

# Hazus-MH: Earthquake Event Report

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**Region Name:** Boulder County Golden fault 2010Census

**Earthquake Scenario:** Golden fault 6.5

**Print Date:** February 25, 2013

*Totals only reflect data for those census tracts/blocks included in the user's study region.*

**DOI:** <https://doi.org/10.58783/cgs.ha08.hmrs2074>

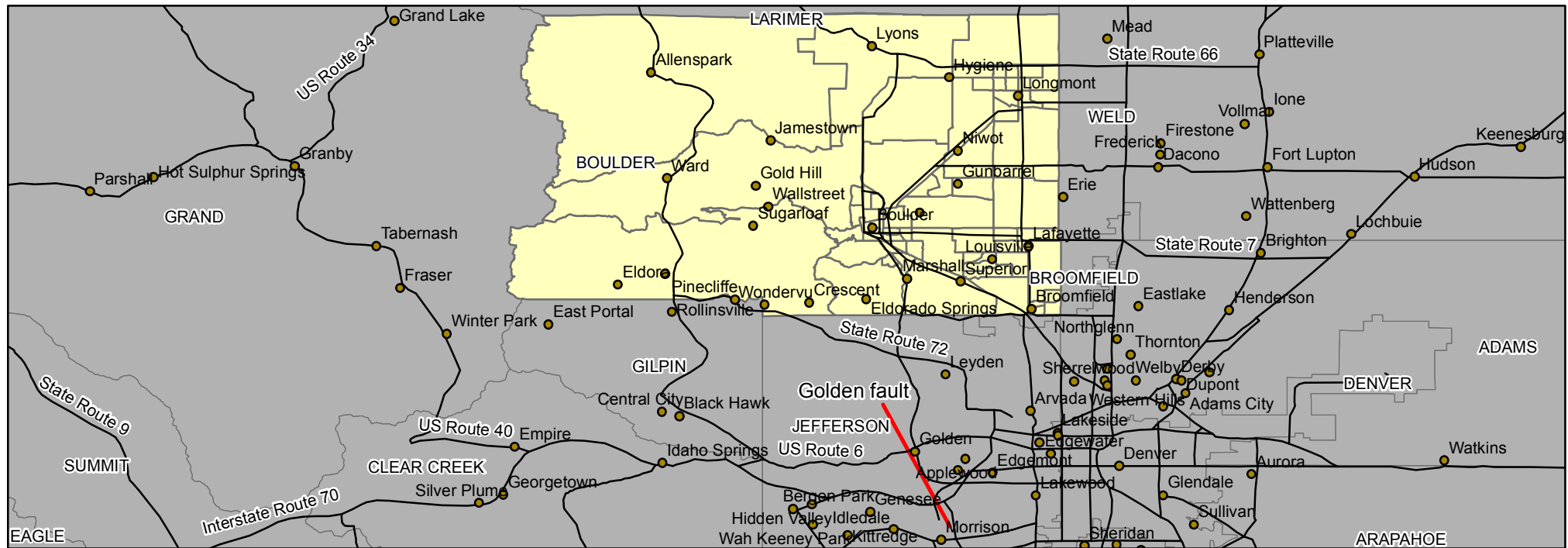
**Disclaimer:**

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.*

# Study Region: Boulder County

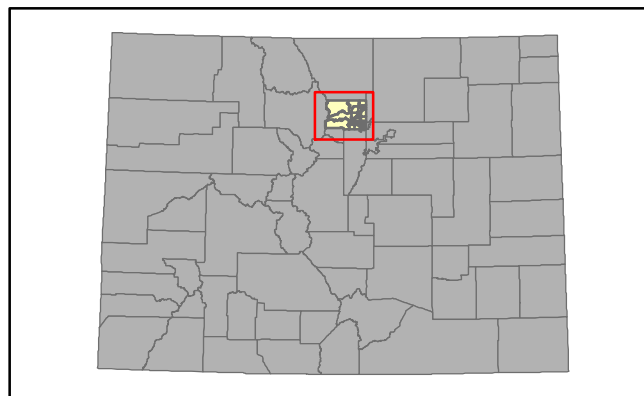
## Hazard Scenario: Golden Fault 6.5

## Overview Map



### Legend

- Cities
- Roads
- Fault
- Study Region Tract



Created by: Colorado Geological Survey

Team: Matt Morgan and Scot Fitzgerald

Date Created: January 2013

Location: Boulder County Colorado

Fault Parameters: arbitrary, magnitude 7, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

Projection: GCS North American 1983

0 10 20 40 Miles



**HAZUS**  
EARTHQUAKE • WIND • FLOOD

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## General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Colorado

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 750.36 square miles and contains 68 census tracts. There are over 128 thousand households in the region which has a total population of 318,008 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 147 thousand buildings in the region with a total building replacement value (excluding contents) of 33,495 (millions of dollars). Approximately 92.00 % of the buildings (and 73.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 2,227 and 1,334 (millions of dollars) , respectively.

## Building and Lifeline Inventory

### **Building Inventory**

Hazus estimates that there are 147 thousand buildings in the region which have an aggregate total replacement value of 33,495 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 69% of the building inventory. The remaining percentage is distributed between the other general building types.

### **Critical Facility Inventory**

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 6 hospitals in the region with a total bed capacity of 0 beds. There are 133 schools, 56 fire stations, 14 police stations and 4 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 75 dams identified within the region. Of these, 24 of the dams are classified as 'high hazard'. The inventory also includes 47 hazardous material sites, 0 military installations and 0 nuclear power plants.

### **Transportation and Utility Lifeline Inventory**

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 3,561.00 (millions of dollars). This inventory includes over 390 kilometers of highways, 238 bridges, 6,299 kilometers of pipes.

**Table 1: Transportation System Lifeline Inventory**

<b>System</b>	<b>Component</b>	<b># Locations/ # Segments</b>	<b>Replacement value (millions of dollars)</b>
<b>Highway</b>	Bridges	238	167.90
	Segments	138	1,915.80
	Tunnels	1	1.20
	Subtotal		<b>2,084.90</b>
<b>Railways</b>	Bridges	2	0.20
	Facilities	0	0.00
	Segments	37	88.10
	Tunnels	0	0.00
	Subtotal		<b>88.20</b>
<b>Light Rail</b>	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		<b>0.00</b>
<b>Bus</b>	Facilities	5	5.30
	Subtotal		<b>5.30</b>
<b>Ferry</b>	Facilities	0	0.00
	Subtotal		<b>0.00</b>
<b>Port</b>	Facilities	0	0.00
	Subtotal		<b>0.00</b>
<b>Airport</b>	Facilities	1	10.70
	Runways	1	38.00
	Subtotal		<b>48.60</b>
		Total	<b>2,227.00</b>

