Wildlife Habitat Status of Restoration Projects Threatened and Endangered Species Animal Protection Information Ice Data Archeological Sites	Army COE Boise De Sioux Watershed Canadian Red Cross City of Crookston City of East Grand Forks City of Fargo City of Moorehead City of Pembina City of Winnepeg Dept. of Hwy & Trans. DNR, Water Resources GF Emer Mgmt Clearwater Cty Emer. Mgmt Manitoba Emer. Mgmt Manitoba Hwys & Transpo. MN Public Safety, Emer. Mgmt MN Div. of Emer. Mgmt MN DNR MN DOT Municipality National We Pembina Cr RM of Frank RM of Macd RM of Ritchi Rosean Rive Selkirk Fire Town of Moi Town of Moi Town of Sell Walsh Cnty Water Reso Wild Rice W Wilkin City F Winnipeg W
Roles		
City/County Water Mngt. Engineer Elected Officials City/County Emergency Official Government Agency Official Forest Manager/Biologist / Fish and Wildlife Officials City/County Highway Engineer Fire Protection Police Services Meteorologists		

**Figure 7-2. Functions, Roles, Information Types and Organizations for Early Warni**

## Stabilize Situation

Functions	Information Types	Organizations
<p>Secure Infrastructure Assess Flood Damage Assess Needs Provide Emergency Response Services Monitor Progress Establish Security</p>	<p>Snowmelt Prediction Aerial Photo Levees - Elevation and Alignment High Water Marks - Flood Extent Emergency Plans &amp; Emergency Org. Charts Discharge-Frequency Data Floodway Alignment Hydrologic Models Potential Spill Sources (Hazardous Materials) Digital Terrain Data Drains-Dimensions and Alignment Hydrometric and Meteorological Real-Time Data Land Use - Current and Historic Satellite Images (Current and Historic) Storm Drain Networks Wetlands &amp; Drained Basins Bathymetry (Cross Sections) Soils Agriculture &amp; Chemical use in basin Ice Data</p>	<p>ADA City Council Army COE Boise De Sioux Watershed Building &amp; Zoning Administration Canadian Red Cross City of Crookston City of East Grand Forks City of Fargo City of Moorehead City of Pembina City of Winnepeg County Emer. Mgmt DNR, Water Resources GF Emer Mgmt Land Force Western Area Det. Clearwater Cty Emer. Mgmt Manitoba Emer. Mgmt Manitoba Health Manitoba Hwys &amp; Transpo. Marshall County MN BWSR MN Div. of Emer. Mgmt MN Dir of Fisheries MN Div. of Emer. Mgmt</p>
<p style="text-align: center; border-bottom: 1px solid black;"><b>Roles</b></p> <p>City/County Water Mngt. Engineer Elected Officials City/County Emergency Official Government Agency Official Forest Manager/Biologist / Fish and Wildlife Officials City/County Highway Engineer Fire Protection Police Services Medical Care Provider Meteorologists</p>		<p>MN DNR MN DOT MN Pollutic (MPCA) Municipalit  ND Game Neighborh  Pembina C Mgmt. Pembina V  RLWD RM of Frar RM of Mac RM of Ritcl Rosean Ri Selkirk Fire State Wate  Town of M Town of Se US Fish &amp;  Walsh Cou Wild Rice \</p>

**Figure 7-3. Functions, Roles, Information Types and Organizations to Stabilize Situat**

## Restore Critical Services

Functions	Information Types	Organizations	
Restore communications Restore power Restore water infrastructure Restore road/transp. infrastructure Ensure facility/building safety	Aerial Photo Emrgncy Plans & Emrgncy Org. Charts Bridge and Culvert Openings Roads - Elevation and Alignment Critical Facilities Digital Terrain Data Land Use - Current and Historic Water Quality Data Satellite Images (Current and Historic) Wetlands & Drained Basins Stage Damage Data Railroads - Elevation and Alignment Wells - Active and Abandoned Power Lines	ADA City Council Army COE Boise De Sioux Watershed Buiding & Zoning Administration City of Crookston City of East Grand Forks City of Fargo City of Moorehead City of Pembina City of Winnepeg County Emer. Mgmt DNR, Water Resources GF Emer Mgmt Clearwater Cty Emer. Mgmt Manitoba Emer. Mgmt Manitoba Hwys & Transpo. Marshall County MN BWSR MN Public Safety, Div. of Emer. Mgmt MN Div. of Emer. Mgmt	MN DNR MN DOT Municipality of W. St. Paul Pembina County Emergency RLWD RM of Franklin RM of Macdonald RM of Ritchie Rosean River Watershed Selkirk Fire Services Town of Morris Town of Selkirk US Fish & Wildlife Services Walsh County Hwy Dept. Wild Rice Watershed District Wilkin City Hwy Dept. Winnipeg Water & Waste De
Roles			
City/County Water Mngt. Engineer City/County Emergency Official Government Agency Official Forest Manager/Biologist / Fish and Wildlife Officials City/County Highway Engineer Fire Protection Police Services			

**Figure 7-4. Functions, Roles, Information Types and Organizations to Restore Critical S**

## Mitigate Damage

### Functions

Restore Agriculture Supplies/Services  
 Ensure Optimum Drainage Flow  
 Ensure Water Containment/Diversion  
 Restrict Aspects of Flood Damage  
 Reduce flood damage vulnerability  
 Enhance community preparedness  
 Enhance institutional preparedness  
 Reduce Building Exposure to Flooding  
 Reduce Likelihood of Flood Damage  
 Improve Waterways  
 Manage Flood Plains  
 Promote Land Zoning  
 Introduce Flood Safety Regulations  
 Develop Agency Coord. Alert Systems

### Roles

City/County Water Mngt. Engineer  
 Elected Officials  
 City/County Emergency Official  
 Government Agency Official  
 Forest Manager/Biologist /  
 Fish and Wildlife Officials  
 City/County Highway Engineer  
 Fire Protection  
 Police Services  
 Meteorologists

