RIVERSIDE

FLOOD DSS MEMORANDUM

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FROM: Amy Volckens - Riverside
DATE: June 03, 2010
SUBJECT: Flood DSS Task 4.0: Data Inventory Memorandum (Final rev 1)

1.0 Introduction

This memorandum is submitted under Task 4.0: Data Inventory. The objective of the memorandum is to present a list of the data layers that will be incorporated into the Flood DSS.

The proposed data layers are organized in this memorandum and the data inventory spreadsheet in the following groups:

County Data
- Preliminary digital flood insurance rate map (DFIRM) data
- Other county data

Statewide Data
- Effective DFIRM data
- Historical flood information
- Real-time data and alerts
- Multi-hazard
- Weather modification
- Watershed restoration
- Community information
- Base data
- Background data

Attachment 1 contains the latest data inventory spreadsheet. Riverside will deliver a final data inventory spreadsheet to CWCB as part of the administrator's manual at the conclusion of the project. The data inventory spreadsheet contains significantly more detailed information than is discussed in this memorandum, for example the data source, original projection, datum, and format, and update frequency. The data inventory spreadsheet also includes information about external links and LaserFiche documents that will be available within the Flood DSS. This memorandum focuses on the spatial data layers that will be included in the Flood DSS.

2.0 Background

This memorandum was written assuming that readers are familiar with previous deliverables submitted for this project, namely:

- Results from the User Needs Assessment (final memorandum submitted September 25, 2009). This document summarizes the data layers, functionality, and use cases that were identified during the user needs assessment.

- Evaluation of Alternative Technologies for Flood DSS Web Mapping Application (final memorandum submitted September 14, 2009). This document recommends that the Flood DSS be developed as a collection of websites. Simple (lightweight) websites will be used to provide access to a subset of data in addition to a power-user website. Given the number and variety of data layers that are being pursued for inclusion in the Flood DSS, Riverside believes this approach will maximize usability of the system.

3.0 County Data

The "County Data" category includes preliminary DFIRM data plus all local and county data collected by AMEC. The county data layers are included in the data inventory spreadsheet on the "PrelimDFIRM" and "County" worksheets (see ***Attachment 1***).

3.1 Preliminary DFIRM Data

The preliminary DFIRM data will be hosted on the Flood DSS map viewer website. The data layers will become visible only if a user has logged into the system. One set of login credentials will be used to grant users access to all restricted data layers. CWCB will be responsible for distributing the login information, for example to communities that have preliminary DFIRMs available.

The number of counties with preliminary DFIRMs varies because of the number of counties working through the DFIRM process with CWCB, FEMA, and UDFCD. The Flood DSS will likely contain data for fewer than 10 counties at one time. The time between preliminary DFIRMs and effective DFIRMs is typically one year. Therefore, it will be CWCB's responsibility to add preliminary DFIRM datasets to the website as they become available, and to remove preliminary DFIRMs once they become effective. Once the DFIRMs become effective, the data layers will be incorporated into the Flood DSS on the map viewer website for public access through FEMA's National Flood Hazard Layer (NFHL) web service.

Riverside anticipates that all spatial data that are distributed with the preliminary DFIRM databases will be incorporated into the Flood DSS. There is no standard projection for the preliminary DFIRM data, so layers will be processed into the same projection for inclusion in the Flood DSS. Associated tabular data (e.g., general study information, affected communities, cross section stationing origins, flood hazard boundary map revisions, historic FIRM revisions, letters of map change) will not be incorporated into the Flood DSS spatially, but can be accessible within the Flood DSS if CWCB enters the documents into the LaserFiche system.

Table 1 presents a list of the data layers that typically are packaged in the preliminary DFIRM database, though the number of layers will vary by county. ***Attachment 1*** contains a list of the preliminary DFIRM layers for four counties that have been incorporated into the Flood DSS.