**Table 2: Utility System Lifeline Inventory**

<b>System</b>	<b>Component</b>	<b># Locations / Segments</b>	<b>Replacement value (millions of dollars)</b>
<b>Potable Water</b>	Distribution Lines	NA	72.90
	Facilities	3	96.90
	Pipelines	0	0.00
	Subtotal		<b>169.80</b>
<b>Waste Water</b>	Distribution Lines	NA	43.70
	Facilities	17	1,098.20
	Pipelines	0	0.00
	Subtotal		<b>1,142.00</b>
<b>Natural Gas</b>	Distribution Lines	NA	29.10
	Facilities	2	0.00
	Pipelines	431	138.90
	Subtotal		<b>168.10</b>
<b>Oil Systems</b>	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		<b>0.00</b>
<b>Electrical Power</b>	Facilities	38	0.00
	Subtotal		<b>0.00</b>
<b>Communication</b>	Facilities	5	0.50
	Subtotal		<b>0.50</b>
		<b>Total</b>	<b>1,480.30</b>

## Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

<b>Scenario Name</b>	Golden fault 6.5
<b>Type of Earthquake</b>	Arbitrary
<b>Fault Name</b>	NA
<b>Historical Epicenter ID #</b>	NA
<b>Probabilistic Return Period</b>	NA
<b>Longitude of Epicenter</b>	-105.22
<b>Latitude of Epicenter</b>	39.74
<b>Earthquake Magnitude</b>	6.50
<b>Depth (Km)</b>	10.00
<b>Rupture Length (Km)</b>	17.18
<b>Rupture Orientation (degrees)</b>	157.00
<b>Attenuation Function</b>	Central & East US (CEUS 2008)



## Building Damage

### Building Damage

Hazus estimates that about 37,640 buildings will be at least moderately damaged. This is over 26.00 % of the buildings in the region. There are an estimated 4,598 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

**Table 3: Expected Building Damage by Occupancy**

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Agriculture</b>	227	0.30	91	0.28	96	0.43	64	0.60	39	0.84
<b>Commercial</b>	2,247	2.93	1,307	3.98	1,960	8.78	1,297	12.09	665	14.46
<b>Education</b>	47	0.06	22	0.07	30	0.14	24	0.22	14	0.31
<b>Government</b>	68	0.09	34	0.10	48	0.22	31	0.29	13	0.28
<b>Industrial</b>	698	0.91	390	1.19	633	2.84	449	4.19	233	5.08
<b>Other Residential</b>	20,287	26.49	9,916	30.20	7,179	32.17	3,642	33.96	1,680	36.52
<b>Religion</b>	180	0.23	84	0.26	108	0.49	74	0.69	36	0.78
<b>Single Family</b>	52,834	68.98	20,986	63.92	12,262	54.94	5,143	47.96	1,919	41.74
<b>Total</b>	<b>76,589</b>		<b>32,831</b>		<b>22,317</b>		<b>10,725</b>		<b>4,599</b>	

**Table 4: Expected Building Damage by Building Type (All Design Levels)**

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Wood</b>	62,286	81.33	26,481	80.66	11,036	49.45	1,680	15.66	194	4.23
<b>Steel</b>	794	1.04	461	1.40	1,091	4.89	1,014	9.45	705	15.33
<b>Concrete</b>	1,165	1.52	741	2.26	1,230	5.51	914	8.52	474	10.30
<b>Precast</b>	599	0.78	267	0.81	568	2.54	549	5.12	306	6.66
<b>RM</b>	9,134	11.93	2,875	8.76	5,462	24.48	4,630	43.17	1,945	42.30
<b>URM</b>	1,406	1.84	924	2.81	1,092	4.89	676	6.30	447	9.72
<b>MH</b>	1,205	1.57	1,083	3.30	1,838	8.24	1,262	11.77	527	11.46
<b>Total</b>	<b>76,589</b>		<b>32,831</b>		<b>22,317</b>		<b>10,725</b>		<b>4,599</b>	

\*Note:

RM      Reinforced Masonry  
URM     Unreinforced Masonry  
MH      Manufactured Housing

## **Essential Facility Damage**

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (15.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 38.00% of the beds will be back in service. By 30 days, 75.00% will be operational.

**Table 5: Expected Damage to Essential Facilities**

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	6	4	0	0
Schools	133	101	2	22
EOCs	4	0	0	3
PoliceStations	14	0	0	12
FireStations	56	0	0	44

## Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

**Table 6: Expected Damage to the Transportation Systems**

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	138	0	0	138	138
	Bridges	238	23	4	215	218
	Tunnels	1	0	0	1	1
Railways	Segments	37	0	0	37	37
	Bridges	2	0	0	2	2
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	5	0	0	5	5
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	0	0	1	1
	Runways	1	0	0	1	1

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	3	0	0	3	3
Waste Water	17	8	0	4	17
Natural Gas	2	1	0	1	2
Oil Systems	0	0	0	0	0
Electrical Power	38	14	0	17	38
Communication	5	2	0	5	5

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	3,643	553	138
Waste Water	2,186	278	69
Natural Gas	471	34	8
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	128,792	10,928	2,560	0	0	0
Electric Power		82,278	41,390	12,662	1,932	129

## Induced Earthquake Damage

### **Fire Following Earthquake**

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 1 ignitions that will burn about 0.02 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 243 people and burn about 21 (millions of dollars) of building value.

### **Debris Generation**

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 2.13 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 23.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 85,360 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

**Shelter Requirement**

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 5,629 households to be displaced due to the earthquake. Of these, 3,222 people (out of a total population of 318,008) will seek temporary shelter in public shelters.

**Casualties**

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
<b>2 AM</b>	Commercial	24	7	1	2
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	10	3	0	1
	Industrial	22	6	1	2
	Other-Residential	336	85	11	22
	Single Family	669	179	29	58
	<b>Total</b>	<b>1,060</b>	<b>280</b>	<b>43</b>	<b>85</b>
<b>2 PM</b>	Commercial	1,284	366	60	118
	Commuting	1	1	2	0
	Educational	1,585	469	79	155
	Hotels	2	1	0	0
	Industrial	159	43	7	13
	Other-Residential	34	8	1	2
	Single Family	87	23	4	7
	<b>Total</b>	<b>3,152</b>	<b>911</b>	<b>152</b>	<b>295</b>
<b>5 PM</b>	Commercial	955	272	45	87
	Commuting	25	34	56	11
	Educational	438	130	22	43
	Hotels	3	1	0	0
	Industrial	99	27	4	8
	Other-Residential	127	32	4	8
	Single Family	260	69	11	22
	<b>Total</b>	<b>1,908</b>	<b>565</b>	<b>143</b>	<b>179</b>

## Economic Loss

The total economic loss estimated for the earthquake is 5,051.63 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

### Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 4,873.73 (millions of dollars); 22 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 48 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