### Information Types

Snowmelt Prediction  
 Aerial Photo  
 Levees - Elevation and Alignment  
 High Water Marks - Flood Extent  
 Emergency Plans & Emergency Org. Charts  
 Elevation Discharge Data  
 Bridge and Culvert Openings  
 Discharge-Frequency Data  
 Floodway Alignment  
 Hydrologic Models  
 Impoundments - Size, Sill elevation, location  
 Potential Spill Sources (Hazardous Materials)  
 Digital Terrain Data  
 Drains-Dimensions and Alignment  
 Hydrometric & Meteorological Real-Time Data  
 Land Use - Current and Historic  
 Water Quality Data  
 Satellite Images (Current and Historic)  
 Storm Drain Networks  
 Wetlands & Drained Basins  
 Bathymetry (Cross Sections)  
 Stage Damage Data  
 Soils  
 Short and Long Term Climate Trends  
 Raised Pads - Location and Elevation  
 Critical Aquatic and Wildlife Habitat  
 Status of Restoration Projects  
 Threatened and Endangered Species  
 Animal Protection Information  
 Ice Data  
 Archeological Sites

### Organizations

ADA City Council  
 Army COE  
 Atmospheric Environment Branch  
 Boise De Sioux Watershed  
 Buiding & Zoning Administration  
 City of Crookston  
 City of East Grand Forks  
 City of Fargo  
 City of Moorehead  
 City of Pembina  
 City of Winnepeg  
 County Emer. Mgmt  
 DNR, Water Resources  
 Environmental Office  
 GF Emer Mgmt  
 History Dept. St. John's College  
 Land Force Western Area Det.  
 Clearwater Cty Emer. Mgmt  
 Manitoba Emer. Mgmt  
 Manitoba Health  
 Manitoba Hwys & Transp.  
 Manitoba NR, Land Info. Div.  
 Marshall County  
 MN BWSR  
 MN PS, Div. of Emer. Mgmt  
 MN Dir of Fisheries  
 MN Div. of Emer. Mgmt  
 MN DNR  
 MN DOT  
 MN Pollution Control Ag  
 (MPCA)  
 Municipality of W. St. P:  
 National Weather Servin  
 ND Game & Fish Dept.  
 Neighborhood Floodplai  
 NW Regional Developpr  
 Commission  
 Pembina County Emerg  
 Pembina Valley Conser  
 Reeve West St. Paul  
 RLWD  
 RM of Franklin  
 RM of Macdonald  
 RM of Ritchie  
 Rosean River Watershe  
 Selkirk Fire Services  
 Senior Planner, Selkirk  
 State Water Commissi  
 Town of Morris  
 Town of Selkirk  
 US Fish & Wildlife Servi  
 Walsh County Hwy Dep  
 Wild Rice Watershed D  
 Wilkin City Hwy Dept.  
 Winnipeg Water & Wate

**Figure 7-5. Functions, Roles, Information Types and Organizations to Mitigate Dam:**

## Mobilize Support

<u>Functions</u>	<u>Information Types</u>	<u>Organizations</u>	
Secure Emergency Needs	Aerial Photo	ADA City Council	MN Dir of Fishe
Assure Agency Response Credibility	Emergency Plans & Emergency Org. Charts	Army COE	MN Div. of Eme
Develop Long-Term Resource Support	Roads - Elevation and Alignment	Atmospheric Environment Branch	MN DNR
Provide Current Credible Information	Digital Terrain Data	Boise De Sioux Watershed	MN DOT
Coordinate w/ Response Org.'s	Land Use - Current and Historic	Buiding & Zoning Administration	MN Pollution Cc
	Satellite Images (Current and Historic)	Canadian Red Cross	Municipality of V
	Health and Medical Services	City of Crookston	National Weath
	Available Volunteers	City of East Grand Forks	ND Game & Fis
	Railroads - Elevation and Alignment	City of Fargo	Neighborhood F
		City of Moorehead	NW Regional D
		City of Pembina	Commission
		City of Winnepeg	Pembina Emrge
		County Emer. Mgmt	Pembina Valley
		DNR, Water Resources	RLWD
		Environmental Office	RM of Franklin
		GF Emer Mgmt	RM of Macdona
		Land Force Western Area Det.	RM of Ritchie
		Clearwater Cty Emer. Mgmt	Rosean River V
		Manitoba Emer. Mgmt	Selkirk Fire Ser
		Manitoba Health	Town of Selkirk
		Manitoba Hwys & Transpo.	US Fish & Wildl
		Manitoba NR, Land Info. Div.	Walsh Cnty Hw
		Marshall County	Water Resource
		Mayor, Breckenridge, MN	Wild Rice Wate
		MN BWSR	Wilkin City Hwy
		MN PS, Div. of Emer. Mgmt	Winnipeg Water

**Figure 7-6. Functions, Roles, Information Types and Organizations to Mobilize Supp**

## Agency Coordination

<u>Functions</u>	<u>Information Types</u>	<u>Organizations</u>	
Prepare and implement regional preparedness plans	Aerial Photo	ADA City Council	MN DNR
Enhance relationships with organizations	Emergency Plans & Emergency Org. Charts	Army COE	MN DOT
Promote operational independence but information interdependence	Digital Terrain Data	Atmospheric Environment Branch	MN Pollution Cont (MPCA)
Develop and implement protocols and agreements	Land Use - Current and Historic	Boise De Sioux Watershed	Moore Engr Inc.
	Satellite Images (Current and Historic)	Buiding & Zoning Administration	Municipality of W.
	Health and Medical Services	Canadian Red Cross	National Weather
	Available Volunteers	City of Crookston	ND Game & Fish I
	Zoning	City of East Grand Forks	Neighborhood Flo
	Law Enforcement Data	City of Fargo	NW Regional Dev
		City of Moorehead	Commission
		City of Pembina	Pembina Cnty Em
		City of Winnepeg	Pembina Valley C
		County Emer. Mgmt	Reeve West St. P:
		DNR, Water Resources	RLWD
		Environmental Office	RM of Franklin
		GF Emer Mgmt	RM of Macdonald
		History Dept. St. John's College	RM of Ritchie
		Land Force Western Area Det.	Rosean River Wat
		Clearwater Cty Emer. Mgmt	Selkirk Fire Servic
		Manitoba Emer. Mgmt	Town of Morris
		Manitoba Health	Town of Selkirk
		Manitoba Hwys & Transpo.	US Fish & Wildlife
		Manitoba NR, Land Info. Div.	Walsh Cnty Hwy E
		Marshall County	Water Resources
		Mayor, Breckenridge, MN	Wild Rice Watersh
		MN BWSR	Wilkin City Hwy D
		MN PS, Div. of Emer. Mgmt	Winnipeg Water &
		MN Dir of Fisheries	
		MN Div. of Emer. Mgmt	

**Figure 7-7. Functions, Roles, Information Types and Organizations for Agency Coordination**

## 7.5 Structured Approach

As stated by the US Federal Emergency Management Agency (FEMA), the primary responsibility of every member of the emergency management community at each level of government is to protect the lives and property of its citizens. Each echelon of government has their own unique floodplain management mandate, and has trained their respective staffs and augmenting personnel to operate during normal operations, as well as during a catastrophic event. At all levels, emergency response community leaders are aware that the key to successfully performing their mission is through the establishment of a structured approach that has steadily and purposefully evolved over time.