Table 1. Example Preliminary DFIRM Data Layers

Data Layer
Base flood elevation lines on the printed DFIRM
Base map transportation line features
Cross section locations
DFIRM panel scheme polygons

Data Layer
Flood hazard zone lines
Flood hazard zone polygons
Hydraulic structures shown on DFIRM such as levees, weirs, bridges, dams, culverts (can be multiple data layers)
Leader lines for printed DFIRM labels
National Geodetic Survey (NGS) benchmark locations
Point location of printed DFIRM labels
Political boundary line
Political boundary polygon
Public Land Survey System (PLSS) township, range, and section lines
Public Land Survey System (PLSS) section polygons
Raster base map tiling scheme
River Mile marker locations
Stream centerlines
USGS 7.5 minute quadrangle boundaries
Water body polygons

Figure 1 presents an example of the preliminary DFIRM data collected for Summit County. The data have been symbolized to show the flood hazard areas.

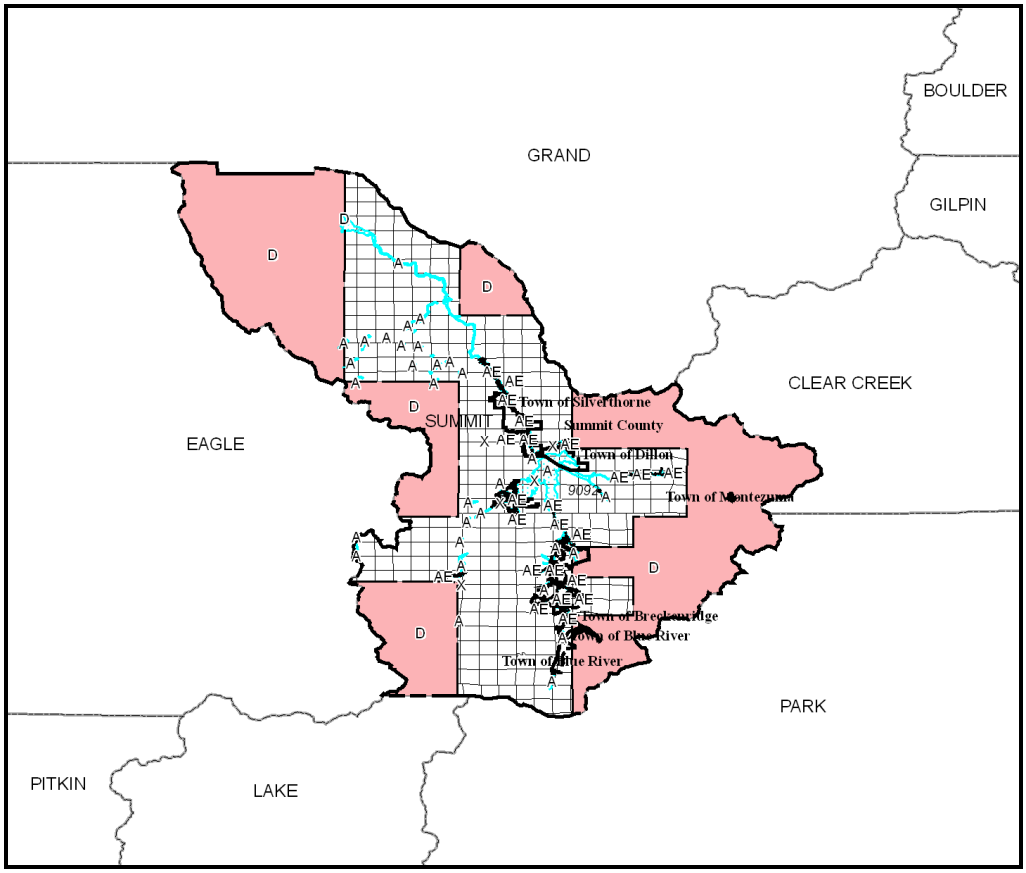

Figure 1. Example Preliminary DFIRM Data for Summit County

3.2 Other County Data

As part of the project, AMEC has collected flood-related data from county and local community officials. The county data have been incorporated into the Flood DSS on the map viewer website. ***Attachment 1*** lists the spatial data layers on the "County" worksheet and the non-spatial documents on the "County_ Laserfiche" worksheet. CWCB will need to add the non-spatial documents to Laserfiche for them to become available through the Flood DSS.

Of the 355 spatial layers collected by AMEC, 167 are classified as critical infrastructure, 29 are classified as local flooding, 41 are classified as multi-hazard, and 117 are classified as other spatial data. ***Figure 2*** presents an example of the local critical infrastructure (CI) data collected for Adams County.

