

A. Flood Management in Nevada

Introduction

Flooding has been a concern for Nevada communities since the first settlers moved to the territory in the mid-1800's. Fourteen significant flood events have occurred on the Truckee River alone since the 1860's. Numerous flash floods take place throughout the state annually. The costs of recovery from flood events is rising. Prior to the January 1997 flood event in northern Nevada, damages due to flooding on the Truckee and Carson Rivers totaled more than \$31.5 million.¹ The damage caused by flooding in northern Nevada during the January 1997 event topped out at over \$600 million if indirect damages such as lost revenue, wages, and sales taxes are included.²

Flood hazards in Nevada are typically underestimated due to the arid climate, few perennial streams, and low precipitation. Lack of data and a sparse stream-gaging network also contribute to underestimation of flood hazards. Two types of flooding occur in Nevada: riverine flooding and alluvial fan flooding. Riverine flooding occurs when water levels in rivers and streams rise and discharge volumes increase over a period of hours or days. Flood waters overtop the stream banks and inundate nearby low lying areas. In Nevada, riverine flooding typically occurs during the winter or spring runoff periods.

Alluvial fans are found throughout Nevada. An alluvial fan is a fan-shaped deposit of material created where a stream flows out onto the valley floor. Alluvial fans are the cumulative result of successive flood events over hundreds to thousands of years. Alluvial fan flooding is potentially more dangerous than riverine flooding because it is less predictable and the threat is not apparent, therefore it is not often considered during land development. Additionally, the influence of minor grading, roads, and structures can greatly impact and exaggerate damage from alluvial fan flooding. This type of flooding can occur with little warning. Alluvial fan flooding occurs when flood waters emerge from canyon mouths and travel downstream at very high velocities carrying an enormous load of sediment and debris. The hazards associated with alluvial fan flooding are compounded by the potential for migration of flood waters across the width of the fan. Alluvial fan flooding impacts are especially severe on fans which are developed without mitigation measures installed.

Flash flooding on streams emerging from steep canyons in the mountains are another significant flood hazard in Nevada. Flash floods are very unpredictable, and can cause flooding at a distance from the precipitation source. Because flash floods are typically caused by high intensity-short duration convective storm events in the mountains, they occur with little warning, and can be very destructive in terms of erosion and sediment deposition.

Nevada's rapid population growth is contributing to flood impacts. As more land is developed in

¹ Flooding Issue Paper, prepared by U.S. Army Corps of Engineers, date unknown.

² The 1997 New Year's Floods in Western Nevada, Nevada Bureau of Mines and Geology, 1998.

river basins and on alluvial fans, the severity of flooding and cost of flood recovery is increasing. As development moves from flat prime real estate to the broad alluvial fans throughout the state, a greater percentage of the population is exposed to flood hazards. The impacts of flooding to the people, communities, and infrastructure throughout the state point to a need for floodplain management.

What is Floodplain Management?

Floodplain management consists of planning and implementing programs designed to alleviate the impact of flooding on people and communities. It includes activities such as instituting land use policies and regulations for development in flood prone areas, and restoring and preserving natural resources and functions of floodplains and contributing watersheds. A key component of floodplain management is implementation of the National Flood Insurance Program (NFIP) at the local level.

The U.S. Congress established the National Flood Insurance Program in 1968 with the passage of the National Flood Insurance Act. The purpose of the act is to encourage local communities to mitigate future flood damage by adopting and enforcing minimum floodplain management ordinances, thus making the community eligible for federally-subsidized flood insurance. In Nevada, 15 counties and 13 communities currently participate in this program. Participation in the program allows property owners in the communities to purchase federally subsidized flood insurance. The program provides Flood Insurance Studies (FIS) and Flood Insurance Rate Maps (FIRMs) prepared by the Federal Emergency Management Agency (FEMA) to participating communities. A FIRM designates Special Flood Hazard Areas (SFHAs) within a community which are subject to flooding that has a one-percent chance of being equaled or exceeded in any given year. This flood is also referred to as the '100-year' flood.

Floodplain management consists of both structural and nonstructural measures for mitigating flood impacts. Structural approaches include measures which reduce the amount of flood water in a stream or contain flood water in a channel so that it does not inundate nearby areas. Such measures may include detention facilities, levees or dikes. Structural measures built with public money have been used historically to manage flood impacts with varying degrees of success. Structural flood controls may require the use of valuable land and natural resources.