For floodplain management organizations, a process for cooperation, coordination, and response must be agreed to before a decision support system is implemented. A decision support system can only be effective with organizations working together under a common approach to get tasks completed. The requirements for a structured approach includes:

- identifying the risks faced by each governmental jurisdiction;
- establishing priorities for meeting these risks;
- taking necessary actions to reduce these risks;
- establishing plans, policies, and procedures for how jurisdictions (separately or together) will respond to emergencies;
- establishing training programs to improve readiness to execute critical emergency management functions contained in emergency plans;
- providing a structured program to rigorously exercise approved plans, policies, procedures, systems, and facilities during emergency response activities, and under realistic simulated conditions on a recurring basis;
- identifying operational deficiencies during these exercises and taking corrective action;
- training emergency response personnel, crisis action teams, operations center personnel, and government officials to improve operational understanding and capability; and,
- providing the facilities, equipment, and expertise necessary to implement response plans when an emergency or a disaster strikes.

## 7.6 The Decision Support Subsystems

The term “subsystem” is used to denote a major element in the decision support system design. Once again, there is no intent to imply which elements must constitute the initiation of a system for the basin. Nor is any priority order prescribed. Together these subsystems provide for the functions and information necessary for each floodplain organization to effectively perform its mandated duties in any flooding event.

Each subsystem component or part of a subsystem component may consist of one or more computer applications, for example – a GIS, that may even be the “operational systems” of one or more floodplain organizations. These organizations can retrieve data and operate applications with their own criteria based on their own mandate. They can also make relevant data needed by other organizations available to authorized users via the ‘hub’ decision support system.

The Decision Support System should be an integration of the essential components of prediction, estimation, assessment, direction, and control, and database management:

**Prediction** is supported primarily with the use of prediction analysis tool sets that include flooding specific models. These prediction analysis models yield visual and quantitative products that enable the decision-maker to localize an expected area of impact and infer information about possible extents of flooding in a part of the basin.

**Estimation** involves the processing of critical resources data that define the underlying resources potentially affected within the predicted area of flood impact. This could include natural resources affected, structures that are vulnerable, critical infrastructure that is threatened, or populations at risk.

**Assessment** occurs with the introduction of best available flooding assessment reports, including those on-scene observations and field measurements from sensors or human observers. Assessment builds upon the information products of prediction analysis and the critical resources data bases used in estimation. It is dependent upon timely data and information from various resources, and it spans a wide spectrum of media formats and sources.

**Direction and Control.** A decision support system must facilitate decision-making and response actions by supporting task management, robust multi-mode communications, and distributed, remote access. The DSS should be easily configurable for floodplain management roles, responsibilities, and authority. It should support situation-dependent response teams that may differ in size and subject matter expertise.

**Database Management.** A decision support system must provide a robust database management system component to enable dynamic updates, to facilitate customization of data presentation formats and reports, and to manage the metadata base that facilitates a distributed data service among cooperating institutions that hold data of interest. Finally,

the data base management system should be tightly coupled, in an open architecture with the geospatial applications, including commercially-available GIS applications.

A key point is that successful floodplain management is simply information management for effective decision support. It benefits from modeling and simulation tools, however it often occurs in the absence of these tools. It depends upon the assimilation, validation, and assessment of a torrent of information, the composition of the total current picture, and the determination of a viable course of action. It is about the decision-making life-cycle of a crisis: inclusive of preparedness, response, recovery, and mitigation. The DSS must enable the leadership and the stakeholders to “cut through the fog”. It is not limited to mapping, monitoring, modeling, or measuring --- rather it is the proper *fusion* of these functions into a dynamic decision support system that overcomes the *confusion* of a crisis situation.

The current implementation approach is to maximize use of the intranet model, consistent with the emergency support functions (ESFs) of the multi-agency, geographically disparate response activities such as those enumerated in the US Federal Response Plan (FRP). This allows a seamless web that emerges among government and private sector organizations, disaster field offices, on-scene or incident command centers, and the various discipline-oriented specialties (e.g., transportation, mass care, communications, hazardous materials, law enforcement, fire fighting, medical services, and so forth).

## **APPENDICES**

## Appendix A: Workshop Attendees

### Workshop Attendees

July 14, 1998

### Moorhead, Minnesota

Mike Anderson	National Weather Service, River Forecast Ctr	612.361.6660
Joe Belfors	Ramsey County, North Dakota	701.740.2538
Clifford Barth	Mayor of Breckenridge, Minnesota	218.643.4772
Melanie Bengston	North Dakota State University	701.231.7461
Keith Berndt	Cass County, ND	701.282.2226
Tim Bertschi	Corps of Engineers, Fargo	701.232.1894
Al Biggs	Richland County Water Resources	701.474.5724
Terry Birkenstock	Corps of Engineers, St. Paul	612.290.5271
Mark Bittner	City of Fargo	701.241.1572
Paul Bourget	Department of Defense	703.325.3264
Andy Bruzewicz	Corps of Engineers, CRREL	603.646.4372
Lyle Eisert	Commissioner, Polk County	218.281.3395
Quentin Fairbanks	Red Lake Tribal Council – RRBB Board Member	218.679.2202
Mike Ginnaty	Minnesota Dept of Transportation	218.847.1512
Randy Gjestvang	North Dakota Water Commission	701.282.2318
Roy Holmes	Minnesota Dept of Public Safety/Dive Emerg Mgmt	218.327.4496
Sharon Josephson	Congressman Peterson's Office	218.847.5390
Al Kean	Minnesota BWSR Chief Engineer	612.297.2907
Cam King	Sterling Associates, Winnipeg	204.224.9985
Bob Kloubec	Buffalo – Red River Watershed District	218.236.8839
Terry Lejcher	DNR Fergus Falls, Minnesota	218.739.7576
Jay Leitch	IJC Red River Task Force	701.231.7577
Dave Loss	Corps of Engineers, St. Paul	612.290.5435
Tom Lutgen	Minnesota DNR, Waters	651.296.0522
Jim McLaughlin	SE Cass WRD	701.281.0223
Tim Magnusson	Clay County Planning/Flood Plain Mgmt	218.299.5002
Aaron Meyer	North Dakota State University	701.231.9464
Bob Morrirt	Minnesota DNR, Waters	218.847.1580
Dick Nelson	Mayor of Warren/RRBB	218.745.5388