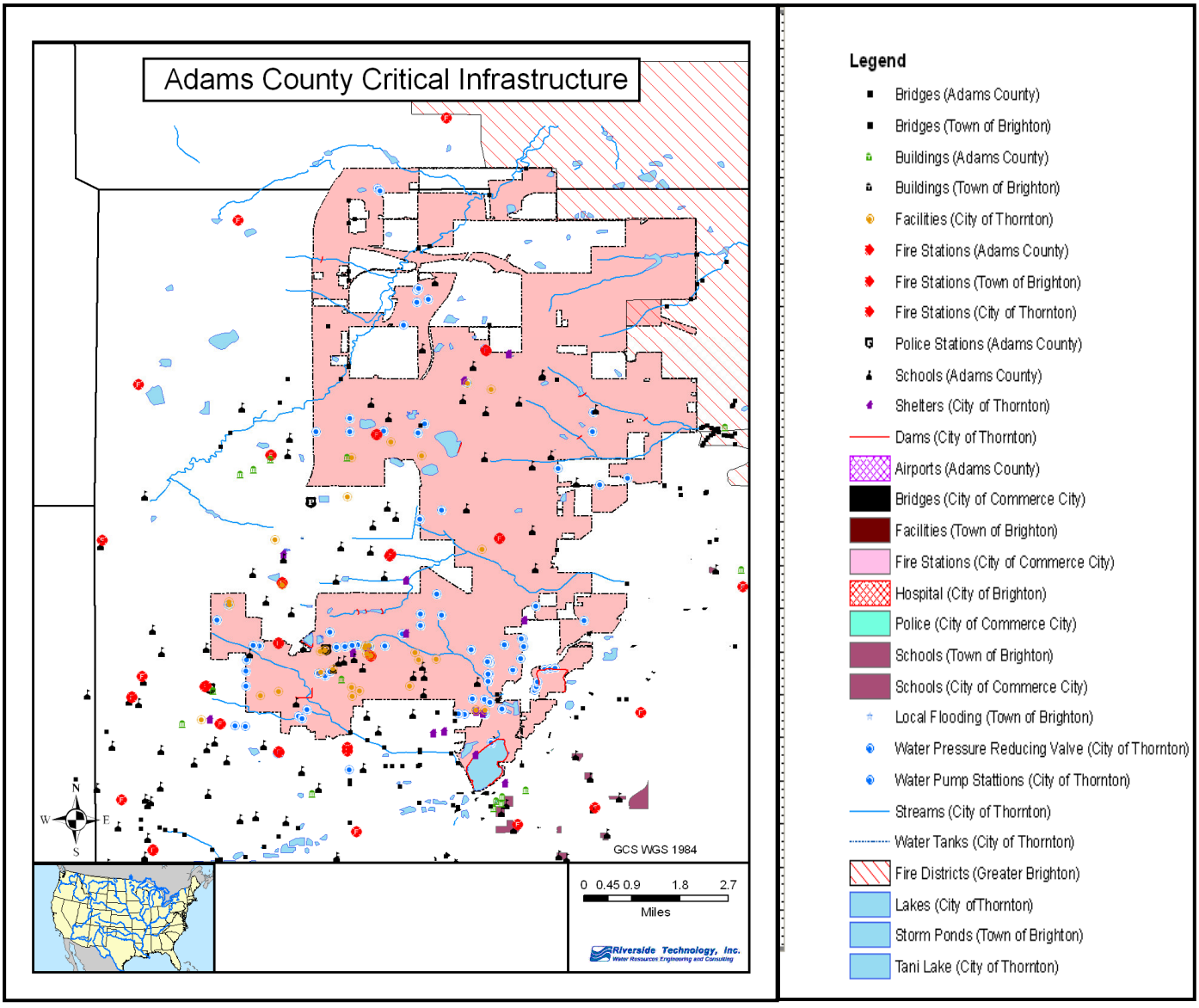

Figure 2. Example Critical Infrastructure Data for Adams County

Table 2 presents a list of typical critical infrastructure layers that have been collected as part of the project.

