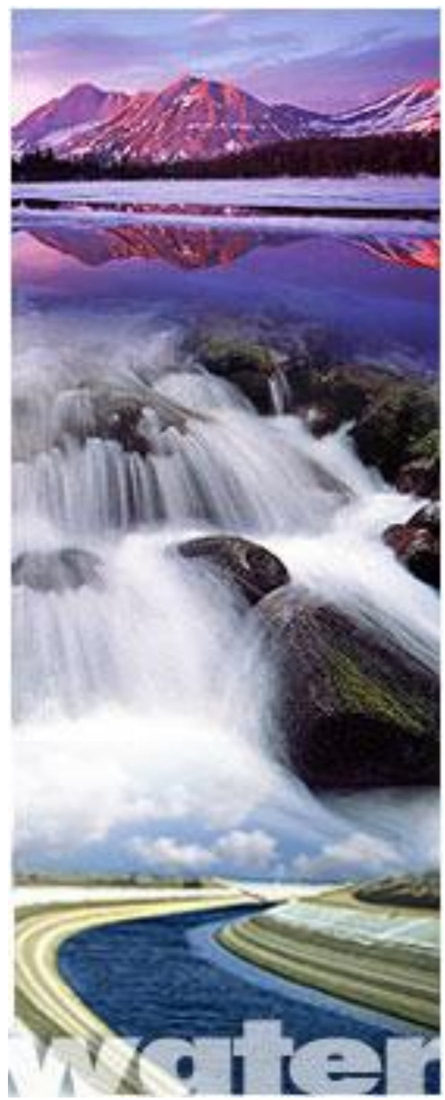
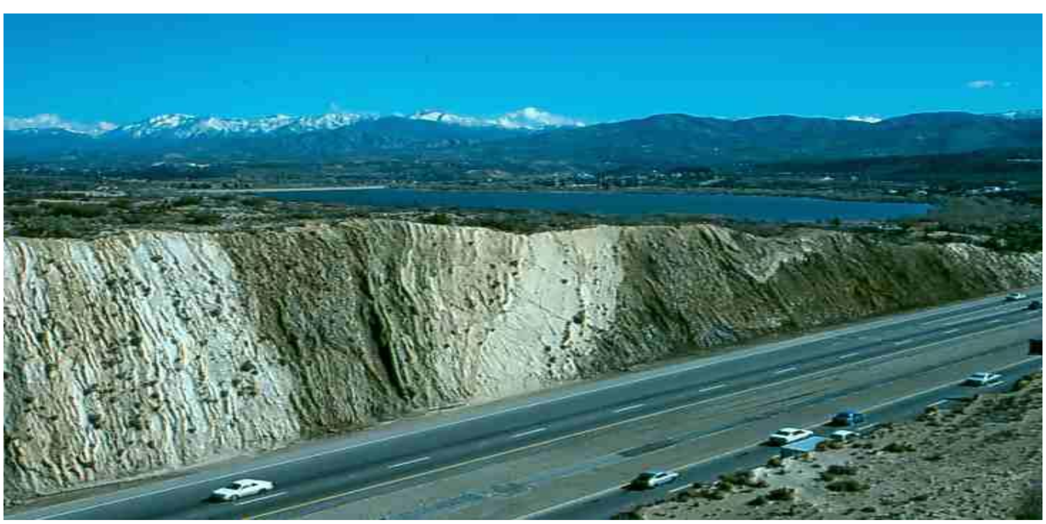
PALMDALE WATER DISTRICT LOCAL HAZARD MITIGATION PLAN DECEMBER 2008





(DRAFT)
Adoption by Local Governing Body: §201.6(c)(5)
Palmdale Water District

RESOLUTION OF THE PALMDALE WATER DISTRICT BOARD OF DIRECTORS ADOPTING A LOCAL HAZARD MITIGATION PLAN

RESOLUTION NO. __________

WHEREAS, the Disaster Mitigation Act of 2000 requires all jurisdictions to be covered by a Pre-Disaster All Hazards Mitigation Plan to be eligible for Federal Emergency Management Agency pre- and post-disaster mitigation funds; and

WHEREAS, the Palmdale Water District recognizes that no jurisdiction is immune from natural, technological or domestic security hazards, whether it be earthquake, flood, severe winter weather, drought, heat wave, wildfire or dam failure related; and recognizes the importance of enhancing its ability to withstand hazards as well as the importance of reducing human suffering, property damage, interruption of public services and economic losses caused by those hazards; and

WHEREAS, the Federal Emergency Management Agency and California Governor's Office of Emergency Services have developed a hazards mitigation program that assists jurisdictions in their efforts to become Disaster-Resistant entities that focus, not just on disaster response and recovery, but also on preparedness and hazard mitigation, which enhances economic sustainability, environmental stability and social well-being; and

WHEREAS, Palmdale Water District fully participated in the Federal Emergency Management Agency prescribed mitigation-planning process to prepare this Local Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED that the Palmdale Water District Board of Directors adopts the "Palmdale Water District Local Hazard Mitigation Plan" as an official Plan; and

BE IT FURTHER RESOLVED, the Palmdale Water District, through the Safety and Risk Manager, will submit this Adoption Resolution to the California Governor's Office of Emergency Services and Federal Emergency Management Agency, Region IX officials to enable the Plan's final approval.

PASSED AND ADOPTED at a regular meeting of the Board of Directors of the Palmdale Water District held on *Month, Day, Year*.

____
RICHARD WELLS, President
Board of Directors

ATTEST:

____
LINDA GODIN, Secretary
Board of Directors

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1. Purpose / Vision / Values

1.1 Purpose of Local Hazard Mitigation Plan (LHMP)

The purpose of this Local Hazard Mitigation Plan (LHMP) is to reduce or eliminate long-term risks to people and property from natural and man-made hazards. The Palmdale Water District (District) LHMP is the representation of the District's commitment to reduce risks from natural and other hazards and serves as a guide for decision-makers as they commit resources to reducing the effects of natural and other hazards. The District's LHMP serves as a basis for the State Office of Emergency Services (OES) to provide technical assistance and to prioritize project funding. (See IFR §201.6).

While the Disaster Mitigation Act of 2000 ("DMA 2000") requires that local communities address only natural hazards, the Federal Emergency Management Agency (FEMA) recommends that local comprehensive mitigation plans address man-made and technological hazards to the extent possible. Towards that goal, Palmdale Water District has addressed an expansive set of hazards.

The District is required to adopt a federally-approved Hazard Mitigation Plan to be eligible for certain disaster assistance and mitigation funding. The overall intent of this LHMP is to reduce or prevent injury and damage from hazards. It identifies past and present mitigation activities, current policies and programs, and mitigation strategies for the future. This LHMP also guides hazard mitigation activities by establishing hazard mitigation goals and objectives.

The LHMP is a "living document" that will be reviewed and updated annually to reflect changing conditions and improvements by new information, especially information on local planning activities. The LHMP is written to meet the statutory requirements of DMA 2000 (P.L. 106-390), enacted October 30, 2000 and 44 CFR Part 201 – Mitigation Planning, Interim Final Rule, published October 28, 2003.

1.2 Support of Broader Palmdale Water District Vision

This LHMP supports the broader mission and vision of the Palmdale Water District as reflected in the following statements:

Mission Statement

The Mission of the Palmdale Water District is to provide high quality water to our current and future customers at a reasonable cost.

Vision Statement

The Palmdale Water District will strive for excellence in providing high quality reasonably priced water in a growing Antelope Valley by being a strong advocate for our customers in local water issues, public education, asset management, water conservation, planning and securing additional water supplies, continuing our commitment to operate efficiently with the help of emerging technologies, challenging, motivating and rewarding our employees and offering premium customer service in all we do.

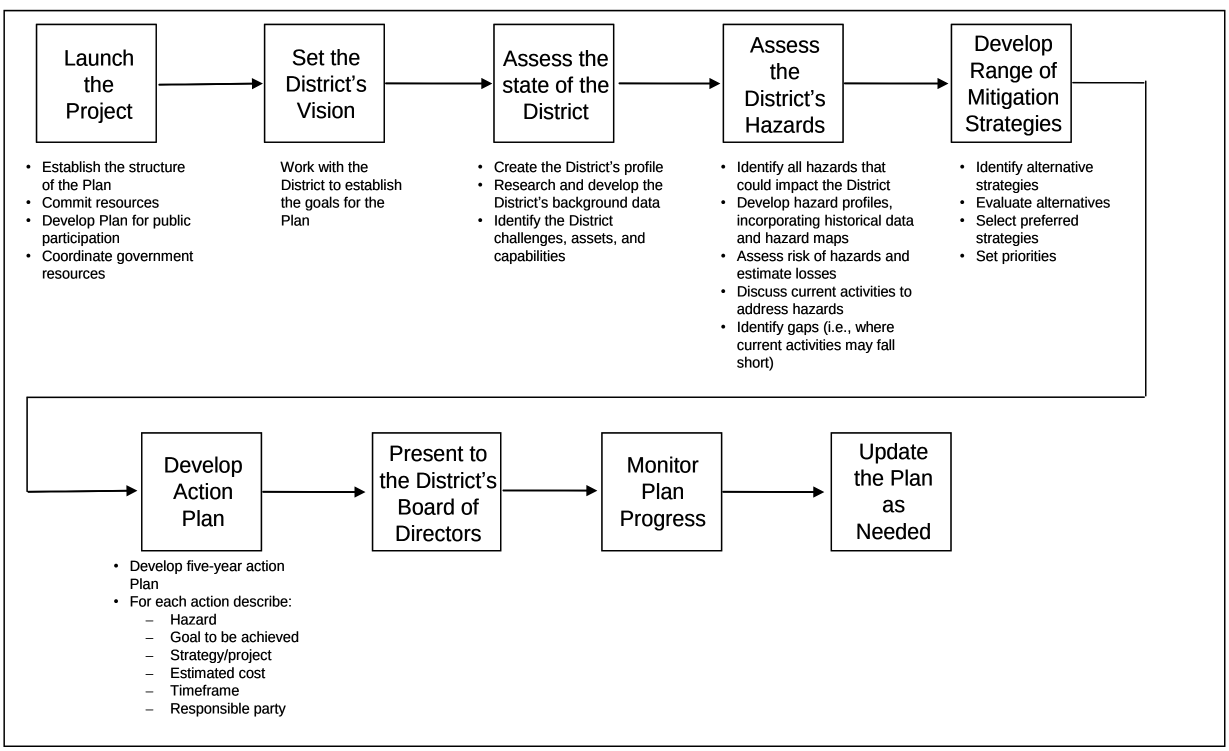
2. The Planning Process

The Palmdale Water District was responsible for the development of the Local Hazard Mitigation Plan. The District hired a consultant, Bluecrane, Inc., (*bluecrane*) to assist in the preparation of the LHMP. The District formed a planning committee, the Hazard Mitigation Working Group, with representatives from the following Departments within the District.

- Department of Risk Management and Safety
- Department of Engineering
- Department of Facilities
- Department of Production

The individuals from these Departments, as members of the Hazard Mitigation Working Group, were responsible for communicating with and soliciting input from all applicable units, offices and division within their Departments as the LHMP progressed through the various stages of development. In this manner, all units, offices and divisions from each of the participating Department as noted above were fully involved in the development of the LHMP.

The figure below depicts the planning process utilized by the District.



The goals and objectives of the LHMP identified by the Hazard Mitigation Working Group are to:

- Reduce risk to existing facilities from hazards
- Prevent loss of services
- Protect public health and safety
- Improve education, coordination, and communication with stakeholders and the public

LHMP Meeting Schedule

Following the Palmdale Water District's Board of Directors' approval of the project, the effort was launched on April 17, 2008 by a project kick-off meeting of the Hazard Mitigation Working Group, in Palmdale, California. The meeting was facilitated by the District's Risk Management and Safety Officer and the professional planning contractors from *bluecrane*. The Hazard Mitigation Working Group was comprised of the District's Managers from the following Departments:

- Department of Risk Management and Safety
- Department of Engineering
- Department of Facilities
- Department of Production

In addition, relevant staff from the various Departments were also in attendance. During this meeting the scope of work, introduction to DMA regulations, the role of the planning contractor, local hazards identification, hazard data collection needs, and an overall timeline were discussed.

The Hazard Mitigation Working Group has participated actively in the LHMP's development. Communications during the planning process involved face to face meetings, phone interviews, e-mail correspondence, and conferring every two to three weeks throughout the process to review and analyze each section of the draft LHMP and make appropriate updates when necessary, and assess the progress of the LHMP in general.

In addition to the steps shown in the planning process figure above, an extensive effort was undertaken to solicit public input during the planning process through website postings, District newsletter announcements, and invitations to public discussions and activities within the Palmdale Water District's jurisdiction. Public comments and input included neighboring communities, agencies, businesses, academia, non-profits and other interested parties. The typical agenda for the interactive information sharing and input gathering sessions with the public included:

- Introductions of the Hazard Mitigation Working Group and planning contractors
- An overview of the LHMP purpose and process

- A detailed interactive discussion of each hazard
- Solicitation of all comments
- An interactive discussion of the next steps
- A broad overview of the Draft Plan as it stood at that time

In the ongoing effort to include presentations, discussions and input gathering on the LHMP in all relevant internal District meetings and interaction with the public, the following Table list the formally scheduled meetings and public announcements conducted in the Palmdale Water District's jurisdiction.