**Table 11: Building-Related Economic Loss Estimates**

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
<b>Income Losses</b>							
	Wage	0.00	11.75	179.61	8.12	31.05	230.53
	Capital-Related	0.00	4.96	159.13	4.86	11.08	180.04
	Rental	38.27	45.81	85.63	4.82	13.71	188.25
	Relocation	137.48	32.05	138.28	16.05	138.93	462.79
	<b>Subtotal</b>	<b>175.75</b>	<b>94.57</b>	<b>562.66</b>	<b>33.86</b>	<b>194.77</b>	<b>1,061.61</b>
<b>Capital Stock Losses</b>							
	Structural	301.67	76.34	176.50	47.36	97.26	699.13
	Non_Structural	941.78	366.73	482.40	136.15	335.93	2,262.99
	Content	274.72	85.28	219.18	88.68	161.61	829.48
	Inventory	0.00	0.00	5.21	14.18	1.14	20.52
	<b>Subtotal</b>	<b>1,518.17</b>	<b>528.35</b>	<b>883.28</b>	<b>286.37</b>	<b>595.94</b>	<b>3,812.12</b>
	<b>Total</b>	<b>1,693.92</b>	<b>622.92</b>	<b>1,445.94</b>	<b>320.23</b>	<b>790.72</b>	<b>4,873.73</b>



## **Transportation and Utility Lifeline Losses**

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

**Table 12: Transportation System Economic Losses**  
(Millions of dollars)

<b>System</b>	<b>Component</b>	<b>Inventory Value</b>	<b>Economic Loss</b>	<b>Loss Ratio (%)</b>
<b>Highway</b>	Segments	1,915.81	\$0.19	0.01
	Bridges	167.91	\$13.84	8.24
	Tunnels	1.17	\$0.02	2.08
	<b>Subtotal</b>	<b>2084.90</b>	<b>14.10</b>	
<b>Railways</b>	Segments	88.05	\$0.00	0.00
	Bridges	0.17	\$0.01	3.02
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	<b>Subtotal</b>	<b>88.20</b>	<b>0.00</b>	
<b>Light Rail</b>	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	<b>Subtotal</b>	<b>0.00</b>	<b>0.00</b>	
<b>Bus</b>	Facilities	5.29	\$1.21	22.96
	<b>Subtotal</b>	<b>5.30</b>	<b>1.20</b>	
<b>Ferry</b>	Facilities	0.00	\$0.00	0.00
	<b>Subtotal</b>	<b>0.00</b>	<b>0.00</b>	
<b>Port</b>	Facilities	0.00	\$0.00	0.00
	<b>Subtotal</b>	<b>0.00</b>	<b>0.00</b>	
<b>Airport</b>	Facilities	10.65	\$2.79	26.24
	Runways	37.96	\$0.00	0.00
	<b>Subtotal</b>	<b>48.60</b>	<b>2.80</b>	
	<b>Total</b>	<b>2227.00</b>	<b>18.10</b>	

**Table 13: Utility System Economic Losses**

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	96.90	\$6.50	6.71
	Distribution Lines	72.90	\$2.49	3.42
	Subtotal	169.77	\$8.99	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	1,098.20	\$149.03	13.57
	Distribution Lines	43.70	\$1.25	2.86
	Subtotal	1,141.95	\$150.28	
Natural Gas	Pipelines	138.90	\$0.07	0.05
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	29.10	\$0.43	1.47
	Subtotal	168.07	\$0.50	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.50	\$0.07	14.60
	Subtotal	0.49	\$0.07	
	Total	1,480.27	\$159.84	

**Table 14. Indirect Economic Impact with outside aid**

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

**Appendix A: County Listing for the Region**

Boulder,CO

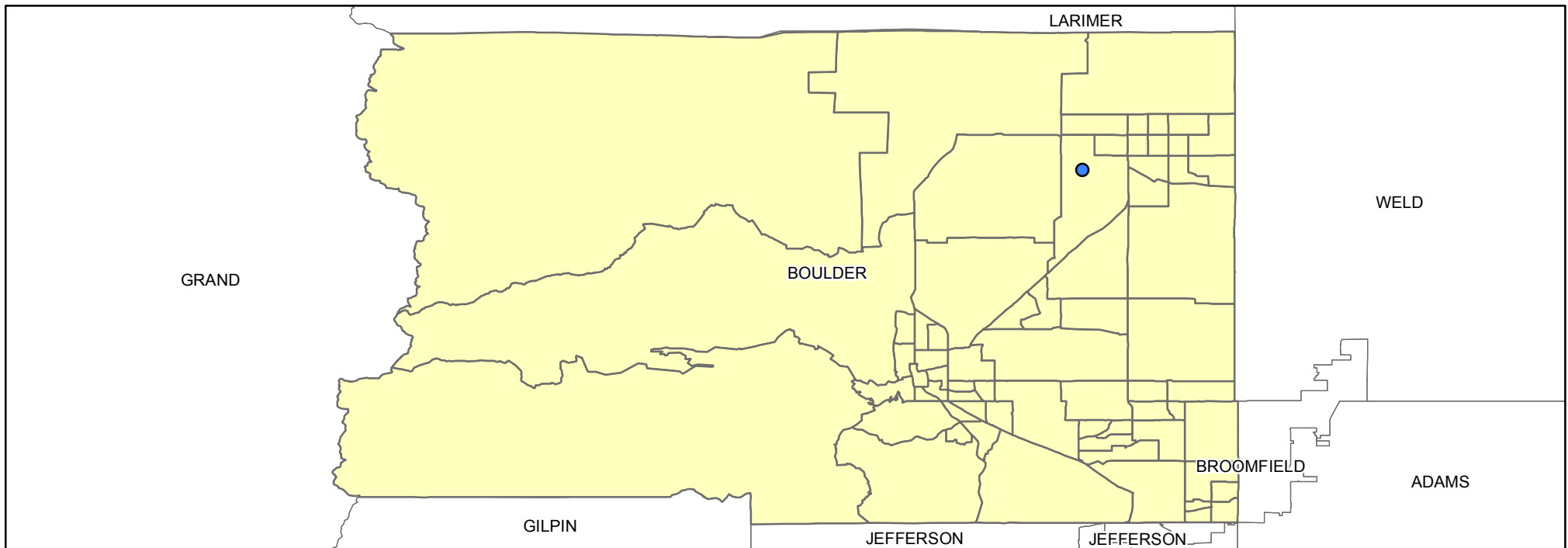
**Appendix B: Regional Population and Building Value Data**

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Colorado	Boulder	318,008	24,494	9,001	33,495
Total State		318,008	24,494	9,001	33,495
Total Region		318,008	24,494	9,001	33,495

# Study Region: Boulder County

Hazard Scenario: Golden Fault 6.5

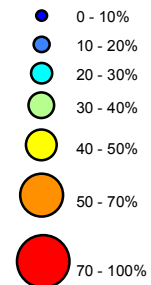
## Airports Map



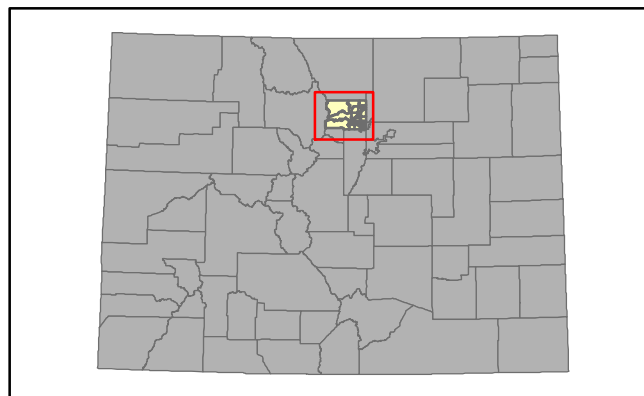
### Legend

#### Airports

#### Probability Damage > Extensive



Study Region Tract  
Counties



Created by: Colorado Geological Survey

Team: Matt Morgan and Scot Fitzgerald

Date Created: January 2013

Location: Boulder County Colorado

Fault Parameters: arbitrary, magnitude 7, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