Table 2. Example Critical Infrastructure Layers

Data Layer
Airports
Ambulance centers
Bridges
Buildings
Dams
Elderly Facilities
Facilities
Fire Stations
Government buildings
Health Facilities
Hospitals
Police Stations
Recreation Centers
Schools
Shelters
Substations
Water / wastewater treatment plants

In addition to the local data that have been collected, spatial data for the city of Fort Collins will be included in the Flood DSS through a web service. These data layers are also listed on the County worksheet in ***Attachment 1***.

4.0 Statewide Data

The "Statewide Data" category includes effective DFIRMs, historical flood information, real-time conditions and alerts, multi-hazard data, weather modification, watershed restoration, community information, base data, and background data. Each of these groups is included in the data inventory spreadsheet on a separate worksheet (see ***Attachment 1***).

4.1 Effective DFIRM Data

The effective DFIRM data layers will be brought into the Flood DSS using FEMA's NFHL web service, which includes 37 data layers, including base and background layers that come packaged with the service. Of the available data layers, Riverside plans to include 18 in the Flood DSS map viewer website (see ***Table 3***). Riverside selected these layers based on input from the user needs and an assessment of significance for flood risk. Data layers that appear repetitive (e.g., flood hazard zones) are visible at different map scales.

Table 3. Data Layers Included from FEMA's NFHL Web Service

Data Layer
Base Flood Elevation
Cross Sections

Data Layer
DFIRM Panels (detailed)
Flood Hazard Zones (Detailed)
Flood Hazard Zones (General)
Flood Hazard Zones (General-large)
Flood Hazard Zones (General-med)
Flood Hazard Zones (linear)
Flood Hazards Zone Boundaries
Flood Map Panels (national)
Floodways (linear)
General Structures
Jurisdiction Boundaries
Jurisdiction Names
LOMA and LOMR-F
LOMR's
Streams
Water Bodies

Figure 3 presents a snapshot from the NFHL web service for the data layers that will be included in the Flood DSS. The data for Weld County shows base flood elevations, cross-section locations, DFIRM panels, LOMAs, and flood hazard areas.