Table 2-1. Schedule of Palmdale Water District Meetings

Date	Event
April 17, 2008	Hazard Mitigation Planning Committee Meeting – Kickoff Session
September 22, 2008	Draft Hazard Mitigation Plan available for public viewing and comments at District's headquarters
October 6, 2008	Draft Hazard Mitigation Plan posted on Palmdale Water District website for public review and comments
October 9, 2008	Palmdale Water District Hazard Mitigation Workshop with the Hazard Mitigation Planning Committee
October 9, 2008	Palmdale Water District Hazard Mitigation Plan Open Forum for Public Input in the planning process including neighboring communities, businesses, academia, nonprofits and other interested parties

Documents that Contributed to the Foundation of the LHMP

The Palmdale Water District's Urban Water Management Plan, Water System Master Plan, Watershed Sanitary Survey and Drinking Water Source Assessment Update, and Five-Year Strategic Plan, in addition to the City of Palmdale's General Plan and the Antelope Valley Integrated Regional Water Management Plan, contributed to the foundation of this integrated LHMP.

3. Palmdale Water District Profile

Palmdale Water District is a publicly owned utility district that provides water service to the City of Palmdale. The District is located in Palmdale, California within the Antelope Valley in Los Angeles County approximately 60 miles north of the City of Los Angeles and 50 miles west of the City of Victorville. The District's primary service area includes the central, eastern, and southern portions of the City of Palmdale and adjacent unincorporated areas of Los Angeles County. The District encompasses approximately 149 square miles and serves approximately 115,000 people through 27,452 service connections.

In addition to the primary service area, there is a federal land area of approximately 65 square miles upstream of Littlerock Dam in the Angeles National Forest. The lands in the area presently served by the District slope gently upward to the foot of the northeast-facing slopes of the San Gabriel Mountains. Elevations range from approximately 2,600 feet to 3,800 feet above sea level.

Governing Bodies

The Palmdale Water District is an independent special district governed by a five-member Board of Directors. With the District's water service boundaries divided into five different areas, or Divisions, a Director is elected to serve a four-year term from each of these Divisions. Directors must live in the Division they are elected to serve. Directors are elected by all customers of the District.

The Board of Directors has two regular meetings each month. They are held on the second and fourth Wednesday. All meetings of the Board of Directors use Robert's Rules of Order as a guideline and is governed by the Ralph M. Brown Act pursuant to the California Government Code sections 54950 et seq. The public is welcome to attend and there is a period reserved on each agenda for public comment.

District Water Supply

The Palmdale Water District receives water from three sources: (1) Littlerock Dam and Reservoir; (2) the State Water Project (SWP - imports water from Oroville to Southern California via the Sacramento River, the Bay-Delta, and the California Aqueduct); and (3) Groundwater. The District acts as a retailer of water supplies for domestic, commercial and industrial users. There are no agricultural deliveries made within the service area boundaries.

The District uses Littlerock Creek as its local surface water supply source. The Watershed is defined by the area tributary to Littlerock Reservoir, Palmdale Ditch, and Lake Palmdale. The

SWP water is also stored in Palmdale Lake before delivery to the Palmdale Water Treatment Plant.

Littlerock Dam and Reservoir. The principal streams tributaries to the District service area are Littlerock and Big Rock creeks, which flow north from the San Gabriel Mountains along the southern District boundary. Numerous intermittent streams also flow into the service area, however run-off is meager. The Littlerock Dam and Reservoir intercepts flows from the Littlerock and Santiago canyons. Runoff from the 65 square mile watershed in the Angeles National Forest to the reservoir is seasonal and varies widely from year to year. For the period 1953-1999, annual inflow was 13,285 acre-feet per year. The median inflow for this period was 6,707 acre-feet per year. The difference between the median and average demonstrates that dry years occur more frequently than wet years and that wet years tend to be more extreme.

Littlerock Dam and Reservoir is located about 8.5 miles from the City of Palmdale and diverts water from Littlerock Creek. Since 1922, the District has shared water from this source with Littlerock Creek Irrigation District (LCID). The District and LCID jointly hold long-standing water rights to divert 5,500 acre-feet per year from Littlerock Creek flows. Per an agreement between the two districts, the first 13 cubic feet per second (cfs) of creek flows is available to LCID. Any flow above 13 cfs is shared between the two districts with 75 percent going to the Palmdale Water District and 25 percent to LCID. Each of the districts is entitled to 50 percent of the reservoir's storage capacity. Water from Littlerock Dam Reservoir is conveyed to Lake Palmdale through an open canal.

In 1992, during renegotiations of the Districts' agreement, a plan to rehabilitate the existing dam was implemented. The plan involved reinforcing the original multiple-arch construction with a roller-compacted concrete buttress, raising the dam by 12 feet to increase capacity, providing recreational facilities around the reservoir, and replacing the historic wooden trestle between the creek and the reservoir with an underground siphon. The entire project was completed by the end of 1995. This agreement gives the District the authority to manage the reservoir. LCID granted ownership of its water rights to the District for the fifty year term of the agreement in lieu of contributing financial resources for the rehabilitation work. LCID is entitled to purchase from the District, in any one calendar year, 1,000 acre-feet of water or 25 percent of the yield from Littlerock Reservoir, whichever is less. Upon termination of the 1992 Agreement, the terms of the 1922 Agreement will again define and govern the rights and responsibilities of the District and LCID with respect to the dam and the waters stored in the reservoir.

California State Water Project. The State Water Project (SWP) is the primary source for imported water in the Antelope Valley. The main transport structure of the SWP is the California Aqueduct, which conveys water from Northern California to Southern California. This facility is managed by the California Department of Water Resources (DWR). The aqueduct is an artificial concrete-lined water transport channel that is about 450 miles in length.

The District is one of 29 contracting agencies having entitlements to water supplies from the SWP. The District has been able to take delivery of SWP water since 1985 from the East Branch of the California Aqueduct, which passes through the service area. The District receives its entitlement from a 30 cfs connection on the East Branch, where SWP water is conveyed to Lake Palmdale via a 30-inch diameter pipeline. Lake Palmdale acts as a forebay for the Districts 30 million gallons/day (mgd) water treatment plant and stores approximately 4,250 acre-feet of SWP water and Littlerock Creek water.

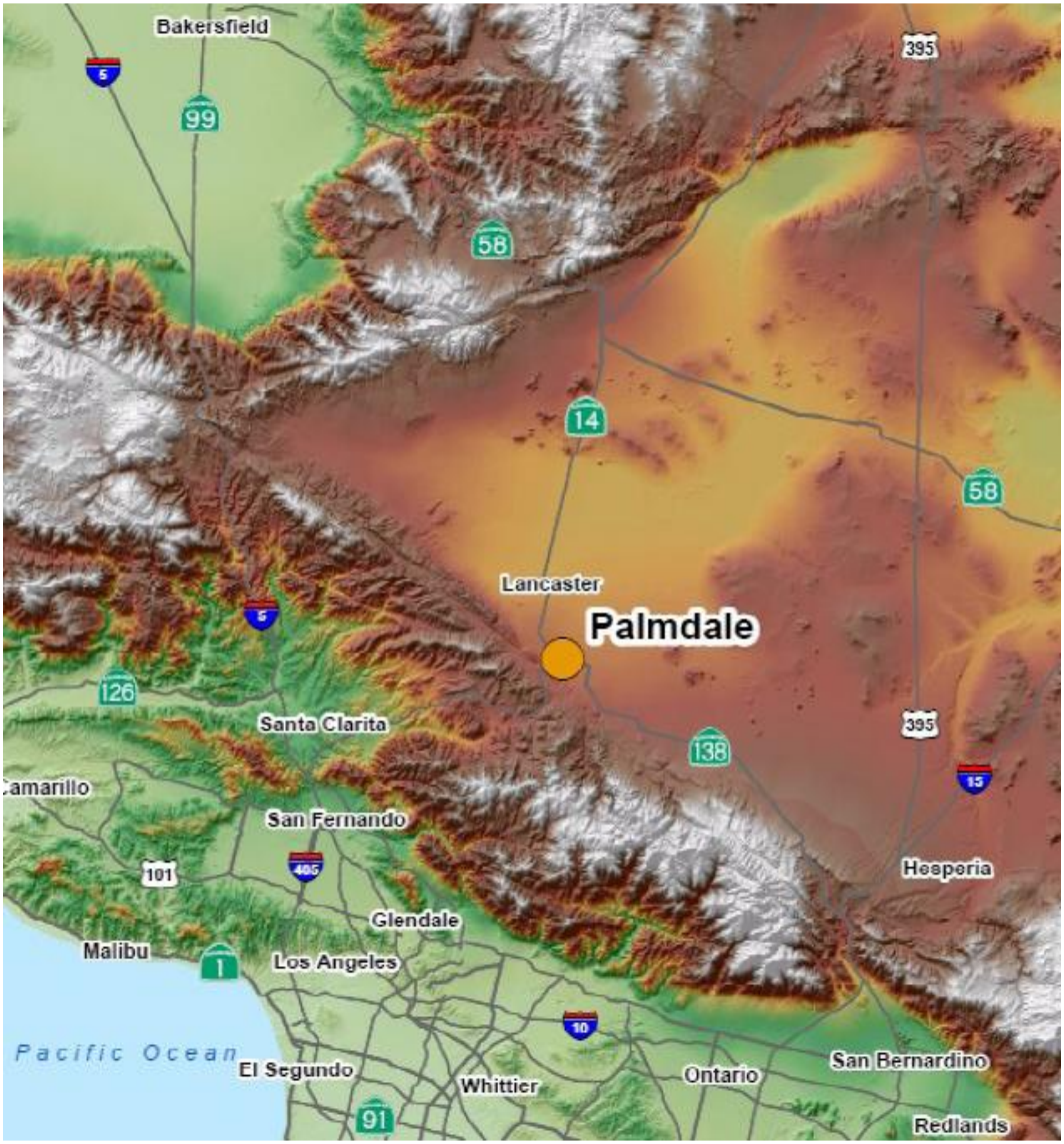
Groundwater. Groundwater is obtained from underground aquifers via 27 active wells scattered throughout the District and chlorinated prior to distribution. Three of the District's wells also pump water from deposits that are within the San Andreas Rift Zone. Since the water quality of the groundwater meets state and federal standards, the wells pump directly into the District's distribution system or into nearby holding tanks without the need for treatment, except for chlorination. Water is conveyed from the wells or treatment plant to the consumers via a distribution system with pipe sizes ranging between 2- and 42-inches in diameter. The District maintains 19 storage tanks within the distribution system, with a total capacity of 44.6 million gallons.

The District produces 26,671 acre-feet annually composed of approximately 60 percent surface water and 40 percent groundwater. The District is usually more dependent on groundwater in winter, prior to the snowmelt.

District Water Treatment Plant

The Palmdale Water District also owns and operates a water treatment plan. The Palmdale Water Treatment Plant provides treatment for water extracted from Lake Palmdale. Lake Palmdale receives water from the two sources noted in the previous sections: the SWP and Littlerock Dam and Reservoir. Water is conveyed from the SWP via a 30-inch diameter pipeline while water from Littlerock Dam and Reservoir is conveyed through an open canal. The treatment plant consists of chemical addition, flocculation, sedimentation, filtration, and disinfection. The capacity of the existing plant is 30 mgd. However, a water supply permit from the Department of Health Services requires that one filter be kept off-line as a redundant source. This limits the capacity of the plant to 28 mgd. The District is spending approximately $40 million to upgrade the Water Treatment Plant in order to meet more stringent water quality regulations. These upgrades are being completed in two phases, and the second phase has just recently been completed. The upgrades will allow the treatment capacity of the plant to be increased to approximately 35 mgd.

The following maps show the location of the City of Palmdale, the Palmdale Water District's Boundaries, Service Areas, and the location of the District's Water Supply Facilities.