Wendy Pearson	National Weather Service, Grand Forks	701.772.0720
Robert Platt	Ada City Council	218.784.4154
Glenn Radde	Minnesota DNR, Waters	651.297.4950
Herb Reimer 218.299.5390	City of Moorhead	
Tom Richels	Wilkin County Engineer	218.643.4772
Robert Rostad	Richland County, Water Resources	701.998.2276
Ogbazghi Sium	Minnesota DNR, Waters	651.296.0444
Robert Stein	Fargo-Moorhead Metro Council of Governments	701.232.3242
Vernon Stoltz	Corps of Engineers, Topographic Engr Ctr	703.428.6802
Paul Suomala	The International Coalition	218.233.0292
Robert Thompson	North Cass WRB-SWC	701.668.2760
Vern Tomanek	City of Fargo	701.241.1545
Gerald Van Amburg	Buffalo-Red River Watershed District	218.299.3794
Don Visser	Mayor of Ada, Minnesota	218.784.7338

**Workshop Attendees**  
**July 15, 1998**  
**Grand Forks, North Dakota**

Mike Anderson	National Weather Service, River Forecast Ctr	612.361.6660
Scott Bassingthwaite	Regional Weather Information Service, UND	701.777.6476
Joe Belford	Red River Basin Board	701.662.4150
Jerry Bents	Houston Engineering, Inc.	701.265.3111
Terry Birkenstock	Corps of Engineers, St. Paul	612.290.5271
Scott Boura	City of Grafton	701.352.1561
Paul Bourget	Department of Defense	703.325.3264
Andy Bruzewicz	Corps of Engineers, CRREL	603.646.4372
Jim Campbell	Grand Forks Emergency Management	701.780.8213
Curtis Carlson	Marshall County Commission	218.437.8168
George Dailey	Red Lake Watershed District	218.253.4233
Tom Dusek	City of Grafton	701.352.1561
Ray Ecklund	City of Crookston	218.281.1232
Terry Ellsworth	U.S. Fish and Wildlife Service	701.250.4491
Steve Erickson	Roseau River Watershed	218.463.3395
Lowell Everson	Red Lake Watershed District	218.681.5800
James Fenske	Town of Selkirk	204.785.4912
Charles Grotte	City of Grand Forks	701.746.2628
Julie Gustafson	Clearwater Water Commission	218.487.5709
Bob Halliday	Red River Basin Task Force	306.665.0805
Elmer Hillesland	State Water Commission	701.775.6649
Wallace Jorgenson	Red Lake Watershed District	218.891.2222
Cam King	Sterling Associates, Winnipeg	204.224.9985
Linda Kingery	Red River Regional Council	701.352.3550
Don Kuryk	Dept of Highways and Transportation Management	204.945.5827
Dave Loss	Corps of Engineers, St. Paul	612.290.5435
Tim Manz	City of Grand Forks	701.746.2628
Dennis Markusen	Walsh County	701.352.1530
Brent Nelson	Walsh County	701.352.1530
Bud Oliver	Town of Selkirk	204.985.4914
Wes Peck	Energy and Environmental Research Center	701.777.5195

Wendy Pearson	National Weather Service, Grand Forks	701.772.0720
Glenn Radde	Minnesota DNR, Waters	651.297.4950
Judy Rue	Minnesota Division of Emergency Management	612.422.3628
Lynn R. Schueler	North Dakota Game/Fish, Devils Lake	701.662.3617
Jerry Skyberg	City of East Grand Forks	218.773.2208
Vernon Stoltz	Corps of Engineers, Topographic Engr Ctr	703.428.6802
Paul Suomala	International Joint Commission	218.233.0292
Wayne Tieman	City of Cavalier	701.265.3111
Ray Trosen	Grand Forks County Water District	701.343.2547
Henry Vasek	Polk County Commissioner	218.773.7110
Webb Voorhees	City of Cavalier	701.265.4520
Charles Walker	Pembina City Commissioner	701.825.6205
Hetty Walker	City of Pembina	701.825.6205
Ron Wencil	U.S. Geological Survey	612.783.3207
Roland Young	Red River Basin Board Task Force	701.775.0551

**Workshop Attendees, July 16, 1998**  
**Winnipeg, Manitoba**

Sayad Ahmad	University of Manitoba	261.474.6862
John Alexander	Roseau River FN	204.427.2139
Mark Bennett	Water and Waste, City of Winnipeg	204.986.4479
Bev Berrington	Rural Municipality of Franklin	204.427.2557
Terry Birkenstock	Corps of Engineers, St. Paul	612.290.5271
Landon Booker	Pembina River Basin Advisory Board	204.726.6095
Paul Bourget	Department of Defense	703.325.3264
Rick Bowering	Manitoba Water Resources	204.945.6397
Susan Boyer	North Ritchot Restoration	204.261.3978
Rodney Burns	Reeve Rural Municipality of Macdonald	204.736.2255
Julie Cranton	Canada Centre for Remote Sensing	613.947.1279
L. (Buzz) Crooks	Free-lance Writer	204.489.3320
Cliff Dearman	Rural Municipality West St. Paul	204.338.0306
Gerry Delorme	Manitoba Water Services Board	204.726.6095
Jay Doering	University of Manitoba	204.474.6942
Karen Duncan	Canadian Red Cross	204.982.7344
Brian Flynn	Department of National Defence	204.833.2643
Aron Friesen	Rural Municipality of Hanover	204.326.7793
J.C. Gagnon	Rural Municipality of St. Andrews	204.738.2264
John Giesbrecht	Mennonite Disaster Service, Manitoba Chair	204.324.5933
Cliff Greenfield	Pembina Valley Conservation District	204.242.3267
Deb Gural	Intern, Emergency Program, City of Winnipeg	204.261.6519
Bob Halliday	Red River Basin Task Force	306.665.0805
Denis Hallson	Canadian Red Cross	204.982.7630
France Heibert	Red River Trauma Team	204.792.2382
Bryon Heinrichs	Red River Basin Board	204.327.5284
Cam King	The Sterling Associates	204.234.9985
Michael Kowalchuk	Environment Canada, Winnipeg	204.983.5500
Marcel Laurendeau	MLA St. Norbert	204.945.1689
Barry MacBride	Water and Waste, City of Winnipeg	204.986.4479
Andrea McDonald	Emergency Preparedness Canada	204.983.3148
Jim McLean	Manitoba Water Resources	204.945.3613