A structural approach to flood control in existing urban areas can provide a cost-effective benefit to the public. In southern Nevada, the Clark County Regional Flood Control District uses structural controls very effectively to manage flash flooding impacts in developing areas. Washoe County is currently implementing a Regional Flood Control Master Plan which also incorporates structural flood control, along with other measures.

Nonstructural approaches to floodplain management have been gaining adherents as our recognition of the limitations of flood control has increased. The most cost-effective approach to flood hazard protection can be achieved using land use planning and sound floodplain management regulations in flood prone areas. Nonstructural approaches to floodplain management include:

1. Development of regional master plans for flood management;
2. Mapping and study of historic flood prone areas;
3. Implementation of floodplain regulations, including zoning ordinances, subdivision regulations, and building codes which guide development in floodplains and flood prone areas;
4. Implementation of a development review process at the local or regional level;
5. Acquisition and removal, or relocation of structures which experience repetitive losses;
6. Flood proofing existing structures by elevating a building's structure or the infrastructure;
7. Flood forecasting and warning systems;
8. Disaster preparedness plans;
9. Rehabilitation of disturbed watersheds, wetlands, and riparian zones;
10. Designation of green belts; and
11. Providing education and information to the local communities.

Flood Management in Nevada

Although floodplain management most effectively occurs at the local or regional level, the state plays an important role. The State's primary functions include coordination between federal and local agencies, education and information dissemination, and management of grant funds passed through from the federal government or the state to the local communities.

State Agency Involvement in Flood Management

Division of Water Planning

In 1997, as a direct result of the flooding in northern Nevada, the FEMA-sponsored Community Assistance Program (CAP) was transferred to the Division of Water Planning from the Division of Emergency Management at DEM's request. The objective of CAP is to provide technical assistance for flood mitigation activities and coordinate floodplain management in communities participating in the NFIP. The Division provides floodplain ordinance review, supports local agencies in development of building codes and enforcement capabilities, provides information and education on flooding issues, conducts floodplain management workshops for local officials, performs community visits to assess compliance with NFIP regulations, and prepares and distributes manuals, newsletters and flyers promoting flood hazard awareness.

In 1997, the Governor's Office named the Nevada Division of Water Planning as the point-of-contact for FEMA's new Flood Mitigation Assistance (FMA) program. The FMA provides grant funds for planning and project activities related to elevation or relocation of structures which experience repetitive losses. The Division is responsible for providing technical assistance to interested communities in preparing FMA grant applications and flood plans, and coordinating FMA funded projects.

Division of Emergency Management

The Nevada Division of Emergency Management (DEM) is responsible for implementing a comprehensive mitigation program which includes flooding mitigation. The State Hazard Mitigation Officer manages the FEMA-sponsored Hazard Mitigation Grant Program (HMGP), which can be used to purchase flood prone privately owned structures and flood easements subsequent to flood events. DEM and the Nevada Division of Water Planning are cosponsoring the state-wide All Hazard Mitigation Advisory Committee to evaluate hazard mitigation needs and funding sources for mitigation projects.

Division of Water Resources

The Division of Water Resources (DWR) manages a program for channel clearance, maintenance, restoration, surveying, and monumenting, established under NRS 532.220. Under the channel clearance program, local entities, including counties, cities, irrigation districts, and flood control districts can apply for matching grant funds to maintain channels of navigable rivers within their boundaries. In addition, the DWR is responsible for the state dam inspection and safety program, established under NRS 535.030. Communities throughout the state can take credit for the State's dam safety program through the NFIP's Community Rating System, resulting in lower flood insurance rates in the participating communities.

Disaster Relief Bill

During the 1997 legislative session, Senate Bill 218 was passed which established a state fund of \$4 million to help communities recover from damages sustained in the event of a disaster. The fund is administered by the Legislative Counsel Bureau, and has been used to provide financial relief following river and flash flooding events in communities throughout the state.

Local Agency Involvement in Flood Management

Provisions for formation of flood control districts are described in the Nevada Revised Statutes, NRS 543. The Clark County Regional Flood Control District was formed under this statute in 1985. It is the only such district in the state. The District is comprised of the unincorporated county and the five incorporated cities within the county. The District was created to manage flooding hazards through land use controls, and to fund and coordinate construction and maintenance of flood control structures. Flood control projects are funded by a one-quarter of one percent sales tax. The District has also implemented a comprehensive floodplain management program that includes flood hazard mitigation and mapping.

