SECTION # DRAFT FLOOD RISK ASSESSMENT

#.1 IDENTIFYING HAZARDS – DESCRIPTION OF THE FLOOD HAZARD

Under 44 CFR Section 201.6(c)(2)(i) of DMA2K, local mitigation plans are required to include a risk assessment with a description of the types of natural hazards that can affect the jurisdiction. This section identifies the risks faced by the City of Roseville from the flood hazard.

#.1.1 Sources of Flooding in Roseville

The City of Roseville is located within portions of two major drainage basins: the Pleasant Grove Creek Basin and the Dry Creek Basin. Pleasant Grove Creek and its tributaries drain most of the western and central areas of the City, while the Dry Creek basin and its tributaries drain the remainder of the City. The Dry Creek system has year-round flows in its major watercourses, while the Pleasant Grove system is intermittent in nature with only seasonal flows. As a result of this geographical fact, portions of the City lie within a flood hazard area. Seven creeks and streams, draining the 80-square-mile Upper Dry Creek Basin, pass through and join within the City limits of Roseville.

Upstream flows, generated elsewhere within Placer County, enter Roseville's creeks and tributaries from the east and north. Picking up additional stormwater run-off, the creek systems flow in a west-southwestern direction through Roseville. These flows continue to move west-southwestward, draining through Placer, Sacramento, and Sutter Counties to their ultimate destination, the Sacramento and American rivers.

In Roseville, there are 2 types of flooding that typically occur: flash flooding and riverine flooding. Flash floods, as the name suggests, occur suddenly after a brief but intense and concentrated downpour. They move fast and terminate quickly and can occur in areas generally not associated with flooding (i.e., sub-divisions not adjacent to a water body, or areas serviced by underground drainage systems). Although the duration of these events is usually brief, the damages can be quite severe. Flash floods also may result as a secondary effect from other types of disasters including large wildfires and dam breaks. Wildfires remove vegetative cover and alter soil characteristics, increasing the quantity and velocity of stormwater runoff and dam breaks to release large quantities of water into receiving drainage ways in a very short timeframe. Flash floods are the number one weather-related killer with approximately 140 deaths recorded in the United States each year.

Riverine floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies use historical records to determine the probability of occurrence for different extents of flooding. The probability of occurrence is expressed as the percentage chance that a flood of a specific extent will occur in any given year. However, flash floods cannot be predicted accurately and happen whenever there are heavy storms.

Flooding within Roseville is associated with stormwater run-off exceeding creek and storm drainage capacities. As a result, flooding in the City is generally confined to limited areas

of low elevation adjacent to creek systems, or low elevation depressions in topography with little or no drainage outlet. In addition to this localized flooding, dam failure could result in widespread flooding within Roseville. Although there are no dams within the City of Roseville, the failure of Folsom dikes numbers 5 and 6 could impact the City should there be a breach of Folsom Dam.

The City of Roseville has identified a ***regulatory floodplain*** based on a detailed modeling approach that exceeds the SFHA mapped by FEMA. This map is the basis to which regulatory authority authorized by Roseville City Code and the Roseville General Plan Safety Element will be applied. (See Figure II.1.)

#.1.2 Degree of Flooding

Now that the sources of flooding have been identified, the degree of flooding that can and has occurred will be discussed. Table II.1 shows observed flooding characteristics for the Pleasant Grove Creek and the Dry Creek watersheds. The parameters measured are velocity, water surface elevation, ***depth of flooding (DOF)*** and warning time. This table represents estimates based on observed conditions from past flood events. It should be noted that the higher velocities cited in this table are those observed in the channel, and the lower velocities are those observed in the over-bank area. Also, it is the City of Roseville's policy to strive for 3 hours advance warning time based on its flood threat recognition system capability.

Depth of Flooding (DOF): The difference between the base flood elevation (BFE) or regulatory flood elevation (RFE) and the elevation of the lowest grade adjacent to a structure.

Regulatory Floodplain: The area identified by the City of Roseville as susceptible to risk from flooding based on city-approved studies. This is the area subject to regulation by Roseville City code and general plan application. These areas are based upon detailed hydrologic/hydraulic floodplain modeling that meet or exceed FEMA criteria for mapping and modeling floodplains. The flood event used to delineate these boundaries will be referred to as "the regulatory flood" in this assessment to differentiate it from the "base flood" used by FEMA. The City of Roseville shall designate the 100-year floodplain area on its land use map in accordance with the best available floodplain information as determined by the Public Works Director. In many portions of the City, the Nolte Future Floodplain (1987) has been utilized to designate floodplain boundaries. The Nolte Future Floodplain defines floodway and floodway fringe boundaries within the floodplain. The floodway fringe is defined as that area along the boundary of the floodplain that, if totally obstructed, would not result in more than a one-foot rise in the water surface elevation. The floodway constitutes the remainder of the floodplain area and is typically where floodwaters have the most velocity.

Where Nolte Future Floodplain information does not exist, or where it is determined that Nolte does not represent the best available information, new floodplain information shall be generated by the mitigation project proponent. New floodplain information shall generally be developed: 1) consistent with the build-out development assumptions utilized by the Nolte Future Floodplain analysis; and 2) in compliance with the most recent Placer County Floodplain Manual.