Bakersfield
5
99
58
395
14
58
Lancaster
Palmdale
5
126
Santa Clarita
395
138
15
amarillo
San Fernando
101
405
Hesperia
Glendale
Malibu
1
Los Angeles
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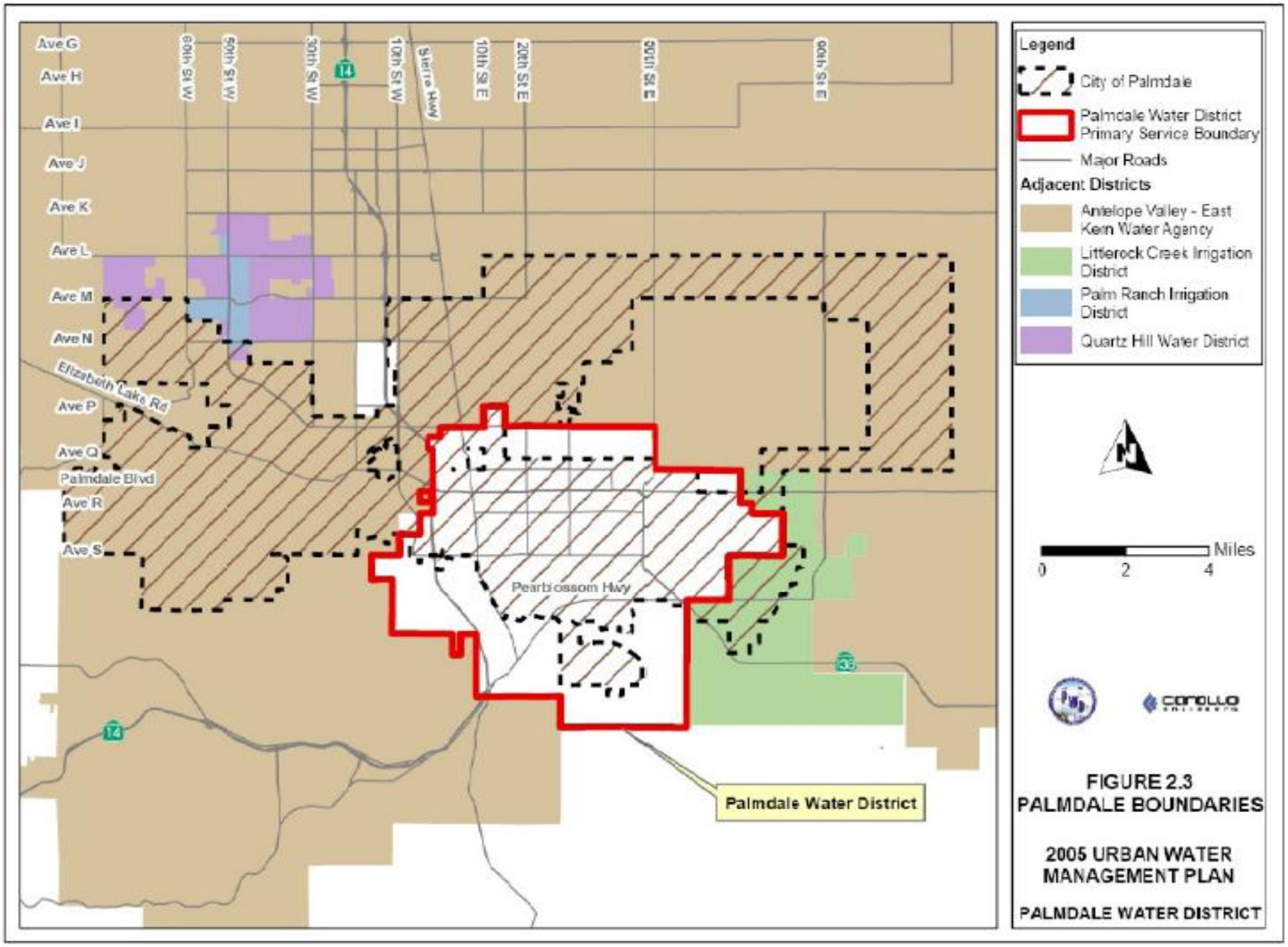
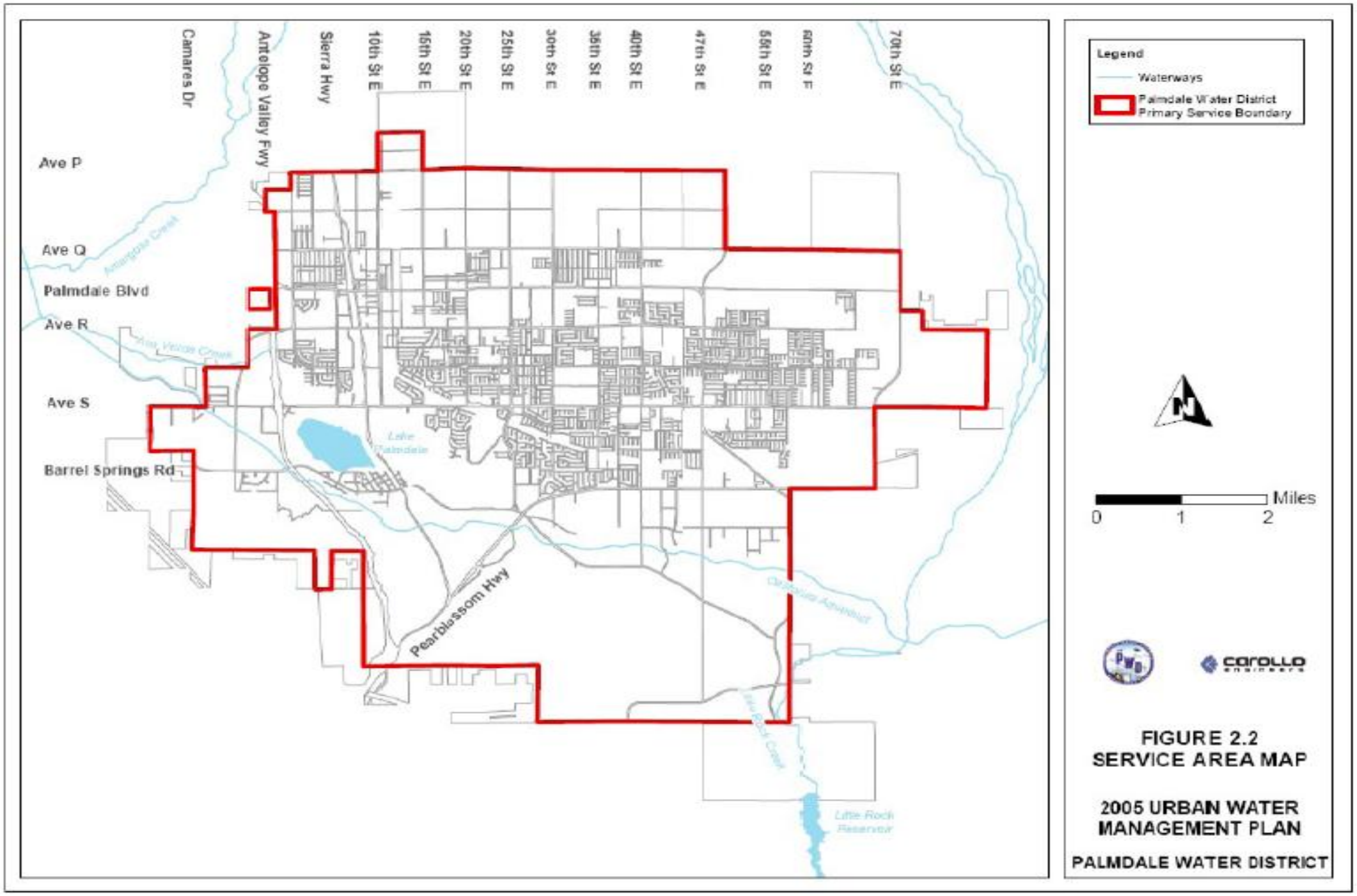
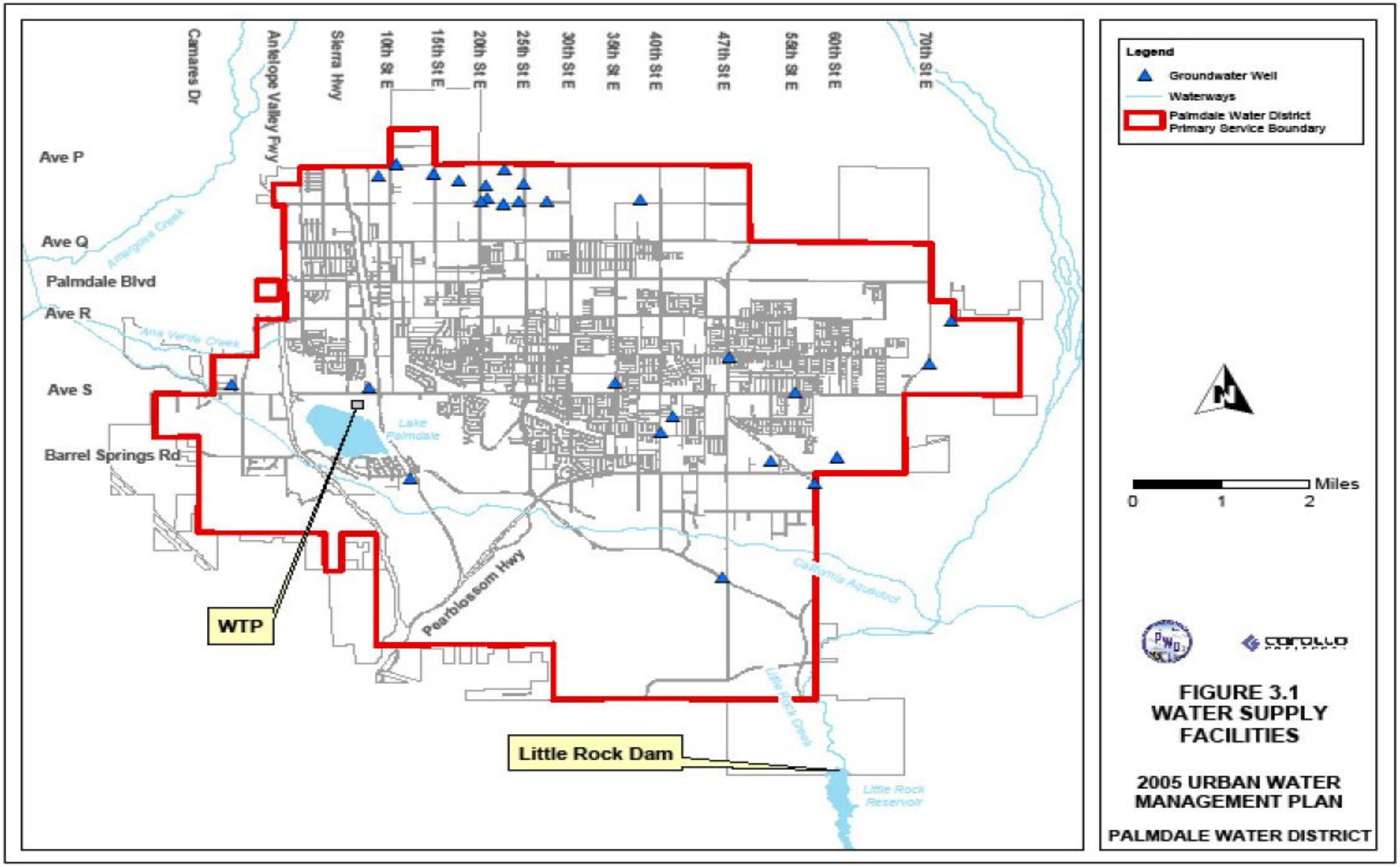
Pacific Ocean
El Segundo
Whittier
Ontario
San Bernardino
91
Redlands


Ave G
Ave H
Ave I
Ave J
Ave K
Ave L
Ave M
Ave N
Elizabeth Lake Rd
Ave P
Ave Q
Palmdale Blvd
Ave R
Ave S
60th St W
50th St W
30th St W
10th St W
Sierra Hwy
10th St E
20th St E
50th St E
90th St E
Pearblossom Hwy
Palmdale Water District
Legend
City of Palmdale
Palmdale Water District Primary Service Boundary
Major Roads
Adjacent Districts
Antelope Valley - East Kern Water Agency
Littlerock Creek Irrigation District
Palm Ranch Irrigation District
Quartz Hill Water District
Miles
0
2
4
FIGURE 2.3
PALMDALE BOUNDARIES
2005 URBAN WATER MANAGEMENT PLAN
PALMDALE WATER DISTRICT


Camares Dr
Antelope Valley Fwy
Sierra Hwy
10th St E
15th St E
20th St E
25th St E
30th St E
35th St E
40th St E
47th St E
55th St E
70th St E
Ave P
Ave Q
Palmdale Blvd
Ave R
Ave S
Barrel Springs Rd
Pearblossom Hwy
Legend
Waterways
Palmdale Water District Primary Service Boundary
Miles
0
1
2
FIGURE 2.2
SERVICE AREA MAP
2005 URBAN WATER MANAGEMENT PLAN
PALMDALE WATER DISTRICT


Legend
Groundwater Well
Waterways
Palmdale Water District Primary Service Boundary
Camares Dr
Antelope Valley Fwy
Sierra Hwy
10th St E
15th St E
20th St E
25th St E
30th St E
35th St E
40th St E
47th St E
55th St E
60th St E
70th St E
Ave P
Ave Q
Palmdale Blvd
Ave R
Ave S
Barrel Springs Rd
Lake Palmdale
Pearblossom Hwy
California Aqueduct
Little Rock Creek
WTP
Little Rock Dam
Little Rock Reservoir
Miles
0
1
2
FIGURE 3.1
WATER SUPPLY FACILITIES
2005 URBAN WATER MANAGEMENT PLAN
PALMDALE WATER DISTRICT

Historical Setting

The Palmdale Water District evolved from several private water companies. The first water agency, the Palmdale Irrigation Company, was established in 1886 to acquire land and water, and then rent, lease, and sell both as they were developed. As a means of providing water for these purposes, they constructed a six and a half mile irrigation ditch to divert water from nearby Littlerock Creek to Palmdale.

Not long after, it became apparent that water storage facilities were needed. In 1895, the South Antelope Valley Irrigation Company constructed an earthen dam forming Harold Reservoir known today as Palmdale Lake. To connect the water from Littlerock Creek to Harold Reservoir, they constructed another earthen ditch, including a flume and wooden trestle, parallel to the ditch being used by the Palmdale Irrigation Company.

By the early 1900's, it was decided that one or more dams on Littlerock Creek were necessary. By this time, the Palmdale Water Company and Littlerock Creek Irrigation District had acquired the facilities of earlier water companies. Together, they studied the costs and options for constructing one or more dams on Littlerock Creek. It was determined that forming a public irrigation district was the best way to finance this construction. The Palmdale Irrigation District was then formed in 1918 by a vote of the public. It maintained a service area of about 4,500 acres and acquired the added facilities of the Palmdale Water Company.