Projection: GCS North American 1983

0 5 10 20 Miles

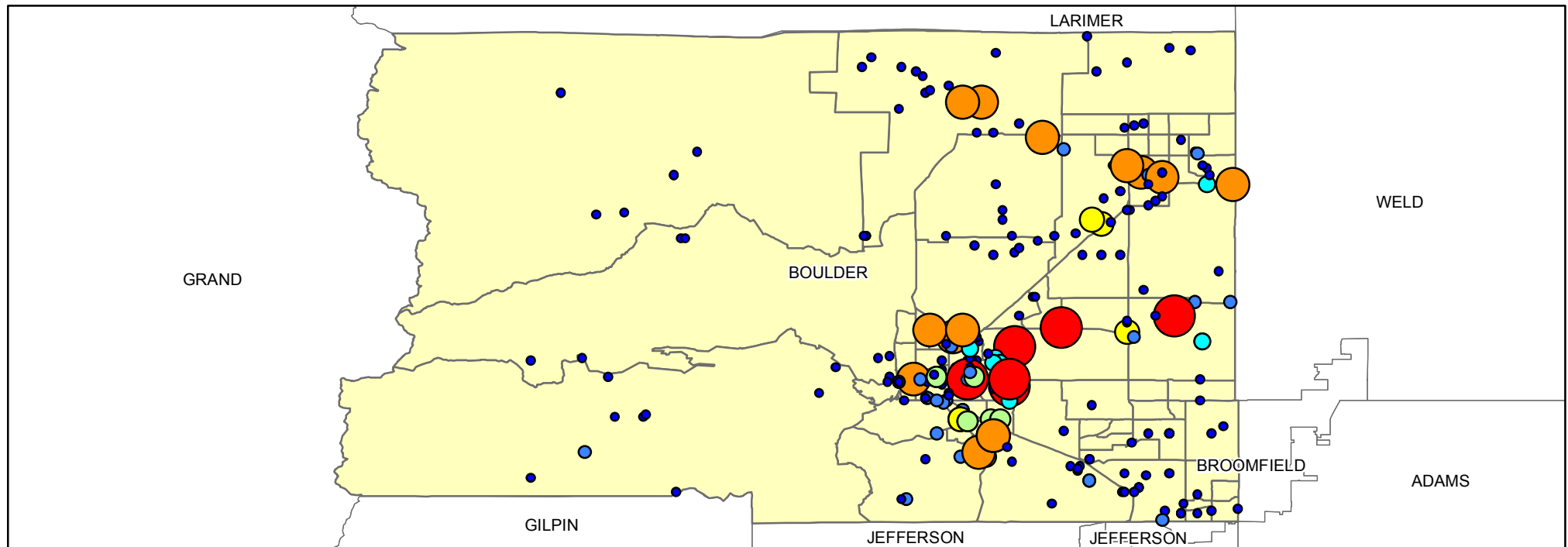


**HAZUS**  
EARTHQUAKE • WIND • FLOOD

# Study Region: Boulder County

Hazard Scenario: Golden Fault 6.5

## Bridges Map

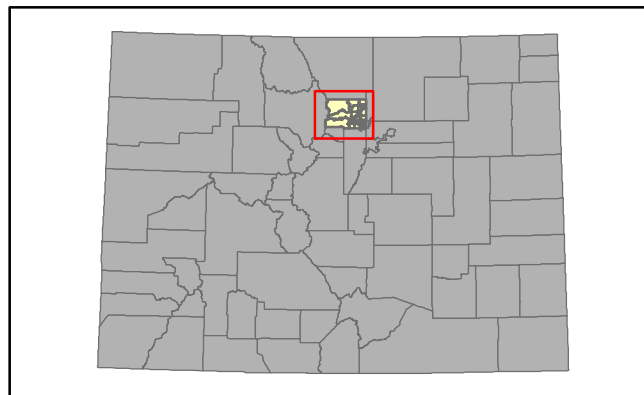


### Legend

**Bridges**  
Probability Damage > Extensive



Study Region Tract  
Counties



Created by: Colorado Geological Survey  
Team: Matt Morgan and Scot Fitzgerald  
Date Created: January 2013  
Location: Boulder County Colorado  
Fault Parameters: arbitrary, magnitude 7, depth 10km  
Data: Changed to CGS Landslides and CGS/FEMA Soils data  
Projection: GCS North American 1983