Designation of floodplain boundaries may normally be terminated where the 100-year floodplain narrows to a width of 200 feet or less and where the associated drainage area is less than 300 acres. Precise termination of boundaries are as approved by the Public Works Director.

Figure II.1

TABLE II.1
OBSERVED CHARACTERISTICS OF FLOODING

Parameter	Pleasant Grove Creek Watershed	Dry Creek Watershed
Approximate Velocity of Base Flood	0.5-8 CFS*	2.0 – 14 CFS*
BFEs	Downstream limit = 89.7 feet NGVD Upstream limit = 150.0 feet NGVD	Downstream limit = 79.7 feet NGVD Upstream limit = 210.0 feet NGVD
Approximate Depth of Flooding (DOF) (Over-bank Area)	0-2 feet (Above existing grade)	0-3 Feet (Above existing grade)
Approximate Warning Time	3 Hours	3 hours

NOTE: **Cubic Feet per Second (CFS)** is the common measurement for discharge or river flow. One cubic foot is about 7.5 gallons of liquid.

The probability of a flood is based on a statistical chance of a particular size flood (expressed as cfs of water flow) occurring in any given year. The annual flood is usually considered the single greatest event expected to occur in any given year. Flood studies use historical records to determine the probability of occurrence for the different extents of flooding. The probability of occurrence is expressed as the percentage chance that a flood of a specific extent will occur in any given year. The extent of flooding associated with a 1 percent annual probability of occurrence – that is, the base flood – is used as the regulatory boundary by a number of agencies. Also referred to as the ***Special Flood Hazard Area (SFHA)***, this regulatory boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities since many communities have maps showing the extent of the base flood and likely depths that will be experienced. The base flood is often referred to as the "100-year flood."

Special Flood Hazard Area (SFHA): The base floodplain delineated on a Flood Insurance Rate Map (FIRM). The SFHA is mapped as a Zone A in riverine situations and Zone V in coastal situations. The SFHA may or may not encompass all of a community's flood problems.

The frequency and severity of flooding are measured using a discharge probability, which is a statistical tool used to define the probability that a certain discharge level will be equaled or exceeded within a given year. The discharge level is the volume of water that will flow into a stream or river and over its banks during a given time. The discharge probability equals 100 divided by the flood frequency. For example, the 100-year discharge has a 1 percent chance of being equaled or exceeded in any given year.

Water-surface elevations are also computed using discharge probabilities. The water-surface elevations describe the exact elevation of the water that will result from a given discharge level, which is one of the most important factors used in estimating the potential damage to occur in a given area.

#.1.3 The National Flood Insurance Program and the City of Roseville

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer-funded disaster relief for flood victims and the increasing among to damage caused by floods. The NFIP makes federally-backed flood insurance available to homeowners, renters, and business owners in communities participating in the program. For most communities participating in NFIP, FEMA has prepared a detailed Flood Insurance Study (FIS). The FIS presents water surface elevations for floods of various magnitudes, including the flood that has a 1 percent probability of being equaled or exceeded in any given year (also called the 100-year flood or base flood) and the flood that has a 0.2 percent probability of being equaled or exceeded in any given year (also called the 500-year flood). The water surface elevation of the 100-year flood event is called the ***base flood elevation (BFE)***. BFEs and the boundaries of the 100- and 500-year floodplains are shown on the participating community's Flood Insurance Rate Maps (FIRM).

Base Flood Elevation (BFE): The base flood elevation is the elevation of a 100-year flood event, or a flood, which has a 1% chance of occurring in any given year as defined by the NFIP.

Flood Insurance Rate Map (FIRM): The base flood elevation is the elevation of a 100-year flood event, or a flood, which has a 1% chance of occurring in any given year as defined by the NFIP.

Roseville entered the regular phase of the NFIP on December 15, 1983. The current effective map date is November 21, 2001. As a participant in the NFIP, the City must, at a minimum, regulate development in its floodplains in accordance with NFIP criteria. Before a permit to build in the floodplain is issued, the City must ensure two basic criteria are met:

- All new buildings and developments undergoing substantial improvements must be elevated to protect against damage by the 100-year flood; and
- New floodplain developments must not aggravate existing flood problems or increase damage to other properties.

Structures permitted or built in the City before the NFIP regulatory requirements were incorporated into the City's ordinances (i.e., before the effective date of the City's FIRMs) are called pre-FIRM structures. For the City of Roseville, this means structures permitted or built before December 15, 1983. Post-FIRM structures are buildings that were permitted or constructed after that date.

#.1.4 The Community Rating System

As a part of NFIP, the Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:

1. Reduce flood losses;
2. Facilitate accurate insurance rating; and

3. Promote the awareness of flood insurance.

For CRS participating communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5% discount (a Class 10 is not participating in the CRS and receives no discount). The CRS classes for local communities are based on 18 creditable activities, organized under four categories:

1. Public Information,

2. Mapping and Regulations,

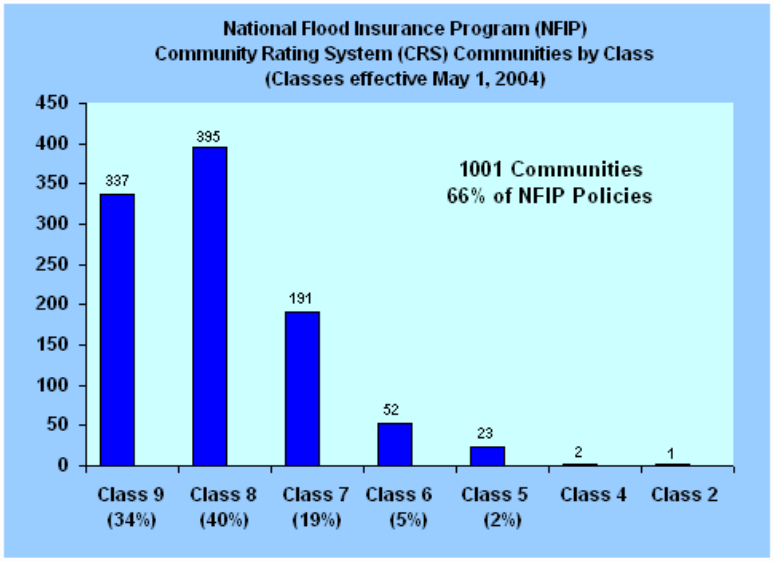
3. Flood Damage Reduction, and

4. Flood Preparedness.

There are now 1,001 communities receiving flood insurance premium discounts based on their implementation of local mitigation, outreach, and educational activities that go well beyond minimum NFIP requirements. While premium discounts are one of the benefits of participation in CRS, it is more important that these communities are carrying out activities that save lives and reduce property damage. These communities represent a significant portion of the nation's flood risk as evidenced by the fact that over 66% of the NFIP's policy-base is located in these communities. Communities receiving premium discounts through the CRS cover a range of sizes from small to large, and a broad mixture of flood risks including both coastal and riverine.

Roseville began its official participation in the CRS program in 1991, achieving its current CRS Class 5 on October 1, 2002. This classification provides flood insurance policy holders in Roseville up to a 25% reduction in flood insurance premiums and represents an annual savings of approximately $33,785 in flood insurance premiums. As one of the premier floodplain management communities in the country, Roseville has long supported the concept of the CRS program as evidenced by its participation as a pilot test community during the CRS development in the late 1980's. Figure III.1 lists the number of CRS communities by class as of May 1, 2004.

FIGURE III.1
CRS COMMUNITIES



#.2 PROFILING HAZARDS – ROSEVILLE'S FLOOD EXPERIENCE

Under 44 CFR Section 201.6(c)(2)(i) of DMA2K, risk assessments are required to include a description of the location and extent of the hazards that can affect the jurisdiction. This sub-section includes information on previous flood occurrences in the City of Roseville (location, extent, and historic damages) and on the probability of future occurrences.

#.2.1 Flood Location and Extent

Reports of flooding along Dry, Antelope, Cirby, and Linda Creeks have been recorded from the 1930's to present time. Correspondence between the US. Army Corps of Engineers and the City of Roseville dating back to the 1930's indicated a need for establishing flood control measures along the Dry, Cirby and Linda Creeks. Recent flooding that resulted in property damage has occurred about every 3 to 5 years since 1950, with the exception of the period from 1973 to 1981 when no significant flooding was reported. Until recently, the largest flood on record took place in February 1986, causing substantial damage to property. This flood was considered to be a 70-100 year event, depending on location. However, in January 1995, the City was subject to flooding that exceeded the 1986 flood event on most streams in Roseville and that is now considered to be the flood of record.

Additional details related to the location and extent of flooding in Roseville are included in sub-sections #.1.1 and #.1.2 and presented on Figure #.1 which maps Roseville's regulatory floodplain.

#.2.2 Previous Occurrences – Roseville's Flood History

Based on data from the National Climactic Data Center and Sheldus, 10 major flood events were reported in Placer County between January 1950 and December 2003. The total value of property damage caused by these floods is presented in Table IV.1 and totaled approximately $42 million for Placer County and an additional $8 million for the City of Roseville's flood of record in January 1995.

TABLE IV.1
DAMAGE FROM MAJOR FLOODING
IN PLACER COUNTY (1950 TO 2003)

Date	Hazard Type	Property Damage
1/97	Flooding	$36,670,000
2/86	Flooding	$5,000,000
2/98	Flooding	$390,909
1/97	Flooding	$150,000
1/95	Flooding	$8,000,000 (Roseville only)
1/73	Flooding, Severe Storm, Thunderstorm	$86,207
2/92	Flooding, Winter Weather	$11,628
2/92	Flooding, Winter Weather	$9,091
2/00	Flooding	$6,429
1/00	Flooding	$4,1667
12/92	Flooding, Winter Weather	$1,316
Total	**--**	**$42,329,746 & $8,000,000**

A summary of significant flood events impacting the City of Roseville is as follows:

December 1955: Flooding occurred primarily along Dry Creek. Homes in the Douglas Boulevard area were surrounded by floodwater and one family was evacuated. Douglas Boulevard was impassable and pavement was damaged. Royer Park was also inundated with floodwater extending across Park Drive. No injuries or fatalities were associated with this flood event.

April 1958: This was the second largest flood event on record at the time. Flood conditions were the most severe on Sunrise Avenue in the southeast portion of the City, on Douglas Boulevard, in the Royer Park area, and on Riverside Avenue at Dry Creek. Agricultural damage occurred along Dry Creek immediately west of the City. Many homes and businesses were surrounded by floodwaters at the peak of the flood. Several families were evacuated by boat from homes in the Columbia Street and Douglas Boulevard areas. As had occurred in the past, Royer Park became a lake and floodwater covered the ball field and extended across Park Drive. Part of the sewage treatment plant was flooded but the plant remained operational throughout the flood, which continued for at least 12 hours. No injuries or fatalities were associated with this flood event.