Together with Littlerock Creek Irrigation District, financing and construction of the Littlerock Dam began on Littlerock Creek in August of 1922 and took two years to complete. At a height of 175 feet with a water storage capacity of 4,200-acre feet it was noted as the highest reinforced concrete, multiple arch dam in the world. However, controversy surrounded the design of Littlerock Dam, and by 1932, the State of California declared Littlerock Dam an unsafe structure and ordered that renovations be made. By 1938, renovations had still not been completed. Subsequently a two-day storm caused major damage to Littlerock Dam spillway as well as the flume and wooden trestle downstream of the Dam. Repairs were made to the damage and by 1940, the re-construction of Littlerock Dam was considered complete.

Until the 1950's, the area within Palmdale Irrigation District's boundaries was primarily agricultural. However, with the activation of Air Force Plant 42 and the increased use of Edwards Air Force Base, agricultural water use diminished. As populations grew within the valley the shift to domestic water began.

In 1963, the Palmdale Irrigation District entered into an agreement to purchase water from the newly planned State Water Project (also known as the California Aqueduct). This agreement guaranteed the District would have sufficient alternative source water to supply projected population growth well into its future. To contain the increased water supply, bonds were sold to rebuild and expand Palmdale Lake (formerly known as Harold Reservoir) to an increased capacity of over 4,100 acre feet. This bond financing also allowed the construction of a new treatment facility adjacent to the Lake. As a result, this new water supply enabled the Palmdale Irrigation District to service a broader area of Palmdale.

It was decided in 1973, that the Palmdale Irrigation District name should be changed to the more appropriate Palmdale Water District. Founded as an Irrigation District supplying water mainly to farms for agricultural use, the District's boundaries had expanded with Palmdale's rapid population growth and the District shifted to providing predominantly municipal and industrial water. To put this substantial growth in perspective, from 1965 to 1985, water production grew from 4,100-acre feet per year to over 8,000-acre feet per year and more than doubled in the five years after that. To keep up with demand, in 1987, the District constructed a water treatment plant that would process 12 million gallons of water per day. Later that year, after years of study, Palmdale Water District and Littlerock Creek Irrigation started planning new renovations of the Littlerock Dam.

As Palmdale's population continued to grow, it was determined that the water treatment plant built in 1987 would not support Palmdale's future water usage needs. An expansion of the facility was determined necessary and was completed in 1993 increasing the District's production capacity from 12 million to 30 million gallons of water per day.

Following extensive environmental and design work, in 1993, the Palmdale Water District and Littlerock Creek Irrigation District began to rehabilitate the dam in three phases. The first phase involved reinforcing the original multiple-arch construction with a roller-compacted concrete buttress. At the same time, the original dam was raised 12 feet, which thereby doubled the reservoir's capacity.

The second phase of construction provided new recreational facilities around the reservoir. Dedication ceremonies were held June 23, 1995, marking the re-opening of the Littlerock Dam area, which had remained closed during the renovation construction process. The final phase of construction included replacing the historic wooden trestle with an underground siphon, which was completed shortly thereafter.

From 1995 to 2000 the Palmdale Water District continued to improve and add to its water distribution and storage facilities. The Palmdale Water District's primary service now covered over 35 square miles versus 4,500 acres in 1918. In 2000 the distribution system had grown to over 345 miles of pipeline, multiple well sites, booster pumping stations, and water storage tanks maintaining a total storage capacity of over 40 million gallons.

City of Palmdale Community

The City of Palmdale has been named one of the fastest-growing cities in America and the City has experienced tremendous growth and prosperity over the last decade. According to the 2000 U.S. Census, there were 116,670 people living in the City. As of January 1, 2007, according to the California State Department of Finance, there are approximately 145,468 residents; making Palmdale the seventh largest city in Los Angeles County. Palmdale is policed by the Los Angeles County Sheriff's Department and the City is served by the Los Angeles County Fire Department.

Climate

The City of Palmdale is located in the high desert (altitude - 2,600 to 3,800 feet above sea level), where the summers are very hot and dry, and winters are cold and windy. Palmdale has over 300 days of sunshine each year. The same weather pattern that brings the marine layer stratus and afternoon sea breeze to the Los Angeles Basin brings gusty winds to Palmdale, especially near the foothills on the south side. Gusty southwest winds blow over Palmdale almost every afternoon and evening all year round.

- Average annual rainfall: 7.36 inches per year
- Average winter temperature: 59 degrees F-high; 33 degrees F-low
- Average summer temperature: 98 degrees F-high; 66 degrees F-low

Local Capabilities Assessment

This section list the District's strategy to utilize resources to achieve goals of reducing losses from future hazard events. Following are the human and technical resources available to engage in mitigation planning processes and a list of financial resources and funding sources which affect or promote mitigation.

Table 3-1. Administrative and Technical Capabilities

Administrative and Technical Capability	
Human Resources	**Department/Agency**
Emergency Managers	District Managers Department Heads Risk Management and Safety Officer Engineering Department Surveyors
Planner(s) or Engineer(s) with knowledge of land development, land management practices, construction practices related to buildings and/or infrastructure	Engineering Department CAD-GIS Specialist Facilities Department Construction Supervisor

Administrative and Technical Capability	
GIS expertise	CAD/GIS Specialist
Grant writers	District Managers Department Heads

Table 3-2. Financial Resources

Financial Resources for Hazard Mitigation Projects
General Fund
Capital Improvement Fee (Developer's fee)
Development fees (Restricted to expansion costs for new development)
Building Permit fees
Assessment Parity Charge (previously called an Acreage Supply Charge)
Fees for water, sewer, gas, or electric service
Impact fees for homebuyers or developers for new developments/homes
State Funding Sources: Commerce and Economic Development Program Infrastructure State Revolving Fund (ISRF) Program Proposition 13 Proposition 84 Integrated Regional Water Management Program Proposition 1E Disaster Preparedness and Flood Prevention Bond Act of 2006 California State Department of Water Resources, Division of Local Assistance, Davis-Grunsky Act Program California State Water Resources Control Board (SWRCB) Proposition 40 California State Water Resources Control Board (SWRCB) Proposition 50 Clean Water State Revolving Fund (SRF) Program Watershed Protection Program
Federal Funding Sources: FEMA (Pre-Disaster Mitigation Program, Flood Mitigation Assistance Program,) U.S. Army Corp of Engineers (USACE) Natural Resources Conservation Service (NRCS) Small Watershed Program Flood Prevention Program Emergency Watershed Protection (EWP) Program Homeland Security Grants (Terrorism) Bureau of Land Management (BLM) Programs

Local Ordinances and Regulations

Local ordinances and regulations which affect or promote disaster mitigation, preparedness, response or recovery for the Palmdale Water District are listed in Table 3-3 below.

Table 3-3. Local Ordinances and Regulations

Local Ordinances and Regulations	
Palmdale Water District Resolution No. 08-7	The Board of Directors approves entering into the agreement for participation in the supply and conveyance of water by the Department of Water Resources of the State of California through the Yuba County Purchase Agreement for the Yuba Accord under the Dry Year Water Purchase Program.
Palmdale Water District Rules and Regulations, Article 10, Section 10.07	Capital Improvement Fee. In order to provide funds for the construction of District facilities to meet water demands created by future development, the Board has determined that developers shall be required to contribute toward the cost of constructing the additional facilities required to meet increasing demands for water service.
Palmdale Water District Rules and Regulations, Article 10, Section 10.06	Assessment Parity Charge. Every applicant for water service from any of the lines or works of the District who has not, either in person or through the predecessor in interest, paid an Assessment Parity Charge (previously called an Acreage Supply Charge) or the equivalent thereof or requests modification of service or change in land use, with respect to the land to be served, shall, before such application will be acted upon by the District, or water furnished pursuant thereto, pay to the District an Assessment Parity Charge computed at a per acre rate set forth in Appendix G of the PWD Rules and Regulations.
Palmdale Water District Rules and Regulations, Article 11, Section 11.12	Related to Minimum Fire Flow Requirements.
Palmdale Water District Water Conservation Regulations	The District adopted water conservation regulations in February 1991. The regulations prohibit the use of water for hose washing of sidewalks, walkways, buildings, and driveways. They also establish limits on a variety of water uses including washing motor vehicles, filling decorative fountains, serving drinking water at restaurants, and watering landscaped areas.
Water Code Law 10632(c)	The Palmdale Water District Urban Water Management Plan is to include actions to be undertaken by the urban water supplier to prepare for and implement during a catastrophic interruption of water supplies including, but not limited to, a regional power outage, an earthquake, or other disaster.
Reliable Water Supply Bond Act of 2008 - SB 59	Contains provisions for conservation, additional surface storage, and Delta conveyance system.
Disaster Preparedness and	This act rebuilds and repairs California's most vulnerable flood control

Local Ordinances and Regulations	
Flood Prevention Bond Act of 2006 – Proposition 1E	structures to protect homes and prevent loss of life from flood-related disasters, including levee failures, flash floods, and mudslides. Protects California's drinking water supply system by rebuilding delta levees that are vulnerable to earthquakes and storms.
Cobey-Alquist Floodplain Management Act	The Cobey-Alquist Floodplain Management Act encourages local governments to plan, adopt and enforce land use regulations for floodplain management in order to protect people and property from flooding hazards. This act also identifies requirements which jurisdictions must meet in order to receive state and financial assistance for flood control.
Flood Damage Prevention Code, Earthquake Hazard Reduction in Existing Building Code	These codes address safety issues associated with flooding and earthquakes directly.
Alquist-Priolo Earthquake Fault Zoning Act	The Alquist-Priolo Earthquake Fault Zoning Act requires the state geologist to identify earthquake fault zones along traces of both recently and potentially active major faults. The Alquist-Priolo Zones are usually one-quarter mile or less in width and proposed development plans within these fault zones must be accompanied by a geotechnical report prepared by a geologist describing the likelihood of surface rupture and other seismically induced hazards.
Earthquake Safety and Public Buildings Rehabilitation Bond Act (Proposition 122)	In 1990, the State of California passed the Earthquake Safety and Public Buildings Rehabilitation Bond Act (Proposition 122). Up to $50 million was allocated for the seismic retrofit of essential services facilities. Many local governments and special districts have retrofitted their essential services buildings with local funds.
Uniform Fire Code	This Code may be adopted by local jurisdictions, with amendments, and provides minimum standards for many aspects of fire prevention and suppression activities. These standards include provisions for access, water supply, fire protection systems, and the use of fire resistant building materials.
California Health and Safety Code and the Uniform Building Code	The Health and Safety Code provides regulation pertaining to the abatement of fire related hazards. It also requires that local jurisdictions enforce the Uniform Building Code, which provides standards for fire resistive building and roofing materials, and other fire-related construction methods.
Title 19 California Code of Regulations	These regulations pertain to fire prevention and engineering measures for new construction.

Mitigation Projects and Programs

The following Table describes the District's in-progress, ongoing and completed mitigation projects and programs.

Table 3-4. Mitigation Projects and Programs

In-progress/On-going/Completed Mitigation Projects and Programs		
Program or Project	**Status**	**Description**
Local Hazard Mitigation Plan (LHMP)	In Progress	The District is preparing a LHMP which is currently under OES and FEMA review. The overall intent of this Plan is to reduce or prevent injury and damage from hazards in the District. It identifies past and present mitigation activities, current policies and programs, and mitigation strategies for the future. This Plan also guides hazard mitigation activities by establishing hazard mitigation goals and objectives.
Emergency Operations Plan (EOP)	In Progress	The EOP will be designed to establish the framework for implementation of the National Response Plan, predicated on a new National Incident Management System.
Replacement Water Main	In Progress	Design is currently underway on this project. (11th Street E)
Palmdale Ditch Enclosure	In Progress	Water is transferred from Littlerock Reservoir to Palmdale Lake through an open ditch. The District received approval for a Proposition 13 grant to enclose a portion of the ditch between Sierra Highway and Palmdale Lake.
Water Treatment Plant Improvements Phase I	Completed	Phase I improvements have been completed. Upgrades included: Installation of a self cleaning automatic screen at the lake outlet structure; installation of a Carbon Dioxide storage and feed system; installation of a magnetic flow meter in the influent meter vault; an additional stage was added to the flocculation basins; mew chemical storage, secondary containment, feed system and structure was added to accommodate the use of either Alum or Ferric chloride as the main coagulants.
Water Treatment Plant Improvements Phase II	In Progress	The Work consist of construction of the Palmdale Water District Water Treatment Plan Improvement Project Phase II 2006, including construction of new granular activated carbon contractors, new low lift intermediate pump station, new chemical facilities, new solids handling lagoons, modifications to the existing filters including two new filters, modifications to the existing solids, handling lagoons, repair and reconstruction of existing improvements affected by the Work and incidentals for complete and usable facility.
Water Facilities Capital Improvement	Completed	The extensive growth occurring in the City and surrounding unincorporated County necessitated the implementation of a 42.5 million dollar capital improvement program by the District to serve

In-progress/On-going/Completed Mitigation Projects and Programs		
Program or Project	**Status**	**Description**
Program (CIP)		the population projected by City Planning Department estimates. The CIP includes construction of pipelines, increased storage capacity, increased well capacity and expansion of the water treatment plant. The CIP provided an increase to 34 MG of storage in 1995. Addition of the new 4 MG storage tank at 50th St. East in 2005 increased finished water storage to 44.6 MG.
Energy Bridge	Completed	The Energy Bridge is a California Energy Commission research grant project at the clearwell booster. The Energy Bridge itself is a demonstration project for future commercial production. The product is able to provide power to the booster station when power is interrupted until backup power systems are brought online. The associated control system will coordinate power supplied by the new hydroelectric generator, a fully permitted natural gas engine, an emergency diesel-powered backup generator and Southern California Edison.
Littlerock Reservoir Sediment Removal	Environmental Review	Remove excess Reservoir sediment that has accumulated over time. Restore the water storage and flood control capacity of the Reservoir. Sediment removal from Littlerock Reservoir is extremely important in order to maintain the reservoir as a water supply for the customers of the District.