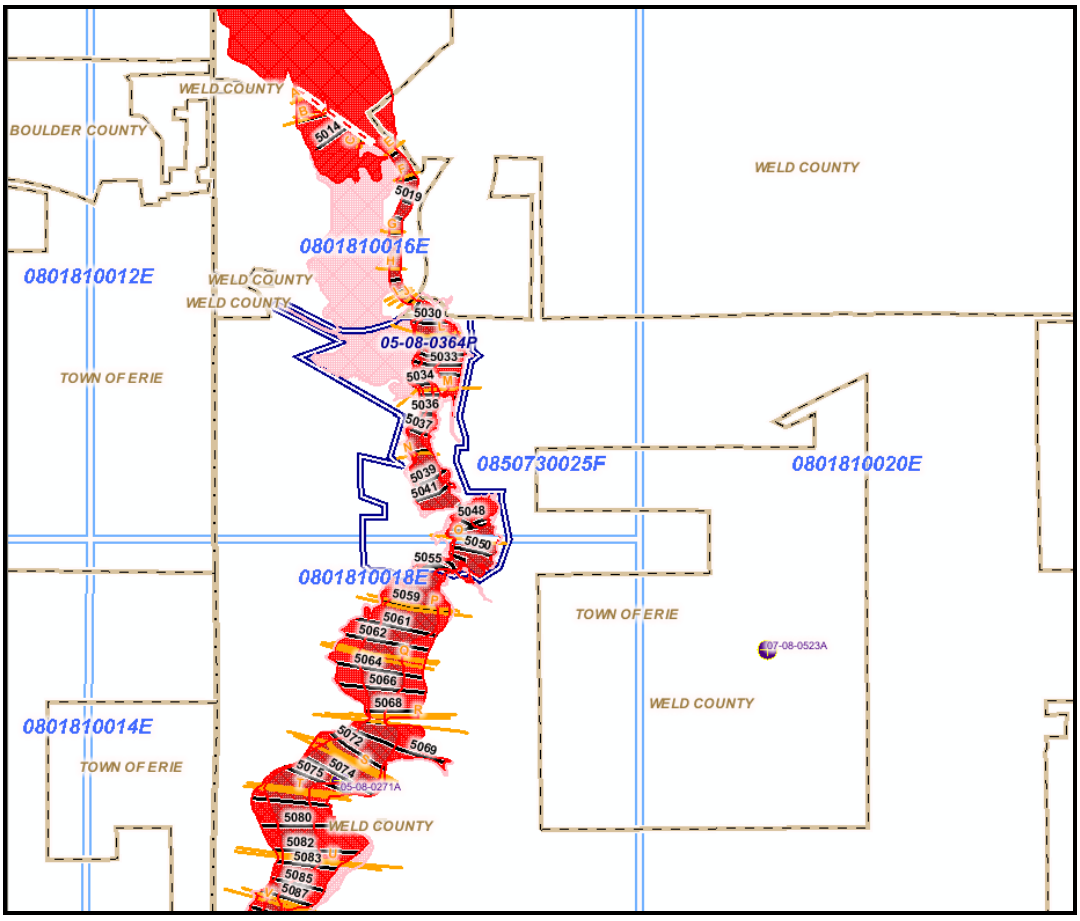

Figure 3. Example NFHL Data for Weld County

Table 4 contains a list of the NFHL data layers that will not be included in the Flood DSS because Riverside feels they are less important. However, Riverside can easily include any of these data layers based on CWCB's preferences.

Table 4. Data Layers Excluded from FEMA's NFHL Web Service

Data Layer
Bench Marks
CBRS and OPA units
Coastal Transects
DFIRM Data Availability
Flood Data Availability
Flood Hazard Zones (mask)
Flood Map Availability
Floodways (linear)
Jurisdiction Names 2
Limit of Floodway
No DFIRM mask
PLSS
Preliminary Maps Issued
Q3 Flood Hazards
Q3 Flood Hazards (red)
River Distance Markers
Streets (from DFIRM)
USGS Quads
Watershed (HUC10)

4.2 Historical Flood Information

One of the most popular ideas for the Flood DSS identified during the user needs assessment was a statewide historical flood layer. Riverside will include the point layer from the prototype, which included basic locations and information for 17 historical flood events, in the Flood DSS map viewer website (see ***Figure 4***).