October 1962: This flood event was considered the flood of record at the time. Over 9 inches of rain fell during the storm event. Creeks overflowed their banks throughout the city, but the areas most severely affected were along Linda Creek in the Sierra Gardens Subdivision and along Dry Creek. A number of families were evacuated from their homes on Lee Way and Douglas Boulevard. Royer Park was completely inundated for a time and one deer in the zoo collection was drowned before the animals could be evacuated. Other flood losses in the park included bank erosion, destruction of fencing, damage to one of the footbridges, and damage to the recreation building and the park office. Restoration of the park required two weeks. Water mains were damaged by flood flows in the Cresthaven and Atlantic Street areas. The Dry Creek Bridge on Riverside Avenue and the Antelope Creek Bridge on Atlantic Street were also damaged. No injuries or fatalities were associated with this flood event.

December 1964: During this flood event, the fire and police departments evacuated four families when floodwater from Linda Creek surrounded their homes on Champion Oaks Drive and Lee Way. Dry Creek overflowed its banks in several locations, and flood borne debris was removed during a flood-fight to keep the stream flowing at Booth Road and the Southern Pacific railroad tracks. Floodwater at that location was deep enough to submerge a car stalled in the under-pass. Stream-bank erosion occurred along the east bank of Dry Creek behind the Campfire Girls lodge on Sutter Avenue. No injuries or fatalities were associated with this flood event.

March 1983: This flood event damaged approximately 25 residences along Linda and Cirby Creeks. Portions of Royer Park were under water as well as areas in Sierra Lakes Mobile Home Park. Dry Creek overflowed Darling Way and Riverside Avenue bridges, disrupting traffic and flooding six businesses along Riverside Avenue. There were no fatalities associated with this event.

February 1986: This flood event caused widespread damage in most of the Dry Creek watershed. Nearly all bridges and culverts were overtopped, with 30 sustaining embankment damage and the crossing at Rocky Ridge Drive washing out. Two bridges over Dry Creek were damaged and street cave-ins occurred at a number of locations. Approximately 209 homes along Dry Creek, Linda Creek, and Cirby Creek reported flood damage with water levels up to five feet above finished floor levels. Roseville City Hall and libraries were temporarily closed when their basements flooded. There was 1 fatality associated with this flood event.

CIRBY CREEK AT TINA WAY, JANUARY 1995

January 1995: In January of 1995, the City was subject to flooding that exceeded the flood event of 1986 on Cirby Creek and Linda Creek. This event is now considered the flood of record for Dry Creek based on flood heights and was calculated to be the 100-year flood event. This flood event resulted in 358 structures being inundated by floodwaters in the Dry Creek basin. No injuries or fatalities were associated with this flood event.

DRY CREEK FLOODING, JANUARY 1995

January 1997: The flood events of 1997 were some of the most severe on record for the Region. An isolated storm event typical for the Roseville area occurred on top of soils saturated from repetitive storm events causing a flash flood. This flooding resulted in 21 structures being inundated with floodwaters. The impact of this event was significantly reduced by a partially completed Cirby-Linda-Dry Creek Flood Control project. No injuries or fatalities were associated with this flood event.

February 1998: A small flood event occurred on February 3, 1998, resulting in 8 structures being inundated by floodwaters in the Dry Creek Basin. Once again, this event was caused by an isolated storm event centered over the watershed. No injuries or fatalities were associated with this flood event.

#.2.3 Probability of Future Flooding

Need to develop additional text on the future probability of occurrence

#.3 ASSESSING VULNERABILITY – ESTIMATING FLOOD LOSSES

Under 44 CFR Section 201.6(c)(2)(ii) of DMA2K, risk assessments are required to include a description of the jurisdiction's vulnerability to the hazards and its impact on the community. This description *should* also describe Roseville's vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the floodplain hazard area and estimate potential dollar losses to vulnerable structures as well as analyze development trends. This sub-section presents the results of the flood vulnerability assessment for Roseville.

#.3.1 Overview of Vulnerability – The Flood Problem

Flooding in Roseville can be associated with stormwater run-off exceeding creek and storm drainage capacities. A similar link can be identified in all flood events that have impacted the City of Roseville. Due to its geographical location in the watershed, isolated, high intensity storms that are relatively short in duration (1 to 3 hours), that concentrate along a stream reach, on already saturated soils typically have caused flooding within the City of Roseville. These are often referred to as "convection storms" and typically generate run-off that will exceed the capacity of conveyance systems.

When looking at the flood problem within Roseville, the scenario is similar to what most communities encounter. Development has occurred in low-lying areas adjacent to creek or stream systems needed to convey the over-bank flooding that can occur during events described above. In Roseville's situation this development occurred because the science and information available at the time of the development did not accurately project the flood heights that could occur from rainfall events typical for this region. This resulted in development occurring in areas needed for conveyance and with insufficient levels of flood protection. Recognizing this fact, the City took it upon itself to model the flooding within Roseville utilizing the best available hydrologic and hydraulic science that better reflected the actual rainfall events that can impact the City. The results of this study generated a much more applicable projection of flood heights and areas of inundation that were well supported by the observed flooding in the events of 1986. The City has since used this information to create and enhance its floodplain management program such that all new development is not subject to the flood risk.