Phil McMackin	Royal Canadian Mounted Police	204.983.5496
Grant Mehr	Tetres Consultants	204.942.2505
Inez Muter	Manitoba EMO	204.945.4791
Sieg Neumann	Emergency Coordinator (Morris)	204.746.2233
Bryan Nichol	Rural Municipality of Franklin	204.427.2557
Jill Ogston	Student Intern, Emergency Program, City of Winnipeg	204.986.5474
Robert Oleson	Manitoba Intergovernmental Relations	204.945.5344
David Oster	Rural Municipality West St. Paul	204.338.0306
Ed Pawluck	Rural Municipality of St. Andrews	204.866.2533
Hartley Pokrant	Land Information Division	204.945.6597
Jan Potter	Construction Management, Government of Manitoba	204.945.0429
Tom Raine	CAO – Rural Municipality of MacDonald	204.736.2255
Jack Schrueder	Manitoba Natural Resources	204.945.6613
Dennis Shanks	Department of Natural Defence	204.833.2642
Diana Soroka	Province of Manitoba-Emergency Public Information	204.945.3810
Bob Stefanick	Rural Municipality of Ritchot	204.883.2293
Barry Stevenson	Town of Morris	204.746.2233
Vernon Stoltz	Corps of Engineers, Topographic Engr Ctr	703.428.6802
Steve Topping	Manitoba DNR, WRB	204.945.7488
Alf Warkentin	Manitoba Water Resources	204.945.6698
Chuck Whalen	Manitoba DNR, Water Resources	204.945.5201
Gene Whitney	Rural Municipality of Ritchot	204.883.2293
Larry Whitney	IJC Red River Task Force	204.945.6395
Dwight Williamson.	Manitoba Environment	204.945.7030

**Appendix B: Sample Questionnaire**

**QUESTIONNAIRE**  
**on**  
**Information/Data Needs for Floodplain Management**

The intent of this questionnaire is to help us capture your information needs and generate a report that will provide a basis for a more systematic sharing of information by relevant users and providers working within the Red River BASIN. Your input is vital for the success of this effort and we ask that you give some thought to the data and information that you need to perform your emergency management and floodplain management functions. Conversely, it would be helpful to hear which data and/or information you might also be able to share with a broadened community (i.e., federal, state and provincial level).

The questions and lists of data below are merely meant as a sample of the information types that we are interested in tabulating. Please take a few minutes to review and complete this form **in preparation for the town hall meeting**. If you are unable to attend the meeting you can send us your comments and information (please be as detailed as possible) by 15 August:

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**1) Do the following answers reflect \_\_\_\_ your personal view or \_\_\_\_ your agency's or organization's view. (Check one)**

**2) What is your background/interest in the use of floodplain information:** *(for example, I am a City Engineer, I am a homeowner affected by flooding, I am a County Emergency Manager, etc.)*

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**3) What role do you play or duties do you have during flood emergencies, in floodplain management (planning), and/or for flood recovery and mitigation?**



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**9) What products do you currently use that are derived from floodplain data/information?** *(for example, flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs (stage and flow), maps of road closures, current levee alignments, etc).*

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**10) Is there a better way to make this information available to you?**

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**11) Which of the following types of data/information do you use and what priority should be given to making such data more accessible to you?** *(Consider Planning, flood fighting, and recovery phases - Use the following codes: A=Highest Priority, B= Moderate Priority, C=Lowest Priority, X = Not a priority)*

- |  |  |
|--|--|
| <input type="checkbox"/> Aerial Photograph (current and historic)            | <input type="checkbox"/> Floodway Alignment                            |
| <input type="checkbox"/> Agricultural and other Chemical Use in the Basin    | <input type="checkbox"/> Health and Medical Services                   |
| <input type="checkbox"/> Animal Protection information                       | <input type="checkbox"/> High-water Marks - Flood Extent               |
| <input type="checkbox"/> Archeological Sites                                 | <input type="checkbox"/> Hydrologic models                             |
| <input type="checkbox"/> Available Volunteers                                | <input type="checkbox"/> Hydrometric and meteorological real-time data |
| <input type="checkbox"/> Bathymetry (cross-sections)                         | <input type="checkbox"/> Ice data                                      |
| <input type="checkbox"/> Bridge and Culvert openings (>5ft)                  | <input type="checkbox"/> Impoundments - size, sill elev., location     |
| <input type="checkbox"/> Census Data   | <input type="checkbox"/> Land Use - current and historic               |
| <input type="checkbox"/> Critical Aquatic & Wildlife Habitat                 | <input type="checkbox"/> Law Enforcement data                          |
| <input type="checkbox"/> Critical Facilities                                 | <input type="checkbox"/> Levees - elevation and alignment              |
| <input type="checkbox"/> Digital Terrain Data                                | <input type="checkbox"/> Potential Spill Sources (Hazardous Material)  |
| <input type="checkbox"/> Discharge-Frequency data                            | <input type="checkbox"/> Power Lines                                   |
| <input type="checkbox"/> Drains - dimensions and alignment                   | <input type="checkbox"/> Railroads - elevation and alignment           |
| <input type="checkbox"/> Elevation-Discharge data                            | <input type="checkbox"/> Raised Pads - locations and elevations        |
| <input type="checkbox"/> Emergency plans and emergency organizational charts | <input type="checkbox"/> Roads - elevation and alignment               |
|  | <input type="checkbox"/> Satellite images (current and historic)       |

- \_\_\_ Short & long term climatic trends
- \_\_\_ Snowmelt prediction
- \_\_\_ Soils
- \_\_\_ Stage damage data
- \_\_\_ Status of restoration projects

- \_\_\_ Threatened and Endangered Species
- \_\_\_ Water Quality data
- \_\_\_ Wells - Active and abandoned
- \_\_\_ Wetlands & Drained Basins
- \_\_\_ Zoning

**12) Who are the key people/agencies/organizations you deal with during:**

*Flood and floodplain management planning*

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*Flood fighting*

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*Flood recovery*

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**13) What questions do you hope this workshop can help answer for you or for your agency or organization?**

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**14) What specific outcomes or products would you like to see the workshop generate?**

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**15) Do you have any documents to share with the other workshop participants such as a list of key information needs or data you or your agency may be able to share**

**relative to floods and floodplain management in the Red River Basin?**

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**Your Name:** \_\_\_\_\_

**Your Organization:** \_\_\_\_\_

**Address:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**16) Additional comments/questions/concerns:**

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*(if needed, continue on back page)*. Please pass this questionnaire on to anyone else you know that might be interested in sharing their ideas. Thank you for your interest and help.