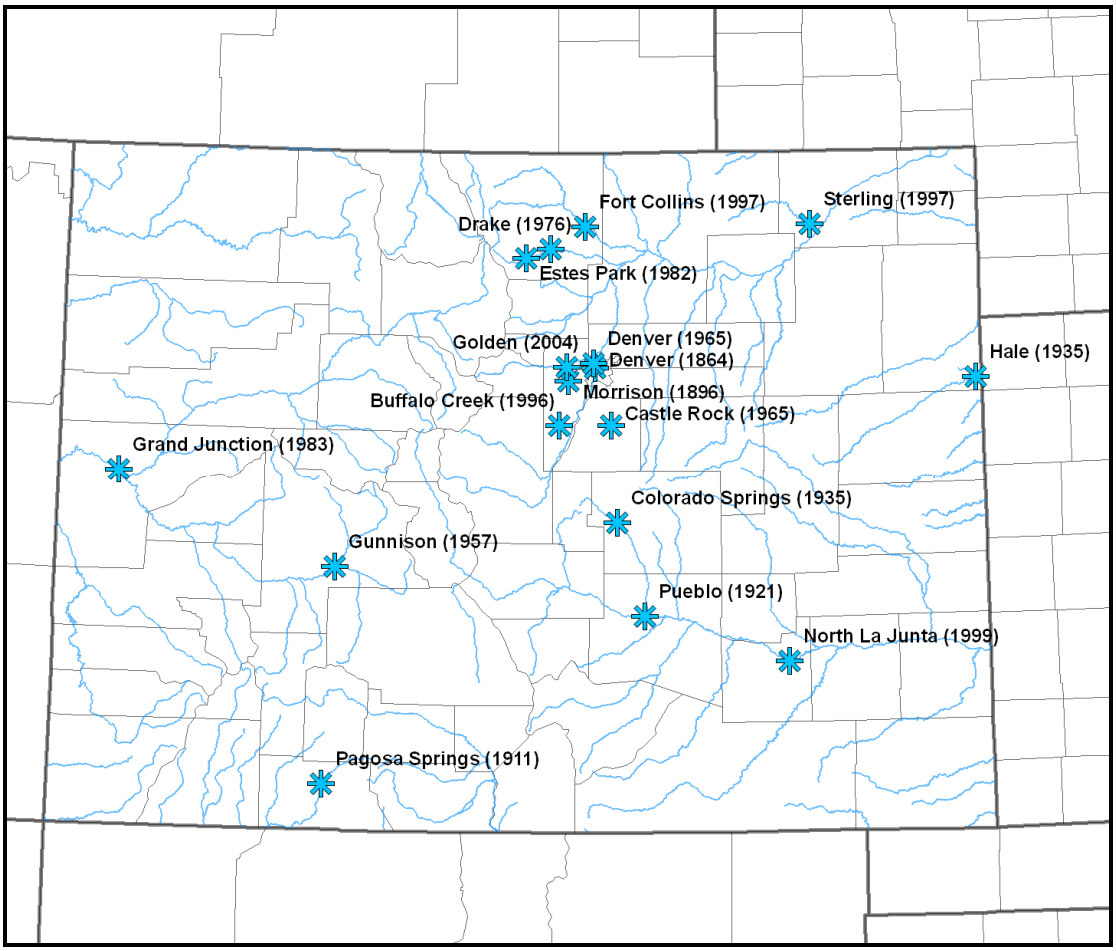

Figure 4. Historical Flood Events Included in the Flood DSS Prototype

During the data collection process, Riverside collected historical storm and flood information from the National Weather Service, Colorado Climate Center, and Urban Drainage and Flood Control District:

- UDFCD Colorado Flood History
  http://udfcd.org/FWP/floodhistory/ColoradoFloodHistoryNotes.xls

- NWS Noteworthy Colorado Floods
  http://www.crh.noaa.gov/bou/awebphp/floods.php

- CWCB Annual Flood Reports
  http://cwcbweblink.state.co.us/Search.aspx?dbid=0

- Colorado Climate Center's Colorado Extreme Storm Precipitation Data Study
  http://ccc.atmos.colostate.edu/pdfs/Climo_97-1_Extreme_ppt.pdf

The statewide historical layer should be improved over time. Riverside proposes that future enhancements include:

- Date of the event - existing date field should be improved to include month and day
- Location of the event - a county field should be added to supplement the existing city and affected stream fields
- Fatalities – a new field should be added and populated
- Damage estimates – the existing field should be populated
- Damage description – a new field should be added and populated
- Precipitation estimate – the existing field should be populated
- Storm description – a new field should be added and populated
- Peak discharge – a new field should be added and populated
- Presidential disaster declaration number – the existing field should be modified from yes/no
- Links to related information – a new field should be added and populated
- Links to LaserFiche documents – a new field should be added and populated

4.3 Real-Time Data and Alerts

The real-time data and alerts component will be a dynamic component in the Flood DSS that provides a snapshot of current weather and flow conditions for community officials. The current project scope includes real-time flow, flow alerts, snowpack, and flood outlook information. ***Table 5*** contains a summary of the layers identified for these data categories along with a description of the data source.

Table 5. Real-Time Data and Alerts Data Layers

Data Layer	Data Source Description
Current Flow Conditions	Hydrobase
Current Flow Alerts	DWR SMS Alert System
1-Hour Accumulated Precipitation	Nowcoast service - NSSL QPE data
24-Hour Accumulated Precipitation	Nowcoast service - NSSL QPE data
Radar Precipitation	Multiple sources - NEXRAD data
6-Hour QPF for Hr 0	Multiple sources – NDFD data
6-Hour QPF for Hr 6	Multiple sources – NDFD data
6-Hour QPF for Hr 12	Multiple sources – NDFD data
6-Hour QPF for Hr 18	Multiple sources – NDFD data
Air Temperature	Nowcoast service – NWS data
Flash Flood Warnings	Multiple sources – NWS data
Flood Warnings	Multiple sources – NWS data
Severe Thunderstorm Warnings	Multiple sources – NWS data
SNOTEL – Current SWE	NRCS
SNODAS – Current SWE	NOHRSC
SNODAS – 24-hour SWE Change	Computed from NOHRSC Data
SNODAS – 7-day SWE Change	Computed from NOHRSC Data
Flood Threat Bulletin	HDR
24-Hour Storm Total Precipitation (Radar)	HDR
24-Hour Storm Total Precipitation (Stations)	HDR

Based on a conversation with HDR, the Flood Threat Bulletin can be incorporated spatially into the Flood DSS if HDR modifies their current procedures to produce a file in dbf or geodatabase format and push the file onto a ftp server. In addition to the spatial data, Riverside will include the statewide text that typically comes with the product as a text popup or an external link to

HDR's website.