With this in mind, the focus of the flood problem is centered on existing development that occurred prior to 1986. As stated under Section II.A of this risk assessment, there are two basins impacting the City of Roseville, Pleasant Grove Creek and Dry Creek. <u>There are no structures subject to flooding within the Pleasant Grove Creek basin due to floodplain management policies adhered to by the City of Roseville. Therefore the focus of the flood problem is in the Dry Creek Basin.</u>

There are 3 primary creeks that impact the City of Roseville in the Dry Creek basin. These are Cirby Creek, Dry Creek, and Linda Creek. The City of Roseville has recently completed 5 phases of a 7-phase structural mitigation project called the Cirby-Linda-Dry Creek Flood Control Project. The purpose of this project was to reduce stormwater back up at constrictions and increase the overall capacity of the floodplain during storm conditions. This project was designed to provide 1 foot of freeboard above the projected 500-year flood elevation where elements of the project were in place. The impact of this project in the reduction of flood risk exposure along these creeks was significant.

However, this project did not mitigate 100% of the exposure to flooding within the basin. Therefore, there is still a flood risk exposure within this basin, all be it is significantly less than exposure prior to construction of the above described flood control projects.

Like every city, localized flooding not associated with a creek or stream overflowing its banks occurs within Roseville to some degree. This type of flooding occurs due to rainfall and runoff exceeding the design capacity of drainage facilities, or the lack of drainage facilities to control the flows. The City of Roseville has attempted to address this type of flooding with regulations that require an "overland release" of stormwater generated by a sight to a recognized stormwater facility and regulations that require the mitigation of the increase in run-off generated from new development. However, there are areas within the City with development and facilities that were put in place prior to the policies stated above. These areas can be subject to flooding from the same events that cause flooding on the creeks and streams within Roseville.

The potential impact of flooding on Roseville will be evaluated in the following terms:

- Impact on life, safety, and health of Roseville residents
- Impact on critical facilities
- Impact on existing structures at risk
- Economic impact
- Repetitive losses
- Impact of flooding and floodplain management on development/redevelopment trends

#.3.2 Impact of Flooding on Life, Safety, and Health

Flooding can be a deadly hazard. Roads running through low-lying areas that are prone to sudden and frequent flooding during storms are a serious threat. Motorists often attempt to drive through barricaded or flooded roadways. Because it takes only 18 to 24 inches of water moving across a roadway to carry away most vehicles, this presents a significant potential safety risk. The second largest potential for injuries from flooding results from people walking or playing in or near flooded areas. Generally, floods kill people in two ways: when people ignore basic safety precautions (such as evacuations and warnings), or when a flash flood hits an area with no warning. While an analysis for the flood hazard on life and safety can be done, injuries and casualties are typically negligible for this hazard because of the warning times associated with the flood hazard. Therefore, injuries and casualties were not estimated for this hazard.

With one recorded fatality caused by flooding in Roseville within the last 50 years, the impact of flooding has not been as detrimental in terms of life safety as it has been on its impact to damage to structures. This can be attributed to several factors. One, the type of flooding that has occurred has been rapid in succession in terms of rise and fall of floodwaters. Due to its geographical location in the watershed, the floods tend to come and go quickly as they move towards their drainage endpoint. This decreases the

opportunity to be trapped by floodwaters. Additionally, the City has made it a priority to warn and educate its citizens on the dangers and impacts of flooding. The City implements public outreach programs that provide information on flood warning, property protection, flood safety and flood insurance. The City also has developed a comprehensive flood-warning program that can deliver real-time data to the citizens and emergency management personnel necessary to provide up to a three-hour advance warning of flooding within the 100-year floodplain. This has resulted in an educated and well-informed constituency.

As far as health concerns, the City of Roseville, owns a sewage treatment facility located on the downstream end of Dry Creek that has overflow ponds that lie within the 100-year floodplain. In the rare occurrence that the plant's demand would exceed its capacity, and these overflow ponds were being utilized to contain raw, undiluted sewage, simultaneous with a 100-year flood event, flood waters could be contaminated. This situation has not occurred in past flood events and its potential impacts on health have therefore not been estimated as part of this study.

#.3.3 Impact of Flooding on Critical Facilities

Critical facilities are structures where vital community operations are performed. If these facilities are flooded or damaged, there could be severe consequences to public health and safety. Therefore, it is imperative that critical facilities be adequately protected from flooding. Critical facilities are not strictly defined by FEMA. Rather, communities are encouraged to evaluate their own community and determine which facilities would be necessary during an emergency event. As such, critical facilities fall into two general categories: (1) buildings or locations vital to the response effort (i.e., Emergency Operations Centers, police and fire stations, hospitals, evacuation centers, municipal highway garages, etc.); and (2) locations that, if flooded, would create secondary disasters (i.e., hazardous materials facilities, water treatment plants, wastewater treatment and sewage facilities, schools, nursing homes, etc.).

critical facilities were identified in Roseville within any floodplain areas. This included seven highway bridges, one fire station, and one high school. Table V.1 provides a list of critical facilities that lie in Roseville's regulatory floodplain.