Land Use and Development Trends

Historically, the Palmdale Water District has been primarily agricultural. However, in the mid 1970s, the District's service area shifted from agricultural to municipal and industrial uses. In the 2006 Water System Master Plan (WSMP) Update, the District's land use types were grouped into five categories: Residential, Commercial, Industrial, Open Space, and Other.

Residential-low density consists of those parcels that are zoned for 0-2 dwelling unit (du)/acre. Residential medium consists of those parcels zoned for 2-6 du/acre, which consists of most single-family homes. Residential-high density consists of those parcels zoned for 10-16 du/acre and consists mainly of apartment buildings, condominiums and townhouses.

Commercial land use consists of the following land use types: business parks, downtown commercial, community commercial, neighborhood commercial, and regional commercial. Industrial land use consists of the following land use types: airport, community manufacturing and industrial. Open Space land use consists of open space and public facilities such as schools and public buildings.

The following Table lists Palmdale Water District's Land Use categories, developed areas, and projected developed areas in acres.

Table 3-5. Land Use Categories

Land Use Categories (Primary Service Area) Urban Water Management Plan Palmdale Water District		
Land Use	**2005 Developed Area (acres)**	**2030 Projected Developed Area (acres)**
Residential		
Low Density	7,641	18,787
Medium Density	325	469
High Density	343	411
Commercial	933	2,438
Industrial	405	1,227
Open Space	717	5,122
Other	2,162	870
Total	12,526	29,324

Source: 2006 WSMP Update

Topographic constraints to development exist along the south and west portions of the Planning Area in the form of fault zones and foothills of the San Gabriel and Sierra Pelona Mountains. The San Andreas rift zone traverses the Planning Area from northwest to southeast, and is designated as an Alquist-Priolo special study area requiring development setbacks. Within the rift zone are springs and wetland areas which have been preserved through the development process. A number of natural drainage courses and flood hazard areas traverse the Planning Area. Hills and ridges to the south and west of the developed portions of the City of Palmdale rise to over 4,500 feet in elevation, while developed portions of the City generally range in elevation from 2,400 to 2,700 feet.

The Palmdale Water District's Engineering Department is responsible for establishing any requirements or conditions and any estimates of fees and charges for providing water service to unserved properties within the Palmdale Water District. To assist land owners through the process of providing water service to their newly developed properties, the District has developed guidelines to use to begin meeting the requirements set forth by the District.

City of Palmdale Land Use and Development Trends

The Palmdale Water District also supports the goals, objectives, policies and trends contained within the City of Palmdale's Land Use Element of their General Plan, and specifically to:

GOAL L1: Create a vision for long-term growth and development in the City of Palmdale which provides for orderly, functional patterns of land uses within urban areas, a unified and coherent urban form, and a high quality of life for its residents.

Objective L1.4: Adopt land use policies which minimize exposure of residents to natural hazards, protect natural resources, and utilize land with limited development potential for open space and recreational uses where feasible.

Policy L1.4.2: Establish the following standards in and adjacent to Alquist-Priolo Earthquake Fault zones and other active fault zones as determined based on geotechnical analysis, in order to protect residents, property and infrastructure systems from damage by seismic activity:

1. Restrict development of habitable structures in these zones in accordance with requirements of State law.
2. Establish a maximum permitted density for all residentially-designated land between the outer boundaries of the Alquist-Priolo Earthquake Fault Zone of three (3) dwelling units per acre (gross) within the project site, except where the Land Use Map indicates lower densities in these areas. This policy specifically excludes any non-residential land uses within the project site from the calculation of density.
3. Require placement of roads, utilities and other infrastructure to be located outside of active fault zones, where feasible.
4. Establish a maximum floor area ratio (FAR) of .5 for new non-residential development within Alquist-Priolo Earthquake Fault Zones.

Policy L1.4.3: Establish the following standards for development in hillside areas:

1. Development in hillside areas should minimize grading, conform to natural topography, preserve ridgelines and exhibit sensitivity to natural landforms.
2. Development should be restricted on natural slopes of fifty percent and greater.
3. Visually prominent ridges and hillsides should be retained in a natural condition.
4. Flexibility in land use regulations may be permitted when it can be demonstrated that such flexibility will meet hillside management objectives.

Policy L3.1.2: In calculating the actual permitted density on a parcel of land, the following constraints will be considered:

1. No residential density shall be calculated for any seismic set back zone adjacent to active or potentially active fault traces where construction of habitable structures is not permitted, as delineated by a site-specific geotechnical report.

However, seismic set back zones may be included in the calculation of minimum lot area and building setbacks. Areas located within the Alquist-Priolo Earthquake Zone, as delineated by the State Geologist, are subject to the density limitations described in Policy L1.4.2.

2. A maximum residential density of .5 (one/half) dwelling unit per acre shall be calculated for flood hazard areas shown on the latest Flood Insurance Rate Maps as Zone A, and within the historic high water mark of Amargosa Creek, Ana Verde Creek, Littlerock Wash, Big Rock Creek, Hunt Canyon or any natural blue-line creek, except where the Land Use Map indicates lower densities in these areas.
3. In hillside areas, density calculation will also be subject to the provisions of the City's Hillside Management Ordinance.

Objective L7.1: Identify areas within the City which merit special planning considerations and develop policies containing development criteria for these areas.

Policy L7.1.1: Ensure that development within the area designated as Special Development (SD) on the Land Use Map located near the intersection of Avenue S and the Antelope Valley Freeway is complimentary to lake, surrounding hillside and mountain views and is consistent with sound water quality management practices by following the development criteria listed below:

1. Balance building heights with appropriate setbacks to preserve view corridors.
2. Require a minimum 100 foot setback from the historical high water mark of Lake Palmdale.
3. Require that proposed buildings incorporate the architectural design guidelines adopted in the Avenue S Corridor Area Plan, to minimize view-shed impacts and enhance community image.
4. All new development may be required to design and construct drainage structures to convey storm and nuisance water away from Lake Palmdale.
5. New development in the area shall be served by a sanitary sewer system for all non-residential uses and residential uses of less than one acre in size. Septic systems will be allowed only for residential uses consisting of one dwelling unit per acre or more.
6. New development proposing underground storage of petroleum or similar products which have the potential to cause contamination of Lake Palmdale shall provide site-specific analysis to address risks associated with the high pressure gas lines located along the south side of Avenue S due to rupture of the San Andreas Earthquake Fault.
7. Rear and side elevations should contain similar elements of the front elevation, ensuring that buildings within the area maintain a cohesive, unified appearance on all sides.

8. Loading and refuse containment areas must be screened from public view utilizing architectural elements consistent with overall building design.
9. Completely screen all mechanical and rooftop equipment from view from S.R. 14 and Avenue S. Roof top equipment screening shall be accomplished through architectural means compatible with the building design.
10. Require view studies to fully evaluate adequacy of equipment screening and building impacts on view-shed. Renderings for such studies should show landscaping at introduction as well as a maturity.
11. Utilize landscaping to soften building mass and parking areas without impending views.
12. Utilize earth tone colors for building and roof materials to blend with natural setting to the maximum extent feasible.
13. Prohibit use of sound walls as a method for acoustical mitigation of building interiors. Noise mitigation shall be accomplished through proper site planning and the use of appropriate building and construction techniques.
14. Require conditional use permit or equivalent entitlement for all development within the subject area.

4. Hazards Facing the Palmdale Water District

Identification of Hazards

The Palmdale Water District is subject to potential negative impacts from a broad range of hazards and threats. There are three broad categories of hazards that threaten the District, namely:

- Natural hazards
- Technological hazards
- Domestic security threats

Natural hazards include:

- Earthquakes
- Floods
- Wildfire
- Extreme Weather (drought/windstorms/sudden heavy rain)
- Water Supply Contamination (Waterborne Diseases)

Technological hazards include:

- Dam Failure
- Hazardous Materials (Hazmat) Incidents

Domestic security threats include:

- Terrorism (CBRNE)
  - Chemical
  - Biological
  - Radiological
  - Nuclear
  - Explosive

Table 4-1 below describes how and why the hazards listed above were identified by the District in preparing its LHMP.

Table 4-1. Palmdale Water District Hazards

Hazard	How and Why Identified
Earthquakes	History of events; presence of fault lines and geologic activity
Flooding	History of events
Dam Failure	History of events; presence of dams
Wildfire	History of events
Extreme Weather (drought, sudden heavy rain, windstorms)	History of events

Hazard	How and Why Identified
Water Supply Contamination (waterborne diseases)	History of events
Hazardous Materials (Hazmat) Incidents	History of events
Terrorism	Heightened sense of awareness since September 2001

Following are details of the identified hazards faced by the Palmdale Water District as identified by the Hazard Mitigation Working Group. The hazards also indicate the risk probability and severity assessment identified by the Hazard Mitigation Working Group as related to the District.

For the rating of "**probability**" of occurrence, for each of the following hazards, the Hazard Mitigation Working Group were asked to provide ratings of the likelihood that an event would occur in the future. The ratings that were used were:

- High Probability (highly likely to occur)
- Medium Probability (likely to occur)
- Low Probability (not very likely to occur)

These were subjective, order-of-magnitude ratings that the participants could relate to whether they were highly skilled in a hazards area or not. This approach facilitated utilizing a consensus approach with the Working Group.

For the rating of "**severity**", the Hazard Mitigation Working Group was asked to provide ratings of the likely severity of an event, assuming one occurred in the future. The ratings that were used were:

- High Severity (extensive loss of life and/or property)
- Medium Severity (moderate loss of life and/or property)
- Low Severity (relatively modest loss of life and/or property)

These were subjective, order-of-magnitude ratings that the participants could relate to whether they were highly skilled in a hazards area or not. This approach facilitated utilizing a consensus approach with the Working Group.

4.1 Hazard: Earthquakes

The earthquake risk probability and risk severity assessment listed below was identified by the Palmdale Water District's Hazard Mitigation Working Group as related to the District. Although the Hazard Mitigation Working Group rated the probability of an earthquake event "Low", they stated that the likelihood that an earthquake in the Planning Area would occur is inevitable.

Probability	Severity
Low	High

Hazard Definition

An earthquake is a sudden, rapid shaking of the ground caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual; at other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates.

The major form of direct damage from most earthquakes is damage to construction. Bridges are particularly vulnerable to collapse and dam failure may generate major downstream flooding. Buildings vary in susceptibility, dependent upon construction and the types of soils on which they are built. Earthquakes destroy power and telephone lines; gas, sewer, or water mains; which, in turn, may set off fires and/or hinder firefighting or rescue efforts. The hazards of earthquakes varies from place to place, dependent upon the regional and local geology. Ground shaking may occur in areas 65 miles or more from the epicenter (the point on the ground surface above the focus). Ground shaking can change the mechanical properties of some fine grained, saturated soils, whereupon they liquefy and act as a fluid (liquefaction).

Where earthquakes have struck before, they will strike again. Earthquakes can strike suddenly, without warning. Earthquakes can occur at any time of the year and at any time of the day or night.

Ground movement during an earthquake is seldom the direct cause of death or injury. Most earthquake-related injuries result from collapsing walls, flying glass, and falling objects as a result of the ground shaking, or people trying to move more than a few feet during the shaking. Much of the damage in earthquakes is predictable and preventable.

With increasing magnitude (i.e., larger earthquakes) ground motions are stronger, last longer, and are felt over larger areas. Earthquake "intensity" refers to the effects of earthquake ground motions on people and buildings. Earthquake intensity is often more useful than magnitude when discussing the damaging effects of earthquakes. The most common intensity scale is the Modified Mercalli Intensity (MMI) scale, which ranges from I to XII.

History

The Palmdale Water District is located in a seismically active region. The dominant seismic feature affecting the District is the San Andreas Fault which traverses the southernmost portion of the Planning Area. The San Andreas Fault is the boundary where the North American plate and the Pacific plate meet. Relative movement of the plates along this boundary causes earthquakes. This fault is considered one of the most dangerous in the State of California in terms of destructive potential.

The San Andreas Fault extends over 600 miles from the Salton Sea, northwest toward the Pacific Ocean at Point Arena. Two of the three largest (8.0+ Richter) earthquakes in the State have occurred along the San Andreas Fault: the 1906 San Francisco earthquake which caused 21-foot offsets and the 1857 Fort Tejon earthquake which left a trace at the surface 225 miles long and caused the surface of the earth to shift along the fault about 30 feet.

The photo below is an aerial view of the San Andreas Fault line from just west of the Palmdale Reservoir to Big Pine.

(c. 1935 - Courtesy of the West Antelope Valley Historical Society)

The San Andreas Fault is actually a large system of faults and to pinpoint its location can prove difficult where motion is expressed along many sub-parallel fault strands. This complexity warrants using the term: San Andreas Fault Zone. Evidence for this line of reasoning is expressed in the following picture of the roadcut.