0 5 10 20 Miles

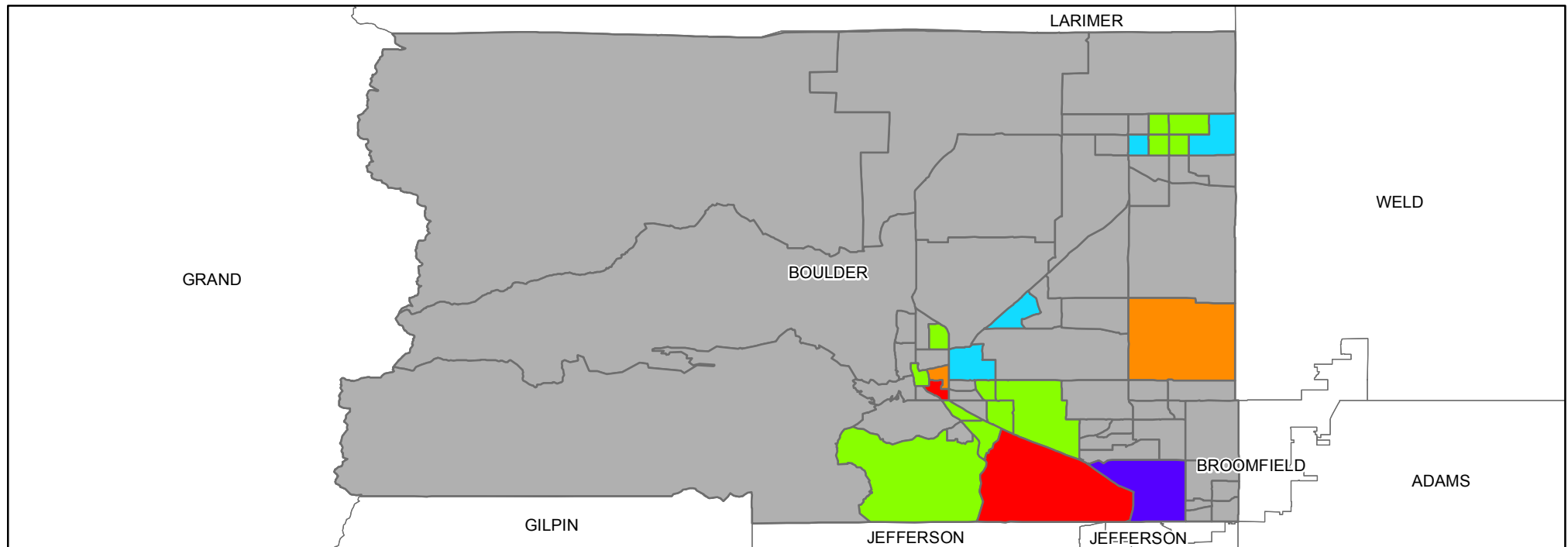


**HAZUS**  
EARTHQUAKE • WIND • FLOOD

# Study Region: Boulder County

Hazard Scenario: Golden Fault 6.5

## Building Economic Loss Map

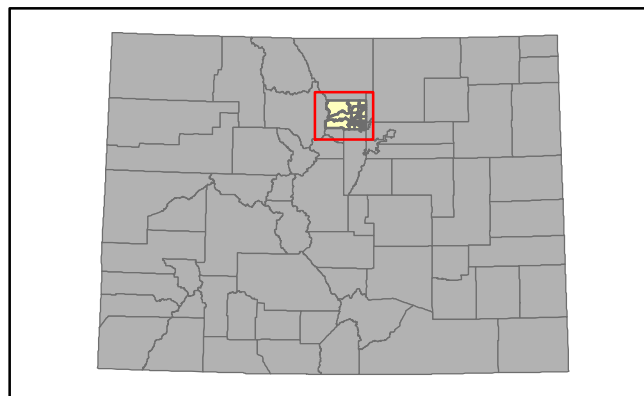


### Legend

#### Building Economic Loss in Thousands of Dollars

- 3579 - 68715
- 68715 - 133851
- 133851 - 198987
- 198987 - 264123
- 264123 - 329259
- 329259 - 394397

- Fault
- Study Region Tract
- Counties



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Team: Matt Morgan and Scot Fitzgerald

Date Created: January 2013

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Projection: GCS North American 1983

0 5 10 20 Miles

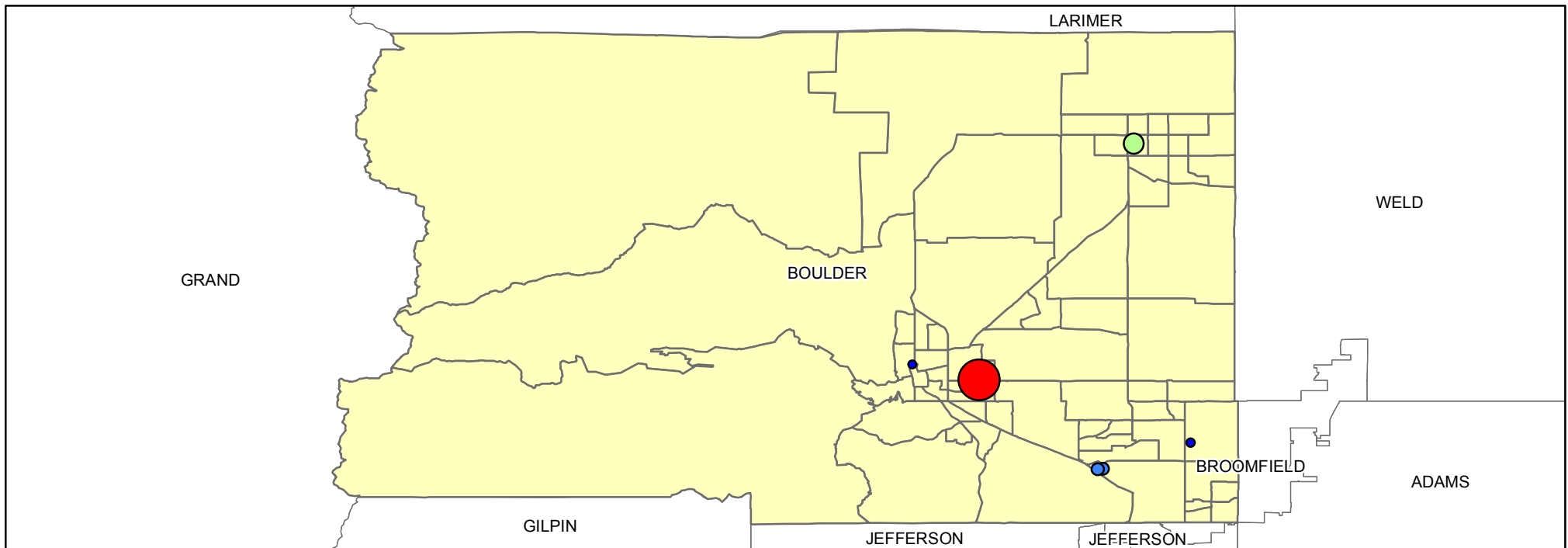


**HAZUS**  
EARTHQUAKE • WIND • FLOOD **MH**

# Study Region: Boulder County

Hazard Scenario: Golden Fault 6.5

## Care Facilities Map



### Legend

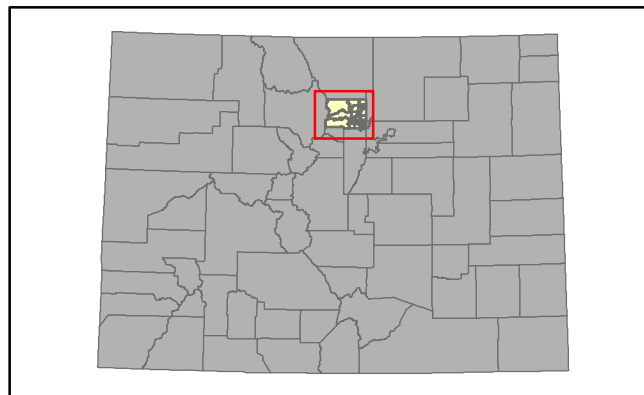
#### Care Facilities

##### Probability Damage > Extensive

- 0 - 10%
- 10 - 20%
- 20 - 30%
- 30 - 40%
- 40 - 50%
- 50 - 70%
- 70 - 100%

Study Region Tract

Counties



Created by: Colorado Geological Survey

Team: Matt Morgan and Scot Fitzgerald

Date Created: January 2013

Location: Boulder County Colorado

Fault Parameters: arbitrary, magnitude 7, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