TABLE V.1
CRITICAL FACILITIES IN ROSEVILLE'S 100-YEAR FLOODPLAIN

Facility Name	Address / Location
CalTrans Maintenance Yard*	1000 Atlantic St
Adelante High School*	350 Atlantic St
Placer County Courthouse	300 Taylor St
Roseville Chamber of Commerce	650 Douglas Blvd
Fire Station #1 / City EOC	401 Oak St
Main Library	225 Taylor St
Roseville Parks and Rec	401 Oak St
Highway Bridges**	Census Tract

NOTES: * Although these 2 facilities have land area located within the floodplain, there are no structures critical to operations or safety located in a designated floodplain.

** All bridges that cross a floodplain have the potential for the footings and head walls to be impacted by floodwaters due to erosion and/or scorer.

Critical facilities also include critical infrastructure (such as roads) that can lead to isolation and evacuation problems during flood events. The City of Roseville has determined the major roadway / stream crossings (bridges or culverts) listed below would be impassable in a 1% chance (100-year) flood event.

Impassable Major Roadways and Stream Crossings Following a Flood

Dry Creek Road Crossings
- Vernon Street
- Riverside Avenue
- Darling Way
- Douglas Boulevard
- Folsom Road

Cirby Creek Road Crossings
- Sunrise Avenue
- Coloma Way
- Oakridge Road
- Sierra Gardens Drive
- Huntington Drive

Linda Creek Road Crossings
- Rocky Ridge Drive
- Champion Oaks Drive
- Sierra Collage (College?) Boulevard

Miners Ravine
- Sierra Collage (College?) Boulevard

#.3.4 Impact of Flooding on Existing Structures At Risk

Being progressive in its approach to managing the floodplains of Roseville, the City has created tools that provide a wealth of information about the risk and vulnerability from flooding. Table V.2 contains a summary of the information found in the "Floodplain Inventory Database" (see Appendix ###) for the following basic categories:

- Buildings Located in the Regulatory Floodplain
- Building Use
- Area of Building
- Value of the Building
- Permit History
- Flood Loss History
- Regulatory Flood Elevation (RFE)
- Base Flood Elevation (BFE)
- Elevation of Lowest Adjacent Grade (LAG)

TABLE V.2
SUMMARY OF STRUCTURES AT RISK

	Roseville Regulatory Floodplain	FEMA SFHA
Area of Floodplain (Acres)	1,493.43	1,098.08
Residential Buildings	142	
Commercial Buildings	20	
Industrial Buildings	2	
Total Buildings	164	
Less than 1' DOF*		
1' to 3' DOF*		
3' or Greater DOF*		
Lowest Floor Elevated		

NOTE: * ***Depth of Flooding (DOF)*** is the difference between the BFE or Regulatory Flood Elevation (RFE) and the elevation of the lowest grade adjacent to a structure.

ADD MORE DETAILS ON BUILDING/STRUCTURE LOSS ESTIMATES – INCLUDE RESULTS FROM HAZUS ESTIMATES

#.3.5 Economic Impact from Flooding

Past experience has shown that flooding can have a major economic impact on a community beyond the flood damage that occurs to buildings. Business revenues as well as tax revenues funding city government can both be affected. All of these factors cumulatively can have a long-term impact on the local economy.

HAZUS-M Loss Estimation Methodology: HAZUS-MH is a Geographic Information System (GIS)-based program that can be used to support the development of risk assessments as required under DMA 2000. The HAZUS-MH software program assesses risk in a quantitative manner to estimate damages and losses associated with natural hazards. HAZUS-MH is FEMA's nationally applicable, standardized methodology and software program that contains modules for estimating potential losses from earthquakes, floods, and wind hazards. HAZUS-MH has also been used to assess vulnerability (exposure) for a number of other hazards facing Roseville.

Utilizing a loss estimation tool created by FEMA called ***HAZUS-MH (Hazards U.S. Multi-Hazard)***, an analysis of the potential economic impact of the regulatory flood for the City of Roseville was performed. HAZUS-MH has been used to streamline the risk assessment process for specific hazards because it (1) uses a consistent and defensible methodology and (2) produces maps and loss estimates that state and local governments, and the private sector can apply to develop quantifiable risk assessments that form the basis for programs and plans required for emergency management.

It is important to note that this is a loss estimation tool used for planning purposes only. The underlying basis of the analysis is census tract data and HAZUS makes numerous assumptions in the compilation of this data. For this risk assessment, the loss estimates and exposure calculations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from (1) approximations and simplifications that are necessary to conduct such a study, (2) incomplete or outdated data on inventory, demographic, or economic parameters, (3) the unique nature and severity of each hazard when it occurs, and (4) the amount of advance notice that the residents have to prepare for the event. These factors result in a range of uncertainty in loss estimates, possibly by a factor of two or more. As a result, potential exposure and loss estimates are approximate. These results do not predict precise results from a hazard event and should be used only to understand relative risk.