**Appendix C Questionnaire Summary, Data Needs/Used**

<b>Questionnaire No.</b>	<b>Data User, Provider, Both U/P/B</b>	<b>Would you access data from Internet?</b>	<b>Current Methods of Data Sharing</b>	<b>Suggested Better Methods of Data Sharing</b>	<b>Products/Data Used</b>	<b>Pr</b>
1	P	Y	Phone, personal contacts		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs	R cc
2	B	N	FAX, Phone		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments, others	
3	U	Y	Public meetings, involvement in RRBB, water shed task force		Topo. maps (1 ft res.), snow depth history, water movement w/ problem ditches & tributaries	F cc th te
4	B	Y	All			T At

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
5	U	Y	Internet, mail data, provide data to meet customers needs	In a format that is easily storable, Flood plain mapping should be digital state of art	flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	Be of A ne to
6	U	Y	whatever has been generated by FEMA	Internet, CD-ROM	flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments, water shed info.	m
7	U	Y	Phone, meetings, local water shed board		fflood forecasts, snow water equivalent, levee alignments, ice flow movements	ac flc
8	U	Y	faxed river staged projections, news releases	FAX, internet, news media, overall tech manual for 1997 flood	flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	re im qu st st

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
9	U	Y	Internet, e-mail, phone, FAX		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments, Satellite imagery, gauge readings, FIS	Co hy El du flo m pl sil ca m da
10	B	Y	prepare maps, digital data	To know what info is available and from where	flood inundation maps	Li da ok m
11	P	Y	printed info.		very little	
12	B	Y	phone, cell phone		stream gauges	Pr ar by
13	P	Y		No	flood forecasts, snow/water equivalent	

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
14	B	Y	phone, media		flood inundation maps, flood forecasts, snow water equivalent, maps of road closures,	Be be aç
15	P	N	internet used by watershed office		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	Fa pr
16	P	Y	piece together data from various sources such as Environment Canada, Water resources, Highways, Municipalities, Landowners	Stored in one location	flood inundation maps, flood forecasts, maps of road closures, meeting data	O th as wi ar di su st A Rl cc st th

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pi
17	B	Y	phone, fax		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	
18	B	Y	FAX, personal contacts, e-mail, Provincial Emergency Management, Org.Info.(MEMO)	e-mail, internet	Data and maps provided by Water Resources, Water Management and MEMO	Sy di lo or ba
19	B	N	word of mouth	Separate entity should be available	fllood forecasts, snow water equivalent	Li
20	B	Y	Local Flood Manual		flood forecasts, River gauge readings, FEMA Studies	G di
21	U	Y	Interagency meetings, e-mail, FAX, ops centers	Digital format for incorporation into ops maps, etc.	flood maps, flood forecasts, hydrographs, maps of road closures, road profiles, dike profiles	cc im cc or

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
						in re St
22	P	Y	Phone, FAX	Internet access to digital flood plain maps	flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	Di wi hi in
23		Y	Govt info and records of Minn.	Internet	Some of the following: flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	A av M
24	U	Y	getting internet	Internet	flood forecasts, snow water equivalent	m flc in ac to

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
25	B	Y	books, articles, lectures, interviews	publicly accessible archive	flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	Ci flc to
26	P	Y	Information Utility in Manitoba, Direct data provision to customers	Internet, FTP site or a special archive & warehouse designed for flood info.	Flood extent maps from satellite imagery	Pl ar of
27	B	Y	Phone, TV, news conferences	Internet, GIS	flood inundation maps, flood forecasts, real-time hydrographs, maps of road closures, evac. routes	wl ev st
28	U	Y			stage & flow daily during a flood event	A ch El ici
29	U	Y	FAX, news reports, internet		Flood forecasts	Ac pr

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pi
30	U	Y	Phone, FAX, internet, cable TV, documents			
31	U	N	FAX		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	
32	B	Y	Radio, mailings, meetings, FAX, internet		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	Mar pr in m pr
33	U	N	Just use data	have hydrologist in organization to update forecasts	flood inundation maps, flood forecasts, stage & flow	
34	B	Y	news letters, seminars, meetings, phone	more gauges linked to satellite upstream	Gauge data, snow pack	In ca us

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
35	<u>U</u>	Y			FIRM maps, insurance studies, flood forecasts, pauging station reports, COE contour maps for construction	
36	P	N	news letters, seminars, meetings, phone		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	wl cc
37	U	Y	phones, meetings		maps, forecasts, snow & water equivalent, stage and flow cur. levee alignments	
38	B	Y	internet, other media/correspondance		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	U
39	U	Y	phone, FAX	format a lay person can understand	flood forecasts, snow water equivalent, maps of road closures	

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pi
40	B	Y	personal contact, periodicals	list of agencies and their data	FIRM maps, As-Built structural plans	
41	B	Y	reports to council, newspaper		flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	a fu
42	U	Y	FAX, verbal, mail	Digital mapping, community database for GIS, flood event modeling	flood forecast, current levee alignment, planning, zoning reqts, potential, site risk analysis	A im fo flc w lo at gc at
43	B	Y	meetings	received by computer or fax at a few hour interval	flood forecast, water equivalent maps of closures and current levees	Tc