Projection: GCS North American 1983

0 5 10 20 Miles



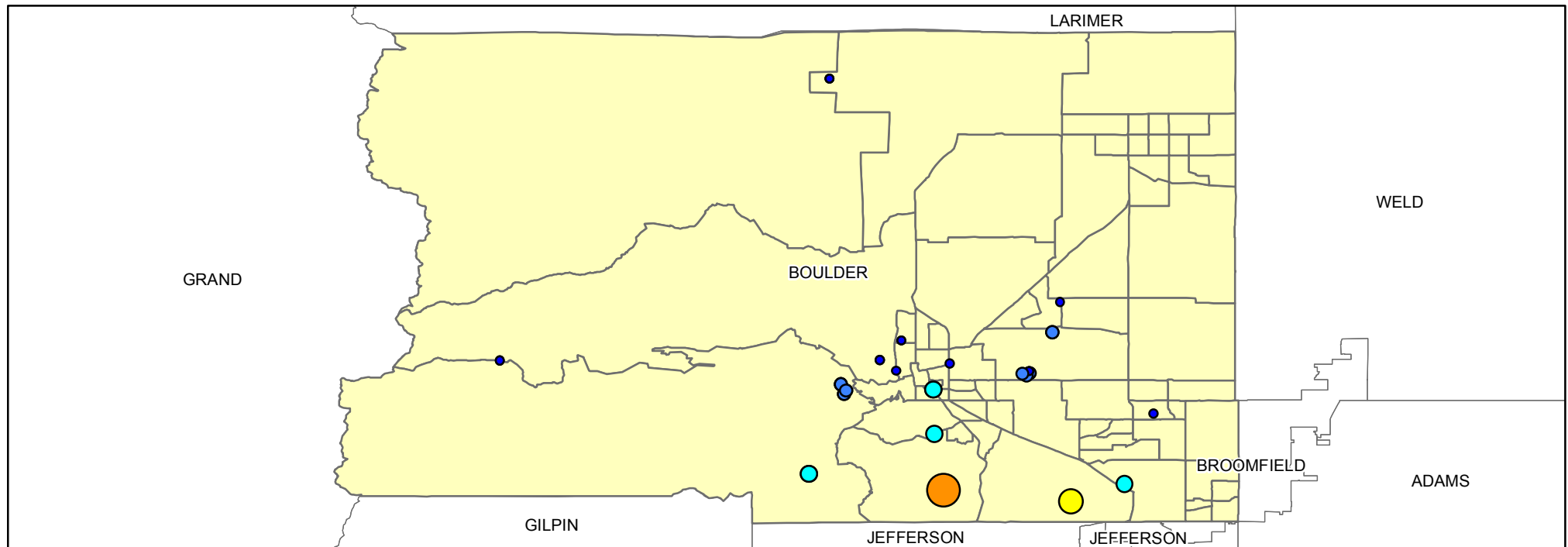
**HAZUS**  
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# Study Region: Boulder County

Hazard Scenario: Golden Fault 6.5

## Electrical Facilities Map



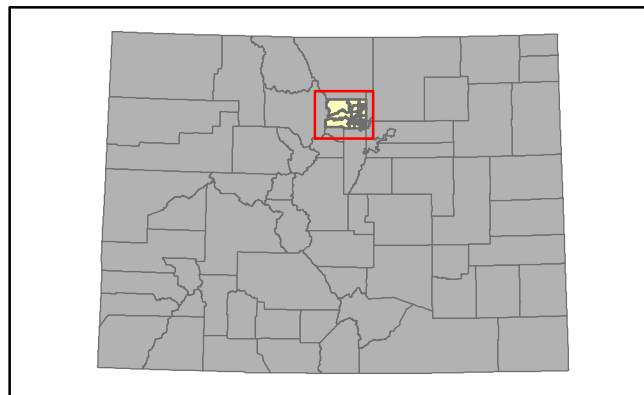
### Legend

#### Electrical Facilities

##### Probability Damage > Extensive

- 0 - 10%
- 10 - 20%
- 20 - 30%
- 30 - 40%
- 40 - 50%
- 50 - 70%
- 70 - 100%

Study Region Tract  
Counties



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Team: Matt Morgan and Scot Fitzgerald

Date Created: January 2013

Location: Boulder County Colorado

Fault Parameters: arbitrary, magnitude 7, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