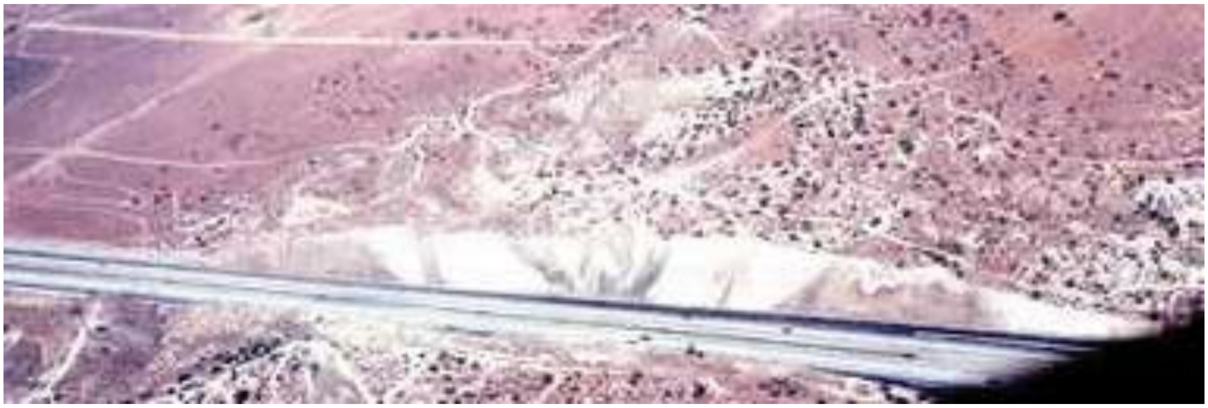


Photo by John Dennis

The roadcut outside Palmdale along Highway 14 in the westernmost Mojave Desert exposes highly folded and faulted lakebed sediments caught up within the San Andreas Fault Zone. The roadcut slices through rocks deformed by the powerful and extensive movement of rocks along the San Andreas Fault. The geology at the roadcut demonstrates that the deformation along a fault can be very complex.

The pictures below show a complex series of folds, but no clearly apparent fault. However, the rocks on the left side of the picture differ greatly from the rocks on the right side of the picture, indicating some sort of geologic boundary. On closer inspection, one finds a multitude of minor faults interspersed within and near the folds. These minor faults more or less have the same orientation, and, if considered to be part of one large fault, comprise the much larger and substantial San Andreas Fault Zone.

Palmdale roadcut looking towards the south.

Aerial photograph of the roadcut.

Several fault traces branch off from the primary fault within the San Andreas Fault Zone. The major fault traces for the San Andreas system in the Palmdale area are the Cemetery Fault, the Nadeau Fault, and the Littlerock Fault. All three faults are active splays of the San Andreas Fault. Thus, movement on the San Andreas Fault may activate one or all of these subsidiary faults. The Nadeau, Cemetery and Littlerock fault traces are located in the City of Palmdale. Other splays of the San Andreas Fault which are found in Palmdale are the Powerline Fault and the eastern end of the Clearwater Fault.

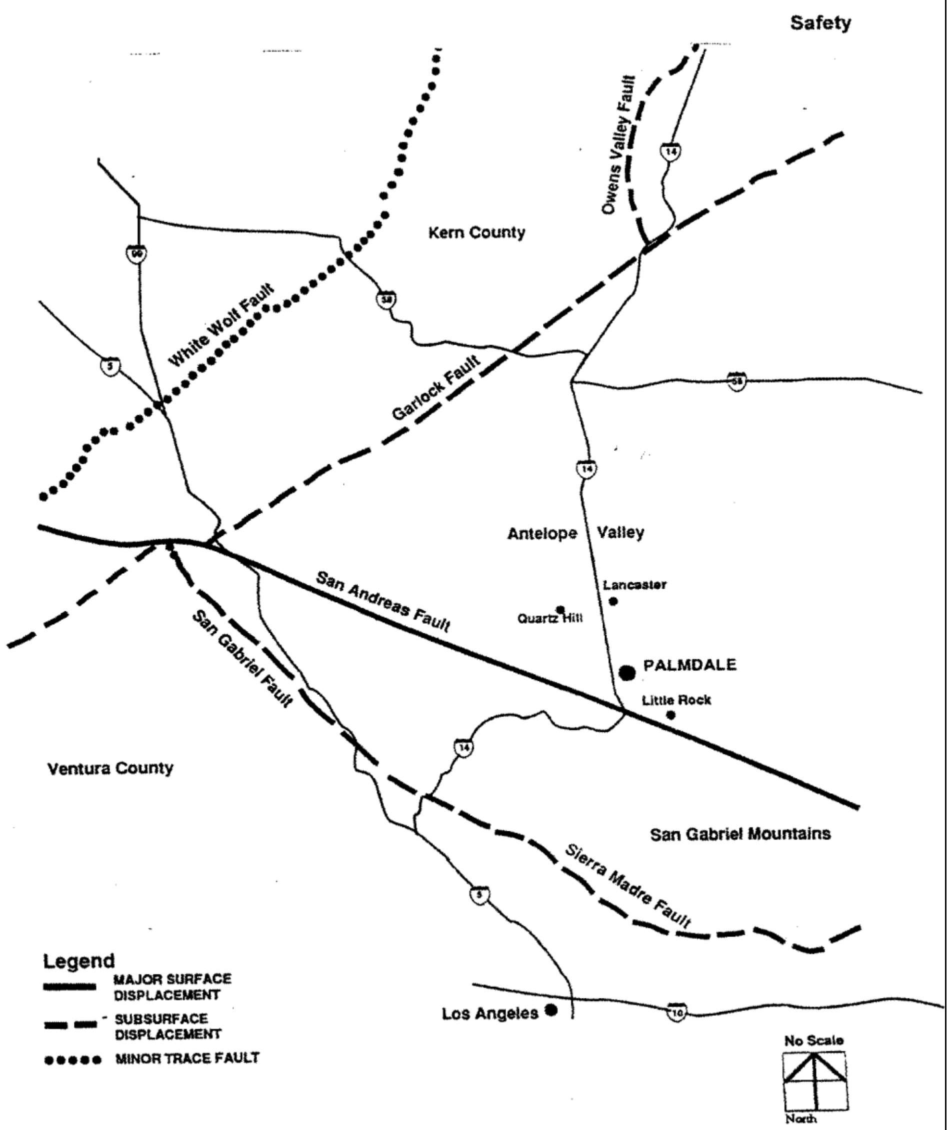
In addition to the San Andreas Fault system, other principal faults that could produce damaging earthquakes in the Palmdale area are the Sierra Madre-San Fernando, Garlock, Owens Valley, and White Wolf faults. The Sierra Madre Fault is located at the base of the San Gabriel Mountains approximately 20 miles from Palmdale; and the Garlock and White Wolf faults are northeast-trending faults located 30 to 60 miles, respectively, northwest of Palmdale. The Owens Valley fault is 60 miles to the northeast and runs north-south. The following Table lists their maximum probable magnitudes. A maximum probable earthquake is the largest event expected to occur within 100 years.

Table 4-2: Fault Magnitudes

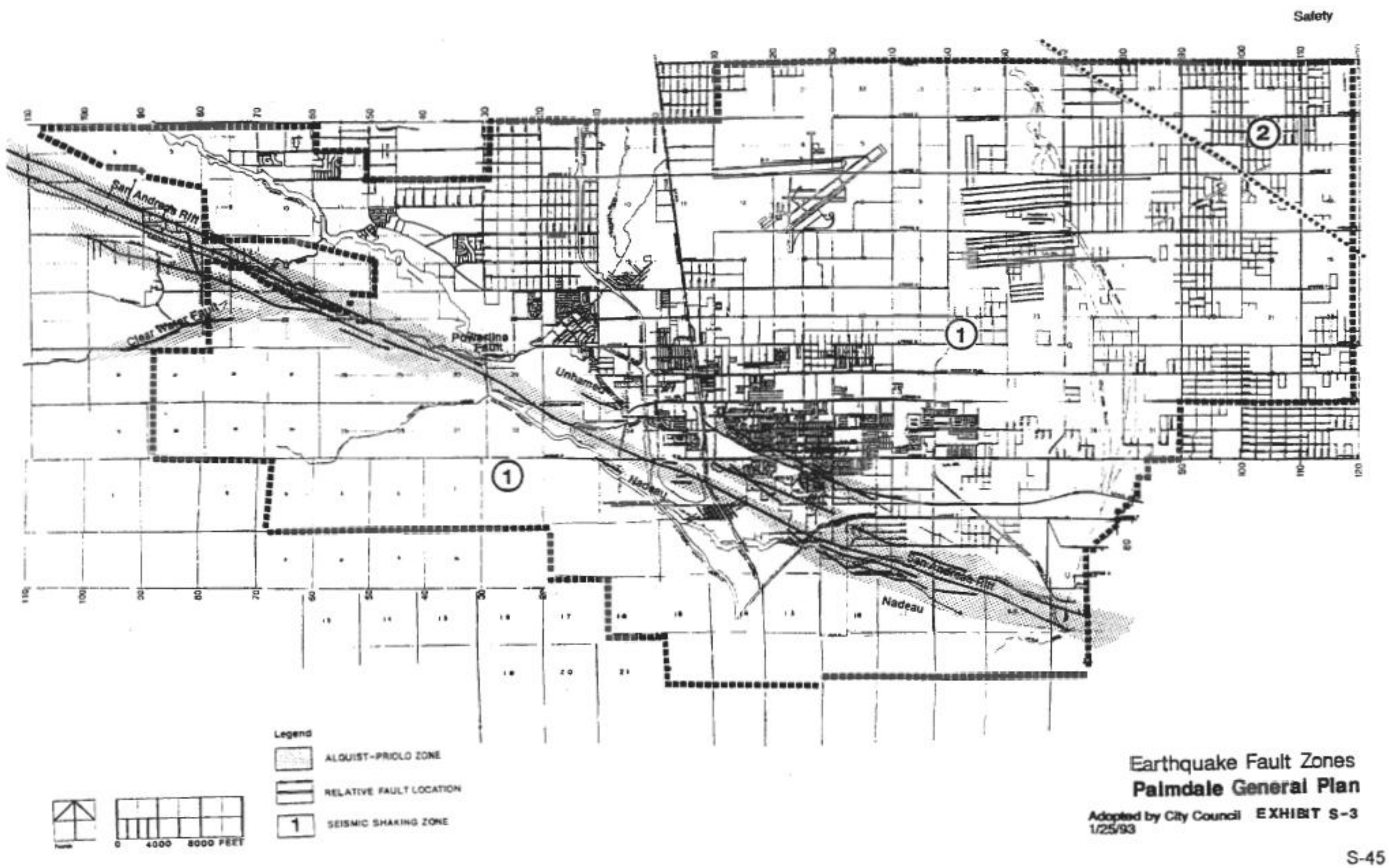
Fault	Maximum Probable Magnitude (Moment*)
San Andreas	8.0+
Sierra Madre – San Fernando	6.6
Garlock	7.5
Owens Valley	7.4
White Wolf	7.2

* The Moment Magnitude is preferred to the Richter Magnitude for earthquakes larger than 6M. As the magnitude surpasses 6.5M (Richter), all events begin to take on the same magnitude values. The Moment Magnitude keeps its integrity and delineates the different values greater than 6.5M. Source: California Department of Mines and Geology.

A number of other faults located in the Southern California region could be responsible for earthquakes that would affect the Palmdale area; although no major damage is expected to occur. The following maps indicate the relative location of the major faults and earthquake fault zones near Palmdale.



Major Faults Near Palmdale


Safety
San Andreas Rift
Clear Water Fault
Powerline Fault
Nadeau
San Andreas Rift
Nadeau
Legend
ALQUIST-PRIOLO ZONE
RELATIVE FAULT LOCATION
SEISMIC SHAKING ZONE
0 4000 8000 FEET
Earthquake Fault Zones
Palmdale General Plan
Adopted by City Council 1/25/93
EXHIBIT S-3
S-45

Scientists have recently discovered that Palmdale is in the center of a 120-mile-long, kidney-shaped area of land that rose as much as ten inches in the early 1960s. The Palmdale “bulge”, as the uplift is called, could be an early warning signal of a major—and potentially disastrous—earthquake.