The results of the HAZUS-MH analysis for flood are summarized in Table V.3 on the following page. Other potential impacts from the regulatory flood event that would have an impact on the local economy include the following:

- It is estimated that this event would **displace 2,992 people**
- That 2,434 people would have short-term shelter needs

- There is the potential for **$4,971,745 in vehicular damage** from this flood event
- That **189,079 ton of debris** could be created by this flood event

TABLE V.3
SUMMARY OF POTENTIAL DOLLAR LOSS

	Residential Structures	Commercial Structures
Building Loss	$282,688	$32,648
Contents Loss	$199,634	$75,316
Inventory Loss	$0	$2,189
Relocation Costs	$16,285	$10,472
Income Loss	$3,263	$38,709
Rental Income Loss	$9,191	$7,753
Wage Loss	$7,711	$56,761
Direct Output Loss	$0	$128,764
Total Losses	$518,772	$352,012

#.3.5 Repetitive Losses from Flooding

Repetitive loss properties make up only 1 to 2 percent of the flood insurance policies currently in force, yet they account for 40 percent of the country's flood insurance claim payments. A report on repetitive loss structures recently completed by the National Wildlife Federation found that 20 percent of these structures are listed as outside the 100-year floodplain. In 1998, FEMA reported that the NFIP's 75,000 repetitive loss structures have already cost $2.8 billion in flood insurance payments, and that numerous other flood-prone structures are in the floodplain and continue to remain at high risk. To address this ongoing issue, the government has instituted several programs that encourage communities to identify and mitigate the causes of their repetitive losses.

Repetitive Loss Properties: Any NFIP-insured property that, since 1978 and regardless of any change(s) of ownership during that period, has experienced:

- Four or more paid flood losses in excess of $1000.00;
- Two paid flood losses in excess of $1000.00 within any 10-year period since 1978; or
- Three or more paid losses that equal or exceed the current value of the insured property.

A repetitive loss area is that portion of the floodplain where buildings have been subject to repetitive flooding. The key identifier for these areas are the structures that have been identified by FEMA as meeting the definition of repetitive loss due to the existence of a flood insurance policy. The repetitive loss list maintained by FEMA is based on flood insurance claims paid. The purpose of identifying repetitive loss areas is to identify those structures in addition to those on FEMA's list that were subject to the same risk, but are not on FEMA's list because a flood insurance policy was not in force at the time of loss. The cause of this repetitive flooding can be attributed to the same causes of flooding discussed in Section V.5 of this assessment – concentrated, intense storms isolated over a watershed creating stormwater run-off that exceeds the capacity of creeks and storm drainage.

According to the list of repetitive loss properties maintained by FEMA, as of February 29, 2004, Roseville has identified three repetitive loss properties (see Figure II.1). Roseville is required to address its repetitive loss areas as a condition of its participation in the CRS program. This mitigation plan meets one of the CRS requirements. It should be noted that in 1991, when Roseville first began its participation in the CRS program, the list of repetitive loss properties totaled 24 locations. Since that time, flood protection and mitigation projects have occurred at 21 of these properties and all 21 properties are no longer subject to repetitive flood losses. This represents **an 88% reduction in exposure of insured properties to repetitive flood losses**. This is a prime example of how the City of Roseville's pro-active flood mitigation practices have decreased the exposure of its citizens to the flood hazard, reduced the number of repetitive loss properties, and minimized their reliance on post-disaster assistance provided by the federal government and the nation's taxpayers.

#.3.6 Impact of Flooding and Floodplain Management on Development and Redevelopment Trends

State law requires that every county and city prepare and adopt a comprehensive long-range plan to serve as a guide for the development of the community. Recognizing that it had a flood hazard problem and that typical growth patterns experienced statewide in California would impact and exacerbate that risk, the City of Roseville took an aggressive, proactive approach to managing its floodplains with the development of its General Plan in 1992. The General Plan serves as a long-term policy guide for the physical, economic, and environmental growth of the City and includes a statement of the community's vision of its ultimate physical growth. With respect to floodplain management, City actions, such as those relating to land use allocations; annexations, zoning, subdivision and design review, redevelopment, and capital improvements must be consistent with the General Plan.

The General Plan also designates land use categories for the entire city. Each land use category is identified and defined within the General Plan and includes information on the general uses, development, intensity, siting, and compatibility standards in relation to the flood hazard. Roseville's General Plan was adopted by the City Council in 1992 and a technical update was adopted in 2003.

A unique element to the City's General Plan is the Safety element. The citizens of Roseville rely on the City for many of their safety needs, such as fire and crime prevention. They count on the City to plan for, and protect them from, natural hazards

such as flooding, earthquakes, and other potentially dangerous situations. The Safety Element in the General Plan addresses the safety concerns of the community and sets forth the goals and policies essential for their resolution. In establishing the policies for the Flood Safety Element of the General Plan, Roseville established policies such that new development would occur in the identified floodplain or if development were to occur in the floodplain it would be required to achieve the appropriate level of flood protection in its design and construction. The Flood Safety Element identifies 9 flood protection policies and 12 implementation measures striving to achieve the following goals:

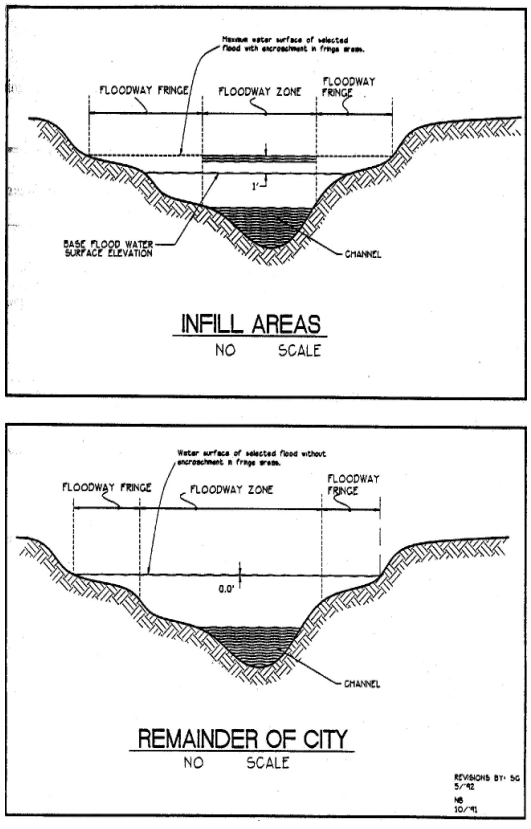
Minimize the potential for loss of life and property due to flooding.