Projection: GCS North American 1983

0 5 10 20 Miles

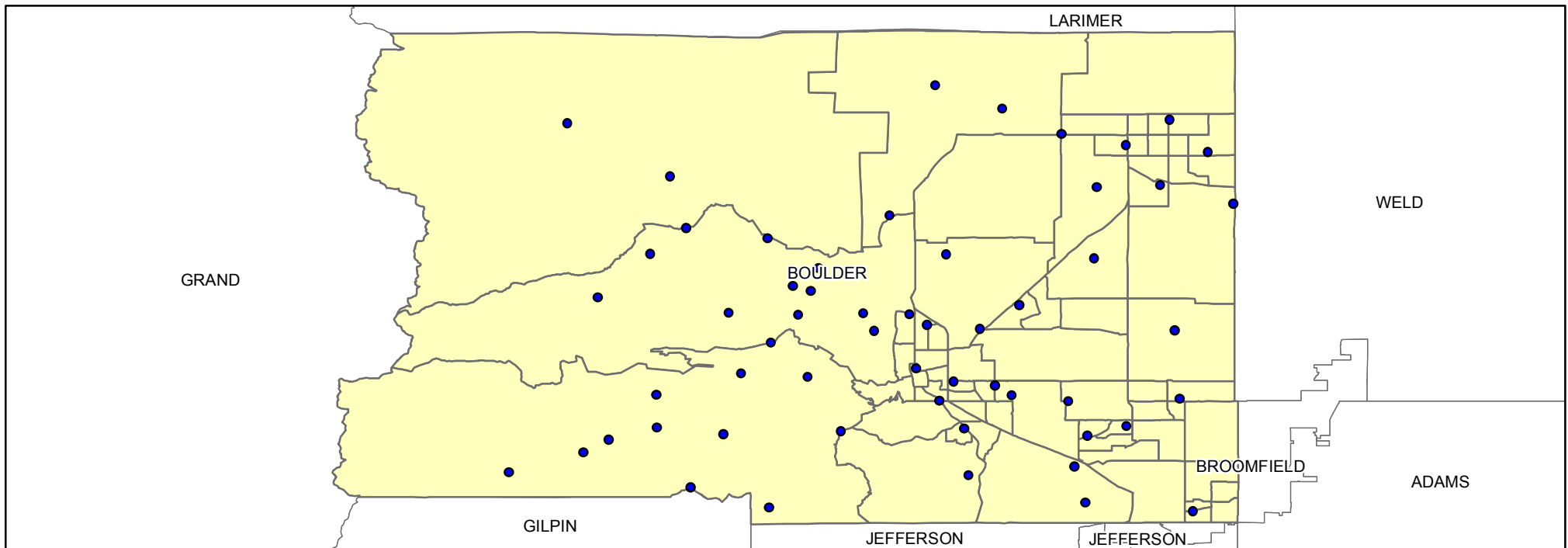


**HAZUS**  
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# Study Region: Boulder County

Hazard Scenario: Golden Fault 6.5

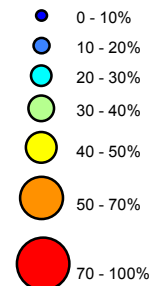
## Fire Stations Map



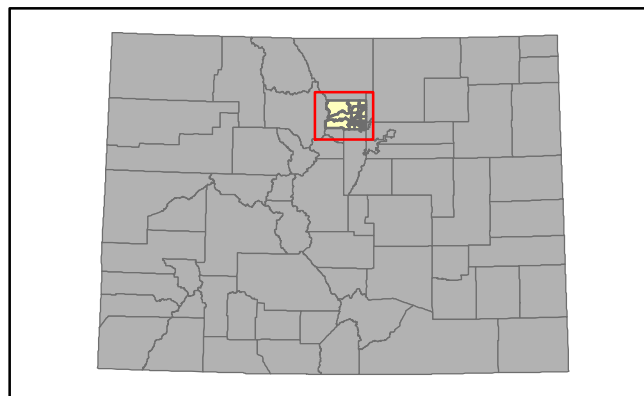
### Legend

#### Fire Stations

##### Probability Damage > Extensive



Study Region Tract  
Counties



Created by: Colorado Geological Survey

Team: Matt Morgan and Scot Fitzgerald

Date Created: January 2013

Location: Boulder County Colorado

Fault Parameters: arbitrary, magnitude 7, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

Projection: GCS North American 1983

0 5 10 20 Miles

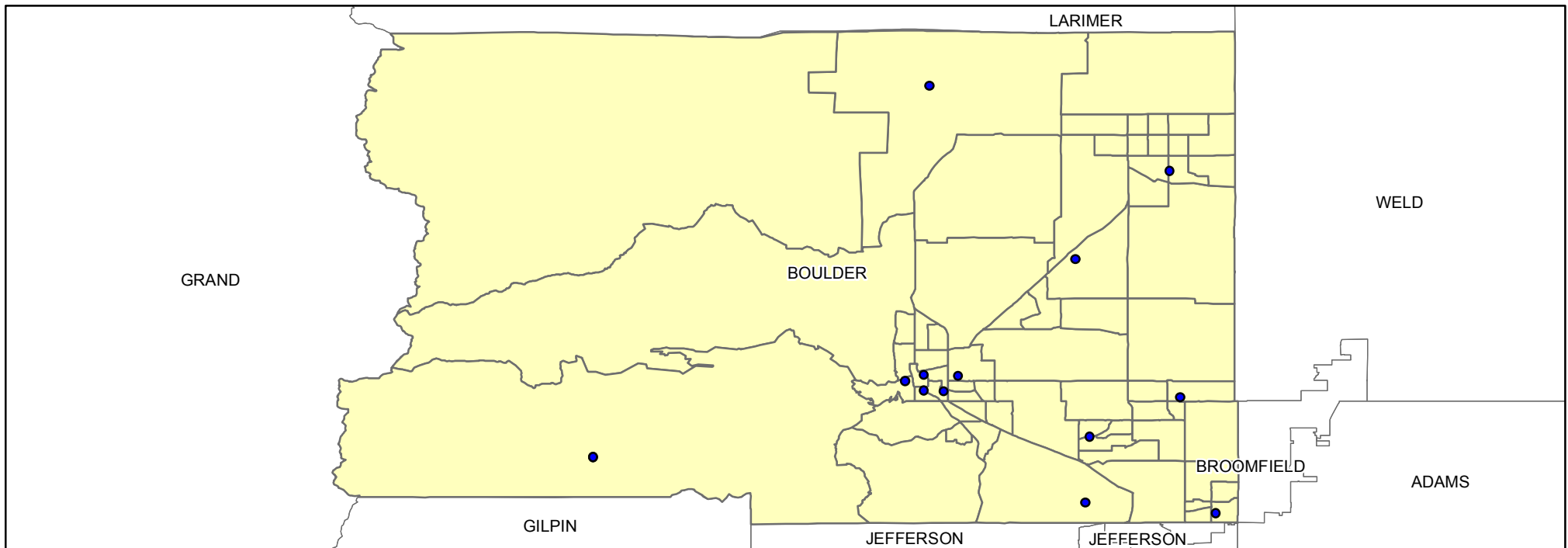


**HAZUS**  
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# Study Region: Boulder County

Hazard Scenario: Golden Fault 6.5

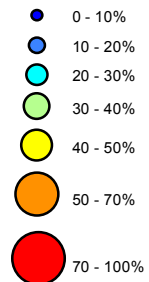
## Police Stations Map



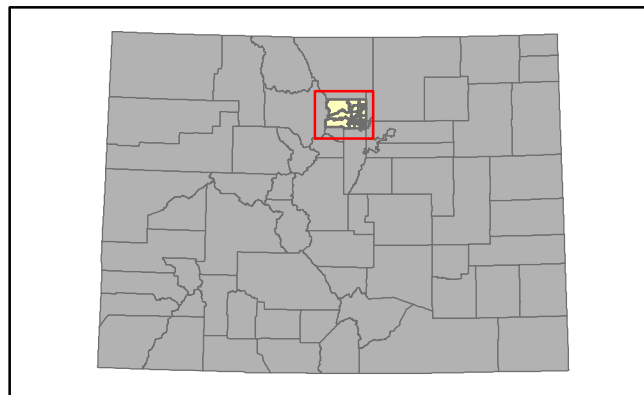
### Legend

#### Police Stations

#### Probability Damage > Extensive



Study Region Tract  
Counties



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Team: Matt Morgan and Scot Fitzgerald

Date Created: January 2013

Location: Boulder County Colorado

Fault Parameters: arbitrary, magnitude 7, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