Local communities and counties are responsible for developing and implementing ordinances for management of areas in their communities which are prone to flooding. Adoption of the minimum standards for floodplain management identified in the Code of Federal Regulations (CFR) Title 44, section 60.3, is the primary requirement for participation in the NFIP. The minimum NFIP

requirements are floodplain management standards which are generally applicable nationwide, but which do not take into account unique regional and local conditions. Washoe and Clark counties have adopted ordinances which go above the minimum NFIP standard. Counties and communities which do more than the minimum required by the NFIP are eligible for participation in the Community Rating System (CRS), which provides credits in the form of reduced insurance costs for property owners holding flood insurance.

Project Impact is FEMA's program for developing disaster resistant communities. This program was initiated in 1998, with the city of Sparks named as the first Project Impact Community in Nevada. Project Impact was developed to help communities take responsibility for mitigating the impact of disasters of all types.

Federal Involvement in Floodplain Management

Several federal agencies have programs which support floodplain management at the state level by providing funding and technical assistance, and facilitating coordination with local communities.

FEMA provides technical assistance on floodplain management issues and oversees the NFIP. In addition, FEMA offers flood mitigation programs and technical assistance in updating the State Hazard Mitigation Plan, and funds mitigation projects through grants such as the Hazard Mitigation Grant Program and the Flood Mitigation Assistance Program.

The U.S. Army Corps of Engineers (Corps) offers both emergency and long-term services for pre- and post-disaster mitigation and response. They perform general investigation studies for flood control, and provide floodplain management planning services, in addition to their role in design and construction of flood retention structures (see Part 1, Section 3 of the State Water Plan). The Corps has recently proposed a new Flood Hazard Mitigation and Riverine Restoration program, titled Challenge 21, intended to focus on nonstructural solutions to restore river channels that were modified for flood control.

The Natural Resources Conservation Service (NRCS) provides services related to measuring and reducing flood hazards and emergency response following a flood event. They conduct floodplain management studies in which ecological resources are cataloged and opportunities for restoring and preserving floodplains are identified. Under the Emergency Watershed Protection program, NRCS provides technical and financial assistance when a natural disaster causes damage in a watershed. Emergency response actions are related to assessing damages and identifying actions.

Regional Involvement in Flood Management

Western Governors' Association

The Western Governors' Association (WGA), adopted a policy resolution on Flood Mitigation and Recovery Issues in December 1997. The Task Force organized by WGA concluded that flood planning and floodplain management are essential elements in reducing flood risk. The task force developed *An Action Plan for Reducing Flood Risk in the West*. The action plan developed by the task force contains 21 recommendations for improving floodplain management and coordination and communication of flood issues. Several of WGA's recommendations are used as a basis for the recommendations presented at the end of this discussion.

Issues

1. Communities participating in the NFIP outside of the major urban centers have not had access to consistent state-level assistance in implementing and managing their floodplain management ordinances. In some cases, this lack of state assistance, combined with turnover in personnel at the community and county level, and resultant lack of training have made it difficult for local communities to comply with NFIP regulations.
2. Alluvial fan or flash flooding is a critical issue for two reasons: a) flash flooding is less predictable than riverine flooding and results in high velocity flows with great erosive capability, and there is a high potential for channel migration to previously unidentified areas; and b) the risk of alluvial fan flooding is either over- or under- predicted due to disagreement on effective models for predicting flows and mapping alluvial fan flood zones among engineering and planning professionals.
3. The Flood Insurance Rate Maps (FIRMs), used by the local administrators outside of major urban centers for planning and permitting development, are well over five years old, and areas which are currently being developed were never mapped in detail in the original studies. Use of regression equations that are based on generalized hydraulic geometry and that do not incorporate site specific geologic and soil type data have resulted in underestimating the extent and depth of flooding. Rapid growth in areas with outdated flood zone maps can result in the construction of homes and businesses in harm's way.
4. In the past, coordination between state agencies, and between state and local agencies, was often inadequate. This resulted in gaps in services and missed opportunities for grant funding. When the 1997 state legislature re-assigned the flood management program to Division of Water Planning and enhanced funding, it created the opportunity for improved coordination and will result in better implementation of flood mitigation efforts and reduced costs of flood recovery. Increased coordination is clearly an essential element in improving flood program effectiveness at all levels.
5. Floodplain management must be considered an essential on-going element in local and regional

planning, not something that takes place after a flooding event. In a presidentially declared disaster, FEMA sets aside a portion of the total reimbursed damages to fund mitigation work. The State has a Disaster Relief Fund, but funds for preventive mitigation are not currently available.