For snowpack information, Riverside has included current snow water equivalent (SWE) conditions using both NRCS SNOTEL gages and NOHRSC SNODAS data grids. Riverside also included 24-hour and 7-day change-in-SWE products based on SNODAS for users interested in snowmelt-driven events.

During the needs assessment, users identified gaged precipitation, radar precipitation, forecasted precipitation, air temperature, and National Weather Service watches and warnings as useful information to include. In order to incorporate these data layers into the Flood DSS, and meet user needs without requiring significant project resources, Riverside identified available web services (see ***Table 5***). In some cases, Riverside identified multiple web services for the same data type. Riverside plans to test the web services during system development to assess reliability and performance. Ultimately, if a satisfactory web service for these data types cannot be identified, these data layers will not be included in this phase of the Flood DSS because Riverside does not have sufficient project resources to develop new processing procedures.

4.4 Multi-Hazard

Two statewide data layers that have been included in the Flood DSS for multi-hazard information are hazard mitigation plan status and funding status based on data collected from the Colorado Department of Emergency Management (see ***Figure 5***). In addition, Riverside has collected and processed a statewide wildfire risk layer from the Colorado State Forest Service (see ***Table 6***).

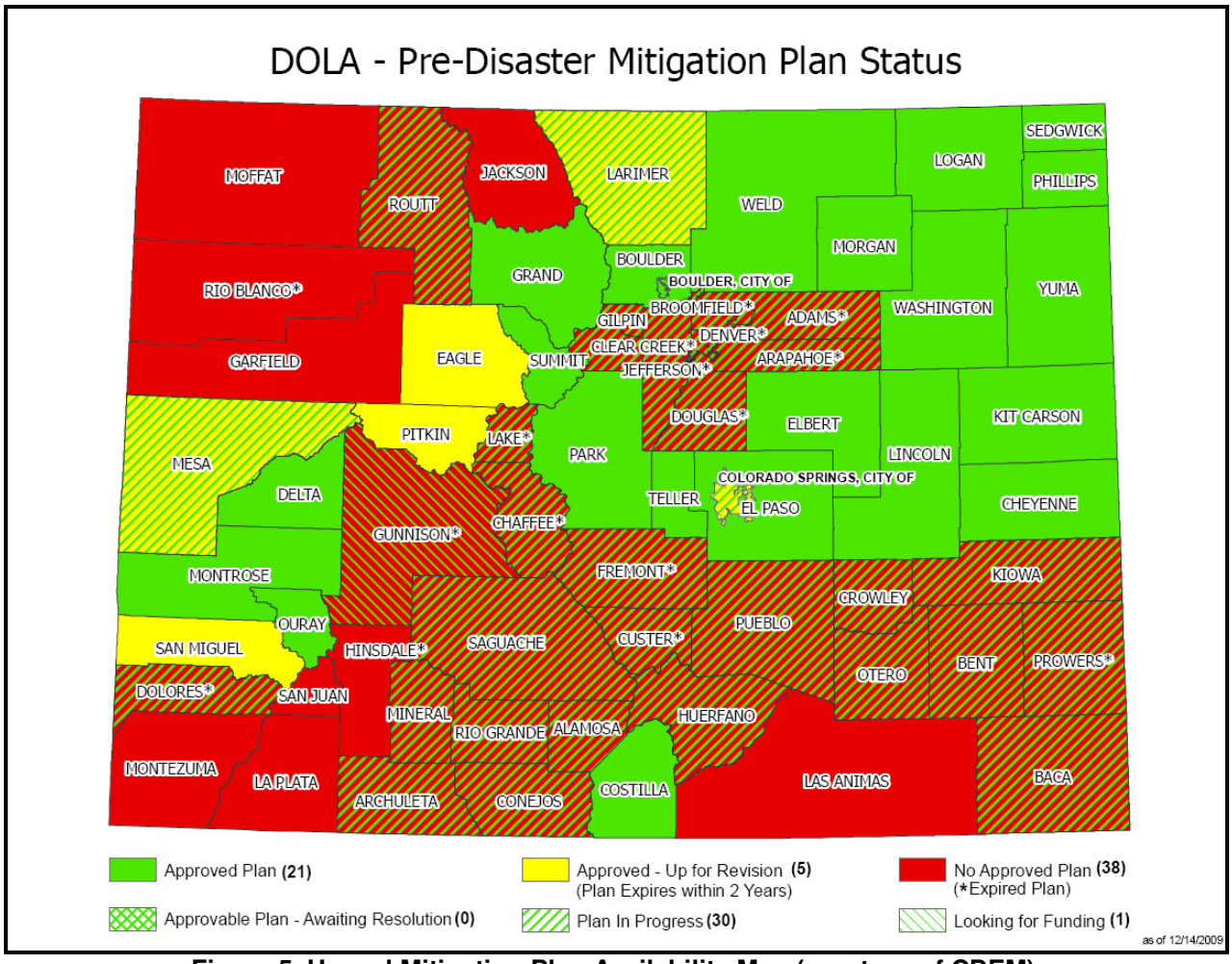

Figure 5. Hazard Mitigation Plan Availability Map (courtesy of CDEM)

Table 6. Multi-Hazard Data Layers

Data Layer
Pre-Disaster Mitigation Plan Funding Status
Pre-Disaster Mitigation Plan Status
Wildfire Risk Assessment 2008

4.5 Weather Modification

The weather modification component includes two data layers (see ***Table 7***). A simple website has been developed for this component that includes current snowpack information in addition to the data layers included in ***Table 7***.

Table 7. Weather Modification Data Layers

Data Layer
Generator Locations
Target Areas

4.6 Watershed Restoration