Projection: GCS North American 1983

0 5 10 20 Miles

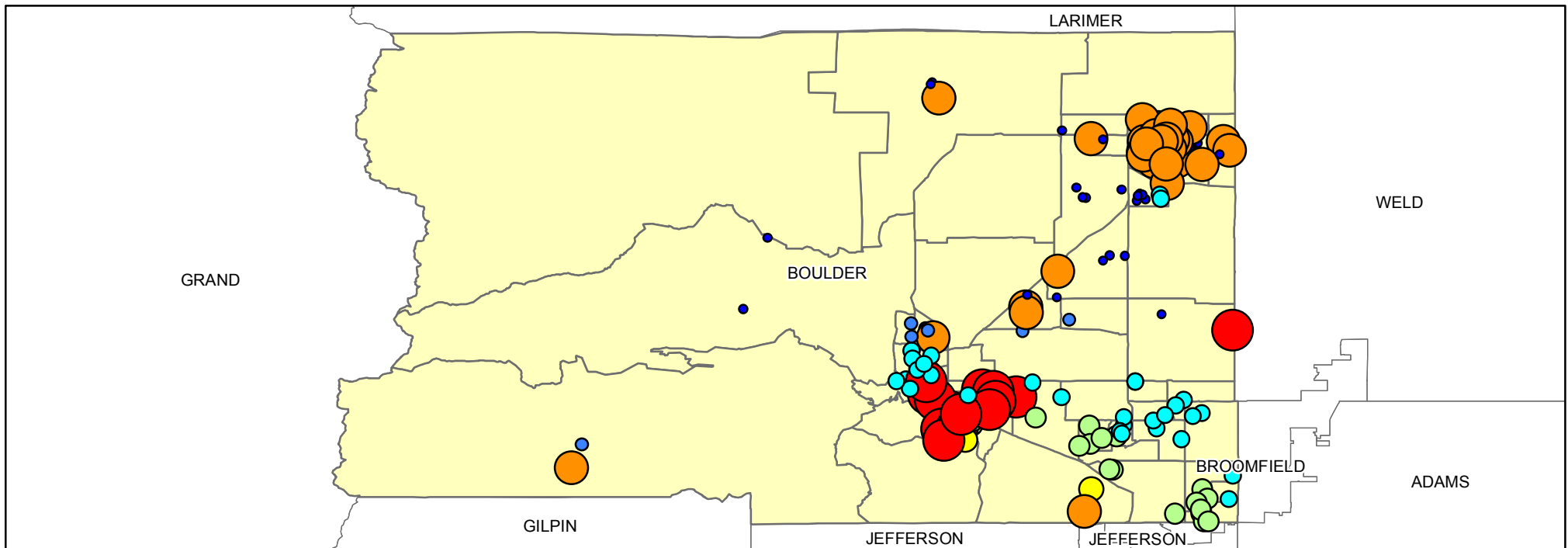


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# Study Region: Boulder County

Hazard Scenario: Golden Fault 6.5

## Schools Map



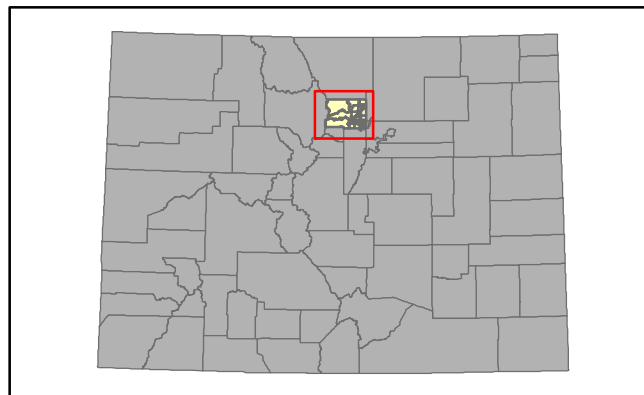
### Legend

#### Schools

#### Probability Damage > Extensive

- 0 - 10%
- 10 - 20%
- 20 - 30%
- 30 - 40%
- 40 - 50%
- 50 - 70%
- 70 - 100%

Study Region Tract  
Counties



Created by: Colorado Geological Survey

Team: Matt Morgan and Scot Fitzgerald

Date Created: January 2013

Location: Boulder County Colorado

Fault Parameters: arbitrary, magnitude 7, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

Projection: GCS North American 1983

0 5 10 20 Miles

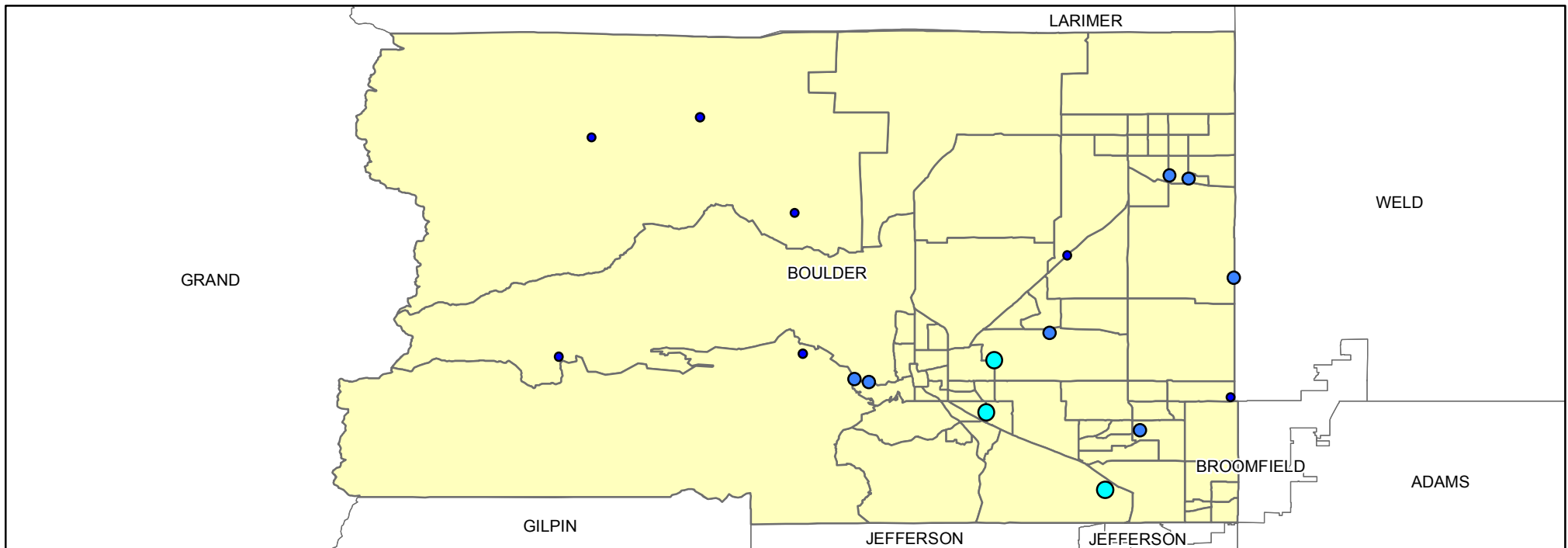


**HAZUS**  
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# Study Region: Boulder County

Hazard Scenario: Golden Fault 6.5

## Waste Water Facilities Map



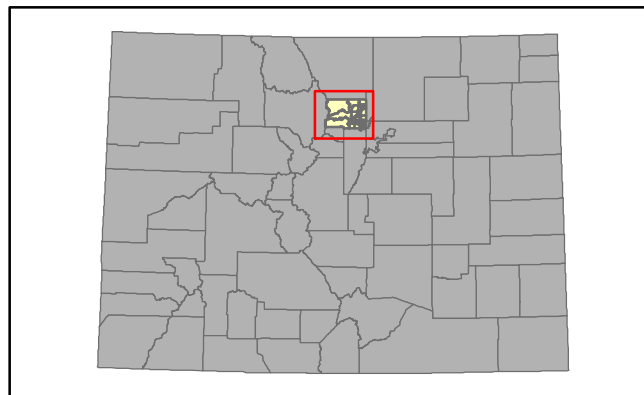
### Legend

#### Waste Water Facilities

##### Probability Damage > Extensive

- 0 - 10%
- 10 - 20%
- 20 - 30%
- 30 - 40%
- 40 - 50%
- 50 - 70%
- 70 - 100%

Study Region Tract  
Counties



Created by: Colorado Geological Survey

Team: Matt Morgan and Scot Fitzgerald

Date Created: January 2013

Location: Boulder County Colorado

Fault Parameters: arbitrary, magnitude 7, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

Projection: GCS North American 1983

0 5 10 20 Miles



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