Pursue flood control solutions that are cost-effective and minimize environmental impacts.

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more that one-foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are those lands that are in the floodplain but outside of the floodway. Some development is generally allowed in these areas with a variety of different restrictions.

FIGURE V.2
FLOODPLAIN DESIGNATION CROSS-SECTIONS



One significant policy identified in the Flood safety Element of the General Plan is that development within designated 100-year future floodplain areas shall be regulated as follows:

a) Infill Areas – No development is permitted within the future ***floodway.*** However, within the future ***floodway fringe*** the City may permit development. In accordance with the Nolte definition, such development shall be limited to that falling within the assumed cumulative one-foot rise in the water surface elevation, provided that it can be demonstrated that the development will not impact flood levels.

b) Remainder of the City (Specific Plans, and the North Industrial area) – No development is permitted within the future floodplain (*floodway and floodway fringe*). Exceptions may be considered by the City on a case-by-case basis if encroachment is limited to only the future floodway fringe and would not result in any off-site increase in the water surface elevation.

The above designations are schematically reflected in Figure V.2.

As urbanization of western Placer County continues to increase within the Pleasant Grove Creek and Dry Creek Basins, Roseville faces the potential of experiencing increased flooding problems. Land development typically results in increased hard surfaces and decreased vegetation. These conditions limit infiltration opportunities and, without adequate mitigation, can increase storm water run-off rates and volumes and decrease the time required to reach peak discharge.

The goals, policies, and implementation measures of the Flood Safety Element focus on minimizing damage due to flood hazards. Key to this effort is the clear definition and application of floodplain boundaries. Emphasis is placed on protecting the floodplain areas and on pursuing regional cooperation on flooding issues. The City is committed to exploring environmentally sensitive flood control solutions. As a result, this component is intended to be utilized in combination with the goals, policies, and implementation measures contained within the Open Space and Conservation Element.

Based on the policies, activities, and mitigation measures as described above, it can be concluded that future land development trends will not impact, or be impacted by flooding in Roseville as long as the City's existing policies remain in force through the City's existing programs. It should be noted that there are only three parcels within the regulatory floodplain that are in the current "buildable" lands inventory. These are all parcels that were created before the policies described were enacted and in essence were "grandfathered" in under the City's flood protection program. Should development occur on these parcels, they would be subject to the strict regulations as cited above.

#.3.7 Risk Assessment Loss Estimates for Multi-Jurisdictional Participants

MUST INCLUDE DETAILS OF RISK ASSESSMENT RESULTS FOR EACH OF THE PARTICIPATING JURISDICTIONS – Required by Section 201.6(c)(2)(iii)

#.4 FLOOD HAZARD MITIGATION STRATEGIES

44 CFR Section 201.6(c)(3) of DMA2K, states that the plan must include a mitigation strategy that provides the jurisdiction a blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools. The mitigation strategy described in this section describes the mitigation goals, analyzes the effectiveness of existing flood management programs, describes alternative approaches for Roseville to reduce or avoid long-term vulnerabilities from the flood hazard, and provides prioritization, benefit/cost justification, and implementation strategies for mitigating against floods.

#.4.1 Roseville's Flood Hazard Mitigation Goals

To Be Completed

#.4.2 Analysis of Existing Flood Mitigation Actions and Floodplain Management Programs

To Be Completed

#.4.3 Identification and Analysis of Proposed Flood Mitigation Alternatives for Existing and New Buildings and Infrastructure

To Be Completed

#.4.4 Implementation of Flood Mitigation Actions – Priorities, Benefit/Cost Analysis, and Implementation/Administration

To Be Completed

#.5 REFERENCES
(TO BE RELOCATED TO SECTION AT THE END OF THE ENTIRE MITIGATION PLAN)

The following references were utilized in the preparation of this section:

- "Draft Environmental Impact Report, CirbyLlinda-Dry Creek Flood Control Project." Prepared for the City of Roseville by Dames & Moore. November 1991.
- "*Finial Report, Dry Creek Watershed Flood Control Plan.*" Placer County Flood Control and Water Conservation District and Sacramento County Water Agency. , April 1992.
- "Floodplain Information, Dry Creek and Tributaries, Roseville, CA." Department of the Army, Sacramento District Corps of Engineers. May 1973.
- "City of Roseville General Plan, Flood Safety Element." November 18, 1992. (updated in 2001).
- The Community Rating System, Coordinators Manual. FEMA, 2002.
- "Getting Started, Building Support for Mitigation Planning." FEMA 386-1. September 2002.
- "Understanding Your Risks, Identifying Hazards and Estimating Losses." FEMA 386-2, August 2001.