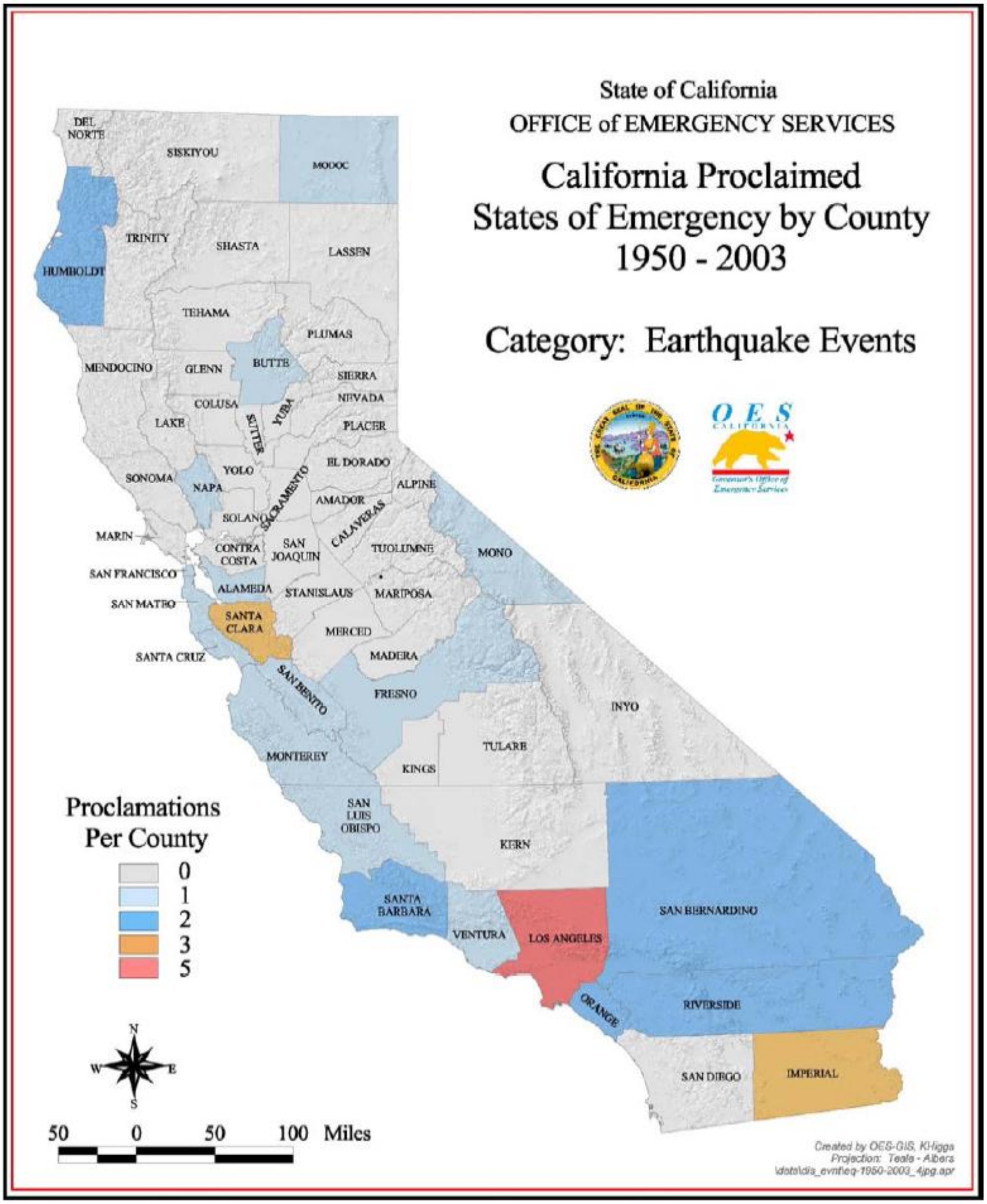
Between November 1976 and November 1977 a swarm of small earthquakes (local magnitude <3) occurred on or near the San Andreas Fault near Palmdale. This swarm was the first observed along this section of the San Andreas since cataloging of instrumental data began in 1932. The activity followed partial subsidence of the 35-centimeter vertical crustal uplift of the Palmdale bulge along this "locked" section of the San Andreas, which last broke in the great 1857 Fort Tejon earthquake. The swarm events exhibit characteristics previously observed for some foreshock sequences, such as tight clustering of hypocenters and time-dependent rotations of stress axes inferred from focal mechanisms. However, because of the present lack of understanding of the processes that precede earthquake faulting, the implications of the swarm for future large earthquakes on the San Andreas Fault are unknown.

Recent studies have shown that the ground rose noticeably before the 1971 San Fernando quake that killed 58 people in California's last major trembler. The location of the Palmdale bulge has added to scientists' concern. The swelling lies along a stretch of the 600-mile San Andreas Fault, a deep fracture that runs from below the Mexican border to about 100 miles north of San Francisco, where it meets the Pacific Ocean. The fault is actually the boundary of two tectonic plates, huge sections of the earth's outer layer that are sliding in opposite directions. A western sliver of California, on the Pacific plate, is moving northwest. The remainder of the State is being carried by the North American plate toward the southeast.

As the two plates grind past each other, friction causes them to stick together briefly at some places. Then, driven by powerful and little-understood forces deep within the earth, they tear apart to resume their journeys, causing minor to moderate tremors. But in the Palmdale region, they have apparently been firmly locked for more than a century, while adjoining parts of the plate have slid as much as 30 feet. Some day, seismologists warn, the stalled sections are going to have to catch up with the main bodies of the plates. Strains are inexorably building up in the crustal rock. When the rock finally fractures, the plates will jolt ahead, causing a major earthquake.

What scientists fear is that the Palmdale bulge could be caused by dilatency, a phenomenon that takes place in rocks before they break under stress. Tiny cracks open in the rock, increasing its volume; this could account for the uplift of land. Dilatency has already been linked to such quake precursors as unexpected variations in velocities of seismic waves through the earth and changes in local magnetic fields as well as in electrical conductivity of rocks; all have been used to make successful forecasts in the emerging science of earthquake prediction.

The following map illustrates California Earthquake Events State of Emergency Proclamations by County between 1950 and 2003. During that period, there were five earthquake State of Emergency Proclamations for Los Angeles County.



The following Table is a list of historical earthquakes with a magnitude of 5.0 or greater occurring in Los Angeles County and felt in the Palmdale area.

Table 4-3. Historical Earthquakes

Location	Date/Time	Richter	Mercalli	Deaths and Property Damage
Northridge	01/17/1994 4:31 a.m.	6.7	---	57 deaths; more than 9,000 injured; estimated $40 billion in property damage. In Palmdale, there was damage to masonry fences, sidewalks, a few chimneys, a few windows, and stucco and plaster walls cracked. A few items were shaken off store shelves; a few people ran outdoors. The Vincent electric power substation was significantly damaged.
Sierra Madre	06/28/1991 7:44 a.m.	5.8	---	2 deaths; $40 million in property damage
Malibu	01/19/1989 10:38 p.m.	5.0	---	No deaths; slight damage
Pasadena	12/03/1988 11:38.p.m.	5.0	---	No deaths; no appreciable damage
Whittier-Narrows	10/01/1987 7:42 a.m.	5.9	---	8 deaths; $358 million in property damage
Malibu	01/01/1979 3:15 p.m.	5.2	---	No deaths; minor damage
San Fernando	02/09/1971 6:01a.m.	6.6	---	65 deaths; $505 million in property damage
San Clemente Island	12/25/1951 4:46 p.m.	5.9	---	No deaths; no appreciable damage
Long Beach	03/10/1933 5:54 p.m.	6.4	IX	120 deaths; $40 million in property damage
Tejon Pass Region	10/23/1916 2:44 p.m.	5.3	---	No information
Fort Tejon	01/09/1857 4:24 p.m.	7.9	IX	2 deaths; heavy property damage and loss. Were the Fort Tejon shock to occur today, the damage would easily run into the billions of dollars and the loss of life would probably be substantial. Some of the present day communities that lie upon or near the 1857 rupture area are Palmdale, Wrightwood, Frazier Park, and Taft.
L.A. Area	07/11/1855 4:15 a.m.	6.0	VIII	Bells of Mission San Gabriel torn down; 26 buildings damaged in L.A.
L.A. Area	09/24/1827 4:00 a.m.	5.5	---	No information
L.A. Area	12/08/1812	7.0	VII	40 deaths, Mission San Juan Capistrano

Location	Date/Time	Richter	Mercalli	Deaths and Property Damage
	3:00 p.m.			severely to moderately damaged. Mission San Gabriel moderately damaged.
L.A. Area	07/28/1769	6.0	VIII	No information

HAZUS Analysis

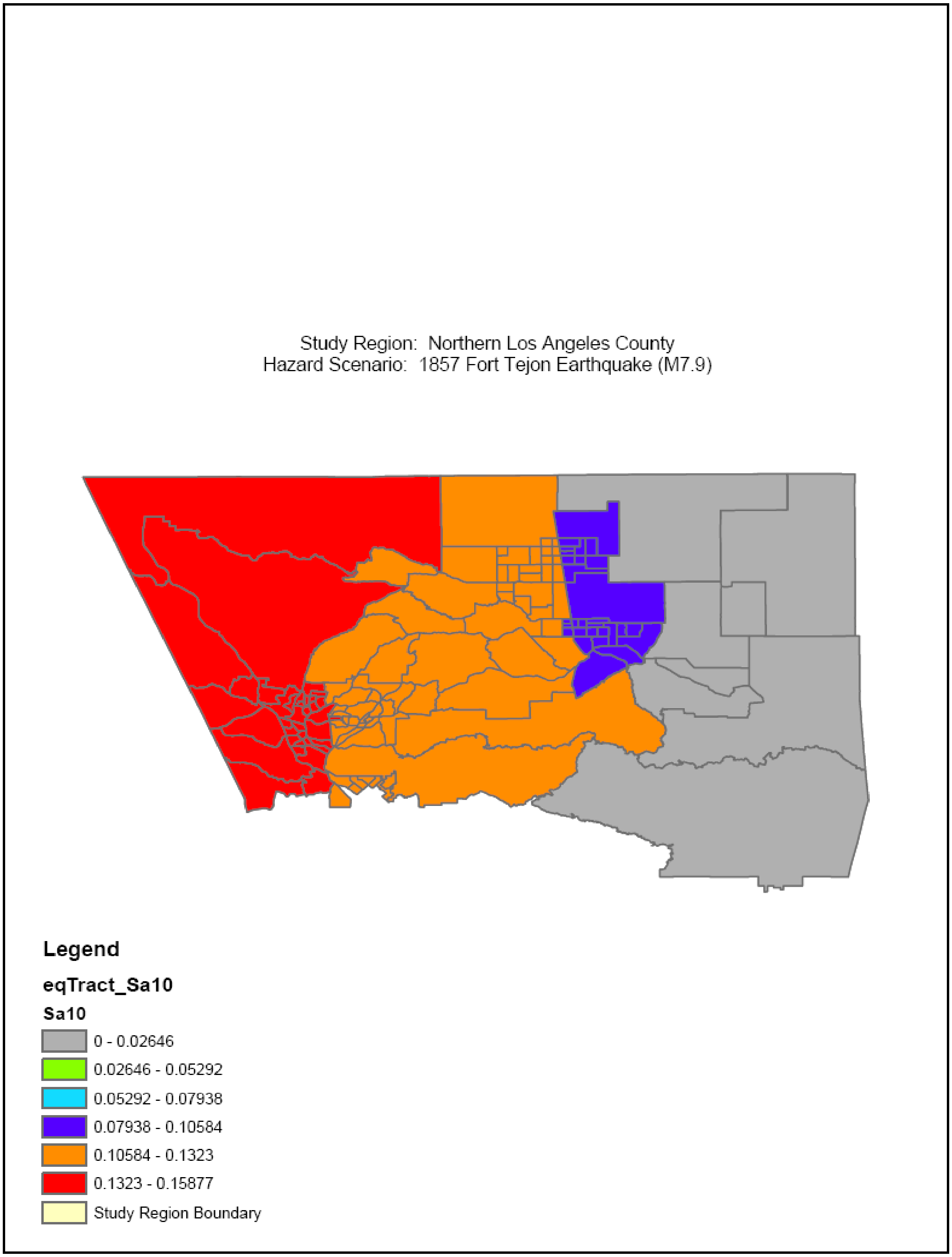
As part of the development of this LHMP, an earthquake scenario was created in HAZUS-MH, the FEMA-approved software program for estimating potential losses from disasters.

For the HAZUS Analysis scenario, a magnitude 7.9 earthquake on the San Andreas Fault with an epicenter at 36.20 Latitude, -120.80 Longitude was simulated replicating the historical 4:24 p.m., January 9, 1857, Fort Tejon earthquake.

The following map indicates the HAZUS analysis earthquake epicenter and the results produced by HAZUS by census tract.

HAZUS Results for Palmdale Water District

The results produced by HAZUS are reported by census tract. The Loss Estimates are stated in $thousands. The summarized results for the Palmdale Water District are presented on the pages immediately following.