6. To avoid recurrence of losses experienced in the 1997 flood event in northern Nevada, the 1997 state legislature requested development of a Flood Management Plan for the state.
7. The State’s Model Floodplain Ordinance contains the *minimum* national NFIP requirements are floodplain management standards which do not take Nevada’s unique regional conditions into consideration. Conditions which make Nevada NFIP requirements that communities and counties must implement to obtain flood insurance. unique are rapid growth in areas with outdated flood maps, alluvial fan flooding and flash flooding. The State Model Ordinance was developed in 1994, prior to the 1997 flood event in northern Nevada, and needs to be updated to include lessons learned from that event. Further, to adequately prevent flood impacts and keep damages and costs of recovery to a minimum, the state also needs to develop a set of recommended standards over and above the minimum standards established in the model ordinance to reflect Nevada’s unique flood management concerns.
8. In Northern Nevada, communities located along rivers are incurring increasing costs due to flooding. Growth and development in floodplains exacerbated flood losses. Further, it is clear that existing structural controls are not effective in preventing damages. Studies throughout the west show the benefits of incorporating non-structural measures such as preservation and restoration of floodplain areas, through zoning and conservation easements, and relocating structures out of floodplain areas.

Recommendations

To further enhance floodplain management in Nevada, the following recommendations are proposed.

1. The State Legislature should amend NRS 540 which describes the duties of the Nevada Division of Water Planning, to include floodplain management. Formal recognition of the role assigned to the Division by the 1997 Legislature would enhance the Division’s ability to administer the CAP and FMA programs.
2. The Nevada Division of Water Planning should coordinate participation of local, state, and federal agencies to develop a procedure for quantifying alluvial fan flooding that is acceptable to engineering and planning professionals involved in floodplain management, as recommended by the Western Governors’ Association. The Division should coordinate with the Nevada Bureau of Mines and Geology (NBMG) to incorporate fluvial geologic information into mapping flood-prone areas in the state.
3. The Nevada Division of Water Planning should develop a plan for reviewing, updating, and maintaining flood maps and research the potential for the state to participate in FEMA’s proposed

map modernization program as a Cooperating Technical Community in conjunction with the NBMG. Several communities in the state already have the capability to develop and maintain their flood maps digitally. This capability combined with the rapid growth in the state would make Nevada a good candidate for the map modernization program.

4. The Nevada Division of Water Planning should take a leadership role in improving coordination with all involved agencies (Nevada Division of Water Resources, Department of Transportation, Division of Emergency Management, Clark County Regional Flood Control District, regional water management districts, local community development agencies, community and county building departments, public works departments, etc.) to accomplish the following flood management objectives:
 - a. Encourage complete statewide participation in the NFIP;
 - b. Encourage participation in the Community Rating System;
 - c. Encourage relocation of flood prone structures and restoration of natural floodplain functions;
 - d. Encourage local communities to take advantage of the FIRM revision process; and
 - e. Emphasize education on floodplain management strategies and flood-loss reduction.
5. The State should create a state-funded Flood Mitigation Fund separate from the Disaster Relief Fund (SB 218), as recommended by the Western Governors' Association. In a presidentially declared disaster, FEMA typically sets aside 15 percent of the total FEMA-reimbursed damages to be spent specifically on flood mitigation. Similarly, 15 percent of the state's \$4 million Disaster Relief Fund (\$600,000) should be set aside for preventive flood loss strategies.
6. The Nevada Division of Water Planning should continue development of a detailed statewide Flood Management Plan which addresses the unique flooding conditions experienced in Nevada. The plan will provide a guideline for communities to use in implementing their flood ordinances. A Flood Management Plan would be particularly helpful to the communities outside of the major urban centers.
7. The Nevada Division of Water Planning should revise the state's Model Ordinance (minimum standards) to include "lessons learned" from the 1997 flood event in northern Nevada and flash flooding events throughout the state, such as higher reference floor elevations for development in flood hazard areas, and more appropriate development and construction standards in known but unmapped alluvial fan areas. Further, the state should develop a set of recommended standards. At a minimum, local governments should adopt the revised Model Floodplain Ordinance and should be encouraged to adopt the recommended standards.
8. All communities should develop flood mitigation plans which identify flood hazards and flooding risks, and evaluate options for flood mitigation. High priority should be placed on relocation of flood-prone development, restoration of natural beneficial floodplain functions and the use of zoning and conservation easements to direct growth away from floodplains.

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