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pi
44	B	Y	zoning by laws and plans @ library, Selkirk zoning by-law is on the net, sell by-laws to individuals	Prepare flood risk maps, and providing GIS data	1950 flood data and aerial photos	flo Se
45	B	Y	e-mail, fax, word of mouth, internet, TV, written reports	internet available on every desktop	flood forecasts, flood risk maps, flood manual, other maps (elevation, property, critical facilities, sewer, water, roads)	Be cc ar cc fo of
46	B	Y	FAX, mail, phone, newspaper	Use newspaper, public service announcements, more effectively reach & inform the entire population of a city. Curently use schools & churches	maps, videos of flood plain, levee alignments, hydrographs, - info shared by the Red River Basin Board	Fl dc ec th di as cc m

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
47	B	Y	verbal, written, diskette exchange	Electronic format	flood forecasts, flood inundation maps	
48	B	Y	letters, memos, phone, e-mail, meetings	Consolidation on a web site	real-time hydrographs	A in
49	B	Y	FIRM maps, FEMA info,		FIRM's	PI be cc
50	B	Y	phone, written	Internet or a central distribution entity	stage & flow readings, frequency of event, square mile of usage, 100 year flood plain map	A de cc m th ar cu PI or re ar to

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
						et
51	B	Y	gathered info from cty emergency resp. staff, radio	MPCA working on establishing GIS for the Northwest region of Minn.		Th ur or Rl or
52	U	Y	PRBAB, Advisory board	internet	Gauge data stream plan, Topo info, PERA hydrologist Water Reservoirs Personnel	Be er w:
53	B	Y	radio, newspaper, meetings	seminars to update flood plain mgrs on new info, mailings	flood forecasts, snow water equivalent, real-time hydrographs, flood plain maps	
54	U	Y	Faxes		flood forecasts,	da sit

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
55	B	Y	phone, internet, NWS computer systems	Internet (flood inundation maps & road closures)	snow water equivalent, precip & temp data	O av
56	B	Y	internet, fax		modeling	
57						
58	U	Y	paper	internet	FEMA floodplain maps, flood inundation maps, current & future levee alignment maps	Ci ke al
59	B	Y	phone, fax	fax, phone, internet	flood forecasts, maps of road closures, flood inundation maps	O cc flc
60	B	Y		internet	hydrographs, levee alignment, precip. data	
61	U	Y	letters, literature search, amps	internet & central database/control		
62	B	Y	electronic, hard copy	Internet access	water quality data	

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
63	U	Y			flood inundation maps, flood forecasts, snow water equivalent, real-time hydrographs, maps of road closures, levee alignments	Fi m
64	B	Y	satellite telemetry, e-mail, CD-ROM, internet, reports, pubs	improved internet access to historical and real-time data, access to affordable, accurate topo data	flood inundation maps, snow water equivalent, historical hydrologic and meteorological data,	re pr re re m se di ok de
65	U	Y	maps, mail, verbal	Data should be available on the Internet incl. flood plain studies. Also GIS downloadable from internet	flood plain mapping & studies, flood forecasts, data/info transfer w/ weather bureau, stage/discharge & modeling data	
66	B	Y	Internet, phone, direct	special access lines to critical	FIS - FIRM, base flood elevations - discharge	

Questionnaire No.	Data User, Provider, Both U/P/B	Would you access data from Internet?	Current Methods of Data Sharing	Suggested Better Methods of Data Sharing	Products/Data Used	Pr
			contact	data for designated officials	frequencies, flood profiles	
67	U	Y	e-mail, CD, hard copy	internet is good method for BWSR & expected good for many LGUs now or soon		Be ap st cc m
68	U	Y	any method	internet web site to download data	flood inundation maps, flood forecasts, maps of road closures	a in re di
69	B	N	FAX & phone		none	
70	U	Y	phone, fax	internet	flood forecasts, current water level	da re ac

**Appendix D Organizations Interacted with During Various Stages of Flood Event.**

Question -naire No.	Responder Title or Organization	Organizations Interacted with During:		
		Flood & Floodplain Management Planning	Flood Fighting	Fl
1	MN DNR	Local Gov't	COE, Local Gov't	Mn De Mgmt
2	Wilkin City Hwy Dept.	DNR, Watershed, COE, NWS	DNR, NWS, COE	FEMA, (
3	Mayor, Breckenridge, MN	City & Cnty Engineers, DNR, FEMA	COE, DNR, Cty Engr, Law Enforcement	City Flo Govern
4	State Water Commissioner			
5	MN DNR, Div. of water	FEMA, Local Gov'ts, Watersheds District		FEMA, Safety/E Trade (OTED)
6	MN DNR, Waters	Local Gov'ts, DNR Field Staff, FEMA, DEM	DNR Field Staff, DEM, FEMA	FEMA, Staff
7	ADA City Council	COE, Cnty Board Wild Rice Watershed District	Nat'l Guard Civil defense	FEMA, (
8	City of Fargo	COE, Weather Service, USGS SWC, Adjacent Jurisdictions	COE, Weather Service, Adjacent Jurisdictions, Politicians	DEM, FI

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9	Army COE		Local Planning & Zoning Officials, FEMA	County EMS, State Agencies, City Leaders, Contractors, NWS	State E FEMA
10	NW Regional Development Commission		USACF, FEMA		
11	MN DNR, Forestry		Watershed districts, COE, County Board	County Emer. Mgmt	
12	Boise De Sioux Watershed			County Govts	FEMA
13	learwater Cty Emer. Mgmt				
14	MN DOT		ND DOT, Manitoba DOT, NWS, DNR Corps	Local Emer. Officials, Counties/Cities NG, Law Enforcement	FHWA, DOT Dis
15	Wild Rice Watershed District		City Cnty Watersheds, DNR, COE	Nat'l Guard, County, city, COE, DNR, Forestry Dept., Watershed Board	COE, F Watersh
16	Manitoba Hwys & Transpo.		Emer. Measures Org.	Emer. Measures Org.	Emer. M
17	County Emer. Mgmt		Law Enforcement, State	Salvation Army	FEMA, I