The watershed restoration component has two data layers that will be included in the Flood DSS (see ***Table 8***). The restoration project layers have been collected from CWCB.

Table 8. Watershed Restoration Data Layers

Data Layer
CO Watershed Restoration Program Projects
CO Healthy Rivers Fund Projects

4.7 Community Information

The community information component will include the data layers identified in ***Table 9***. These data layers have been collected from FEMA and CWCB, then processed into standardized tables that can be joined to city or county shapefiles as appropriate.

Table 9. Community Information Data Layers

Data Layer
NFIP Participation Status - City
NFIP Participation Status - County
CRS Participation Status - City
CRS Participation Status – County
Number of Repetitive Losses - City
Number of Repetitive Losses – County
CRS Rating/Discount - City
CRS Rating/Discount – County
Avg Savings per Policy - City
Avg Savings per Policy – County
Total Savings by Community - City
Total Savings by Community – County

4.8 Base Data

Table 10 contains a list of the base data layers, which are similar to the layers included in the Flood DSS prototype website. Fifteen data layers have been included from HAZUS for statewide critical infrastructure information. The DWR dams layer will only be visible if a user logs into the system.

Table 10. Base Data Layers

Data Layer
Airports (HAZUS Colorado)
Communications (HAZUS Colorado)
Dams (HAZUS Colorado)
EOC (HAZUS Colorado)
Fire Stations (HAZUS Colorado)
HAZMAT (HAZUS Colorado)

Data Layer
Health Facilities (HAZUS Colorado)
Natural Gas Facilities (HAZUS Colorado)
Nuclear Facility (HAZUS Colorado)
Petroleum Plants (HAZUS Colorado)
Police Stations (HAZUS Colorado)
Power Plants (HAZUS Colorado)
Schools (HAZUS Colorado)
Wastewater Facilities (HAZUS Colorado)
Water Facilities (HAZUS Colorado)
Major Cities
Cities and Towns
DWR Water Divisions
Major River Basins
DWR Water Districts
HUC8
Highways and Interstates
Major Roads
Local Roads
Major Rivers
NHD Medium Resolution
NHD High Resolution
County Boundaries
Cities
Neighboring States
Diversions
Townships
Dams - DWR

4.9 Background Data

Table 11 contains a list of background data layers.

Table 11. Background Data Layers

Data Layer
Shaded Relief
National Elevation Dataset
USGS Raster Graphics (Topo Maps)
ESRI Imagery
Land cover