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			DEM, FEMA		
18	Manitoba Health		Nat. Resources, MEMO	MEMO	MEMO
19	City Council		Emergency Services Dir.	Nat'l Guard, Local Law Enforce.	Church Salvatio
20	City of Moorehead		COE, DNR,	COE	FEMA, I
21	Manitoba Emer. Mgmt		Nat. Resources, Municipalities	Municipalities, All Provincial Depts.	Nat. Municip:
22	Pembina Cnty Emergency Mgr, Floodplain Admin.		SWC, Cnty Water Resource Board	Functional Coordinators, City flood coordinators, Volunteer Agencies, State Emer. Mgr., COE	Funcior flood co Agencie COE
23	Municipality of W. St. Paul		EMO, Staff of W. St. Paul,	EMO, Staff of W. St. Paul,	EMO
24	MN Dept. of Public Safety, Div. of Emer. Mgmt			State Div. of Emer. Mgmt, Cnty Emer. Mgmt Directors	State D Cnty Er FEMA
25	History Dept. St. John's College				
26	Manitoba Nat. Resources, Land		Water Resource Branch,	EMO, Dept. of Nat. Resources Executive	IJC, Branch

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	Info. Div.				
27	DNR, Water Resources		Hwys & Agriculture	MEMO, Operations, (ONR) Valley towns, Dikes, Emerson , Morris St. Jean, Municipalities	MEMO, Valley t Flood vi
28	Town of Morris		MB Nat. Resources	Military, MB Health, MB Govt services, MB Nat Resources	
29	Reeve West St. Paul		EMO, Weather Forecasting, Red Cross, salv Army, School, communities	EMO, Weather Forecasting, Red Cross, salv Army, School, communities	EMO
30	City of Winnepeg			All Internal except for Forecasting & CF	Manitob
31	RM of Franklin		Local	Local, EMO, Nat. Def., Nat. Res.	Local, I Red Crc
32	Town of Morris		EMO, DNR	EMO, DNR, Police, Volunteers, Essential Service Providers	EMO, D

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33	Water Resources Branch			Asst. Deputy Minister, Charter Air Craft Companies, Sandbag suppliers, City of Winnepeg, EMO, Truck Co	Municipal Citizens Consult: Manage
34	Rosean River Watershed		MN DNR, COE, SWCD, BWSR, Landowners	Law Enforcement, Nat'l Weather Service, DNR, USGS	FEMA, S
35	City of East Grand Forks		MN Dept. of Nat. Resources, FEMA	COE	MN DEM
36	RLWD				
37	City of Crookston		COE, FEMA	COE, Emer. Mgmt	FEMA, Govt
38	Dept. of Hwy & trans.		MEMO, Sr. Govt Official, Municipalities, Fed. Govt, Residents	MEMO, Sr. Govt Official, Municipalities, Fed. Govt, Residents	MEMO, Municipal: Residen
39	MN Div. of Emer. Mgmt			Cnty Emer. Mgmt Dir., Sheriffs, Nat'l Guard	State Officer
40	Walsh Cnty Hwy Dept.		Cnty Commission, Cnty Emer. Mgr	Cnty Commission, Cnty Emer. Mgr	State Townsh Emer. M

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41	City of Pembina				
42	Town of Selkirk				
43	Selkirk Fire Services		EMO, Fire Commisioner, City Council	EMO, City Council	EMO, C
44	Senior Planner, Selkirk		Water Resources Engr		
45	Winnipeg Water & Wate Dept.		Other City Depts., Diking Commissioner, WRB, MB Water Commission	River Forecast Centre, MEMO, Other City Depts, EOC, Military	Social Other Military
46	Neighborhood Floodplain Group		Red River Basin Board	Neighborhood	Insuranc
47	MEMO			Other Depts, Volunteer Groups, NGOs, Municipalities	Other Groups, Municipi:
48	MN Dir of Fisheries		Local Govt, Water Specs, NDCS, DNR, SWCO, BOWSR		
49	Environmental Office		MN DNR, FEMA,		
50	ND Game & Fish Dept.			FEMA, DEM	FEMA

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51	MN Pollution Control Agency (MPCA)		MN Dept of Nat Res., Red River Watershed, Red River Basin, AOC, Watersheds, Soil water Consev Distr., Cities, Cnties	City, Cnty Govts, Powers Board, Watershed, MN Dept. of Nat. Res./Transpo./Health, MN Dept. Emer. Mgmt, Agriculture, Nat Guard, Soil Conserv., Fed. Govt,	MN Res/Agr Environ.
52	Pembina Valley conserv District		RM	RM	EMO
53	Wild Rice Watershed Dist.		Cnty Zoning/Emer Mgmt, DNR	COE	COE, F NRCS, Watersh
54	Marshall Cnty		Watersheds Cnty Engineers, Fellow Commissions	Neighbors, Fire Dept, High Scool Students	Any Voli
55	National Weather Service				
56	Boise De Sioux watershed Distr.		Cnty Engineers, DNR	Watershed Engineer, Contractors	
57					
58	Buiding & Zoning Administration		City Engineer, Planning & Inspection Dept.	City Engineer, USACE	City Er Inspecti

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59	RM of Macdonald		Community Econ. Dev. Service	Water Resources, MEMO, REMP, ONO	MEMO, Salvatio
60	US Fish & Wildlife Services		COE, State & Local Govt, Fed Agencies		
61	US Fish & Wildlife Serv.		COE, State		
62					
63	GF Emer Mgmt		City of Grand Forks Engr Off.	City of Grand Forks Engr Off.	Local Cross, Depts
64	Atmospheric Environment Branch		Manitoba Nat. Resources, USGS, NWS	MEMO, EPC, USGS, NWS	Manitob
65	DNR Waters		FEMA, Counties, Cities, USSOE	FEMA, Counties, Cities, USSOE, US Weather Service, USGS	FEMA, USSOE
66	Moore Engr Inc.		City, Cnty, State, fed.	City, Cnty, State, fed.	City, Cn
67	MN BWSR		DNR, COE, WDS, Counties		DNR, N
68	Land Force Western Area Det.		MEMO, Preparedness Emer.	MEMO, Preparedness, Emer. Deployed	

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				forces	
69	Canadian red Cross		Water Resources Engr	MEMO	MEMO,
70	RM of Ritchie		MEMO	MEMO, Govt Agencies, Volunteer Orgs	MEMO, Volunteer Agencie

## Appendix E. Glossary

AAR	After Action Report
COE	US Army Corps of Engineers
DoD	US Department of Defense
DNR	Department of Natural Resources
DSS	decision support system
EMO	emergency management office
ESF	emergency support function
FEMA	Federal Emergency Management Agency
FRP	Federal Response Plan
GDIN	Global Disaster Information Network
GIS	geographic information system
IJC	International Joint Commission
NOAA	National Oceanic and Atmospheric Administration
USACE	US Army Corps of Engineers
USGS	US Geological Survey