Study Region: Northern Los Angeles County
Hazard Scenario: 1857 Fort Tejon Earthquake (M7.9)
Legend
eqTract_Sa10
Sa10
0 - 0.02646
0.02646 - 0.05292
0.05292 - 0.07938
0.07938 - 0.10584
0.10584 - 0.1323
0.1323 - 0.15877
Study Region Boundary

Utility System Dollar Exposure

May 16, 2008 *All values are in thousands of dollars*

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
California							
Los Angeles							
Facilities	196,470	157,176	354	0	389,400	1,416	744,816
Pipelines	219,246	131,548	0	87,698			438,492
Total	**415,716**	**288,724**	**354**	**87,698**	**389,400**	**1,416**	**1,183,308**
Total	**415,716**	**288,724**	**354**	**87,698**	**389,400**	**1,416**	**1,183,308**
Region Total	**415,716**	**288,724**	**354**	**87,698**	**389,400**	**1,416**	**1,183,308**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Study Region : Palmdale Water District View01
Scenario : Fort Tejon 1857 TODAY

Page : 1 of 1

Earthquake Hazard Report

Building Stock Exposure By General Occupancy

May 16, 2008 *All values are in thousands of dollars*

	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
California								
Los Angeles	34,035,860	4,564,420	1,491,440	82,597	336,777	92,423	340,259	40,943,776
Total	**34,035,860**	**4,564,420**	**1,491,440**	**82,597**	**336,777**	**92,423**	**340,259**	**40,943,776**
Region Total	**34,035,860**	**4,564,420**	**1,491,440**	**82,597**	**336,777**	**92,423**	**340,259**	**40,943,776**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Study Region : Palmdale Water District View01 Page : 1 of 1

Scenario : Fort Tejon 1857 TODAY

Earthquake Hazard Report

Transportation System Dollar Exposure

May 16, 2008 — *All values are in thousands of dollars*

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Runway	Total
California									
Los Angeles									
Segments	5,313,402	128,755	0						5,442,157
Bridges	781,533	1,218	0						782,751
Tunnels	9,274	0	0						9,274
Facilities		7,717	0	3,859	0	0	57,879	366,744	69,455
Total	**6,104,210**	**137,690**	**0**	**3,859**	**0**	**0**	**57,879**	**366,744**	**6,670,381**
Total	**6,104,210**	**137,690**	**0**	**3,859**	**0**	**0**	**57,879**	**366,744**	**6,670,381**
Region Total	**6,104,210**	**137,690**	**0**	**3,859**	**0**	**0**	**57,879**	**366,744**	**6,670,381**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Study Region : Palmdale Water District View01
Scenario : Fort Tejon 1857 TODAY

Page : 1 of 1

Earthquake Hazard Report

Casualties Summary Report

May 16, 2008

	Injury Severity Level				
	Severity 1	Severity 2	Severity 3	Severity 4	Total
California					
Los Angeles					
Casualties - 2am					
Industrial	0	0	0	0	0
Single Family	3	0	0	0	3
Commuting	0	0	0	0	0
Commercial	0	0	0	0	0
Hotels	0	0	0	0	0
Other-Residential	2	0	0	0	3
Educational	0	0	0	0	0
Total Casualties - 2am	**5**	**0**	**0**	**0**	**5**
Casualties - 2pm					
Commuting	0	0	0	0	0
Other-Residential	0	0	0	0	1
Commercial	3	0	0	0	3
Single Family	0	0	0	0	0
Educational	1	0	0	0	1
Hotels	0	0	0	0	0
Industrial	1	0	0	0	1
Total Casualties - 2pm	**5**	**0**	**0**	**0**	**6**
Casualties - 5pm					
Industrial	1	0	0	0	1
Hotels	0	0	0	0	0
Educational	0	0	0	0	0
Commuting	0	0	0	0	1
Other-Residential	1	0	0	0	1
Single Family	1	0	0	0	1
Commercial	2	0	0	0	3
Total Casualties - 5pm	**5**	**1**	**0**	**0**	**6**
Region Total	NA	NA	NA	NA	NA

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Study Region : Palmdale Water District View01 Page : 1 of 1
Scenario : Fort Tejon 1857 TODAY

Unreinforced Masonry Buildings

Unreinforced masonry structures perform poorly under almost all earthquake conditions, and especially if located on poor ground areas. Nearby relatively small earthquakes can be very damaging because of the sharp motions they generate. Distant events, while more damaging to taller buildings, can also damage unreinforced masonry buildings because of the stresses caused by long-period motions.

Evidence from past earthquakes shows that wood frame structures properly tied to their foundations perform very well, or if badly damaged cause few injuries and life loss even if located in poor ground areas. Older wood frame structures that have stone, brick, or cripple wall foundations, or that are not bolted to their foundations, do not perform well.

Unreinforced masonry buildings can be hazardous to the public during earthquakes. These buildings could collapse due to the lack of steel reinforcements in the walls, and due to a lack of adequate bracing and other reinforcement in the roof structure.

The Palmdale Water District has no unreinforced masonry facilities or buildings. Following are the results of a 2003 Unreinforced Masonry Building Survey of City and County Mitigation Efforts by the State of California Seismic Safety Commission.

Jurisdiction								**Survey Results (Number of URMs)**							
Inventory Completed	Number Historic URM	Number Non-Historic URM	Mitigation Program Established	Replied to 2003 Survey	Uniform Code for Building Conservation (UCBC) Compliance	Compliance Jurisdiction Program	Partial Compliance/ Under Construction	Retrofit Permit Issued	Plans Submitted	Reduced Occupancy	Demolished	Slated for Demolition	Warning Placards Posted	No Mitigation Progress	Owners Notified
City of Palmdale															
Yes	0	0	N/A												

Risk Assessment

Earthquakes are the principal geologic activity affecting the Palmdale Water District. They are a triggering event which permits the force of gravity to operate and create many secondary hazards from ground shaking, including:

- Floods from dam and reservoir failure, and seiches;
- Various adverse results of disruption of essential facilities and systems (water, drainage systems, electricity, sewer, gas, transportation, communication, etc.)
- Differential ground settlement, soil liquefaction, rockslides, mudslides, ground lurching; and
- Ground displacement along the fault

In the event of an earthquake, the location of the epicenter as well as the time of day and season of the year would have a profound effect on the number of deaths, casualties, property damage, agricultural and environmental damage, and disruption of normal government and community services and activities. The effects could be aggravated by collateral emergencies such as dam failure, flooding, hazardous material spills, utility disruptions, fire, landslides and transportation emergencies.

Aside from groundshaking and ground surface rupture, earthquake hazards include the fissuring or cracking of bedrock, landslides, liquefaction, and ground settlement. Structures most likely to be affected by earthquakes are those that are old or near earthquake faults in areas that may be prone to liquefaction. Dams along earthquake faults may be subject to failure and may cause flooding of the surrounding areas. Critical damage may also occur to reservoirs and underground pipes, structures that provide emergency services (hospitals, fire stations, schools, emergency shelters). Roads and utility lines for water, gas, power, telephone, sewer and storm drainage may be disjointed and services cut off.

The City of Palmdale's General Plan, Safety Element states: "In case of a major earthquake on the San Andreas Fault within or near Palmdale, damage to the following structures is expected:

- ✓ Palmdale and Littlerock reservoirs could sustain surface rupture and cause area flooding.
- ✓ The California Aqueduct may rupture causing flooding of the surrounding area and loss of water supply to the region.
- ✓ Water lines, sewer pipes and telephone lines may be truncated
- ✓ High voltage lines may be damaged causing power failure in the area
- ✓ Damage may be sustained by residential and other structures located close to the fault rupture due to intense groundshaking and slope failure."

- **Effects on people and housing.** In any earthquake, the primary consideration is saving lives. Time and effort must also be dedicated to providing for mental health by reuniting families, providing shelter to displaced persons, and restoring basic needs and services. Major efforts will be required to restore and reestablish public services and utilities, remove debris and clear roadways, demolish unsafe structures, and provide continuing care and temporary housing for affected citizens.

- **Effects on infrastructure**. The damage caused by both surface rupture and groundshaking can lead to the disruption of essential District facilities and systems (dams, water, pipelines, and drainage systems).

Relationship to Other Hazards – Cascading Effects

Earthquakes occurring in the Palmdale area are a triggering event which permits the force of gravity to operate and create many secondary hazards from surface rupture and groundshaking. Surface rupture and groundshaking from earthquakes may result in rupture of the Palmdale and Littlerock Dams, causing flooding. Flood waters could be as deep as 50 feet immediately downstream of the Littlerock Dam. Failure of the Littlerock Dam would also result in the inundation of a 300-foot wide area for 0.25 mile north of the dam. Along this length, the water depth would vary from 50 to 15 feet. Ten minutes after failure, the flood water would veer eastward for 800 feet to Avenue U where the depth would be reduced to 10 feet. Trending north from Avenue U, the water would eventually dissipate so that the depth is no longer a risk to downstream developments.

In addition to dam failure and subsequent flooding, a seismic event could cause a water wave, or seiche to occur at Lake Palmdale, which could potentially overtop the dam. The design report for the dam considers a reflection of the wave on return unlikely. Also, wave volume above the dam would not be substantial (approximately 1 acre-foot), and would not result in damaging floods. Overpour on the downstream side of the dam will not cause any damage by erosion as the existing rockfill was designed to withstand it.

Risk Assessment Conclusion

A major earthquake in Southern California is expected to cause loss of life, injury, and property damage at a scale unprecedented in this nation's history.

The Palmdale area is clearly at high risk for a significant earthquake causing catastrophic damage and strains on response and mitigation resources. Both property and human life are at high risk. Areas within the Los Angeles County currently experiences hundreds of minor quakes and tremblers each month from the myriad of faults in the area.

According to the State of California, Department of Conservation, “a repeat of the Great 1857 Fort Tejon Earthquake today would cause significant loss of life, and damage in the billions of dollars”. Palmdale, Wrightwood, Frazier Park, Taft, and other communities that didn’t exist or had tiny populations in 1857 are on or near the trace of the rupture of the Fort Tejon quake. The U. S. Interstate 5 highway -- the main land route between Northern and Southern California -- runs right by the fort, now a state historic park. While Interstate 5 crosses the San

Andreas Fault only once, branches of the California Aqueduct System carrying water from Northern to Southern California cross it at several junctures.

It is difficult to predict the severity of casualties and property damage that could result from an earthquake. The severity of casualties and property damage depend on the intensity of the earthquake, location of the epicenter to populated areas and the time of day of the occurrence. Since the Palmdale area is subject to frequent seismic events, there are concerns related to ground shaking, soil liquefaction, rockslides and mudslides. The composition of geologic strata (bedrock and soil) determines what can be expected from an area as a result of ground shaking. It is therefore important to know the soil makeup in order to determine the appropriate design of structures proposed for an area.

Existing information about earthquakes that have occurred in the Palmdale area suggests that an equal number of earthquakes of equal intensity may occur within the future. The District can expect property damage from earthquakes at some time in the future because of the past frequency of moderately high magnitude and intensity earthquakes; and the distribution of active faults and epicenters.

Current Plans and Programs

Following are Palmdale Water District's current Plans and Programs

- In the event of an earthquake, District personnel will survey and assess damage and respond accordingly with shutdowns and repairs.
- In the event of power loss, Palmdale Water District has permanent emergency power generation that automatically starts to maintain water treatment operations.
- Completed installation of new seismic valve at one 50th St. tank and replacement of seismic valve at 5 MG tank.
- Completed Water Facilities Capital Improvement Project including construction of pipelines, increase storage capacity, increase well capacity and expansion of the water treatment plant all in compliance with seismic policies and procedures.
- Design is currently underway for the replacement of the Water Main at 11th Street E compliant with seismic policies and procedures.

The Palmdale Water District also supports the City of Palmdale's General Plan Safety Element which includes the following Seismic/Geologic Hazards Program and Goals, Objectives and Policies.

- The City of Palmdale implements the Alquist-Priolo Earthquake Fault Zoning Act by means of the development review process, in which every proposed development within the seismic hazard zone is required to prepare a detailed geotechnical report and fault rupture survey. These studies are then reviewed by the City Geologist and special conditions (i.e., structural setbacks and/or special engineered foundations) are placed on projects as deemed necessary by the City Geologist.

GOAL S1: Minimize danger and damage to public health, safety, and welfare resulting from natural hazards.

Objective S1.1: Review development within or adjacent to geologic hazards, to ensure adequate provisions for public safety.

Policy S1.1.1: Provide copies of geotechnical reports for projects located within the seismic hazard zone, as shown on latest California Department of Conservation Seismic Hazard Zones Map, to the State Division of Mines and Geology.

Policy S1.1.2: Assist developers in obtaining necessary technical and policy information regarding seismic hazards.

Policy S1.1.3: Require geotechnical studies, to be reviewed and approved by the City's geologist, for development proposals in areas where geotechnical hazards may be present, and implement the recommendations of those reports as deemed necessary by the City.

Policy S1.1.4: Require appropriate structural setbacks from active fault rupture traces in accordance with Alquist-Priolo standards and as required by the City, based on geotechnical analysis.

Policy S1.1.5: Require structural setbacks or special foundations for structures within potentially active fault zones as determined by the City, based on geotechnical analysis.

Policy S1.1.6: Require special foundations within inactive fault zones if determined necessary by the City.

Policy S1.1.7: Restrict location of utility lines, whether above or below ground, within an appropriate distance from active fault traces, as determined by geotechnical investigation and approved by the City. Utility lines crossing active fault traces should be specifically designed to withstand the expected movement of the earth in these locations. Utility lines as defined here would include, but not be limited to, electricity, water, natural gas and sewer.

Policy S1.1.8: Require that all structures should meet or exceed state required earthquake resistant design standards.

Policy S1.1.9: Review development proposals located in or immediately adjacent to areas of soil instability, liquefaction areas, and steep slopes to determine if a significant constraint exists and to determine appropriate land use or hazard mitigation methods, and require compliance with any such measures identified.

Policy S1.1.10: Develop and adopt hillside grading standards to minimize the hazards of erosion and slope failure.

GOAL S2: Minimize damage associated with man-made hazards.

Objective S2.1: Minimize damage from catastrophic failure of infrastructure.

Policy S2.1.1: Evaluate potential hazards associated with rupture of the California Aqueduct, to ensure that development in areas threatened with inundation is designed to minimize the threat to life and property.

Policy S2.1.2: Evaluate the potential for inundation from failure of the Lake Palmdale or Littlerock dams when reviewing development proposals within potential inundation areas.

Policy S2.1.3: Evaluate potential hazards associated with detention basin facilities, water main or reservoir rupture and minimize possible threat of inundation to life and property through design measures applied during the development review process.

Policy S2.1.4: Require that development in areas near high-pressure natural gas lines be buffered from them and provided with alternative access/evacuation routes.

GOAL S4: Protect public safety through the implementation and enforcement of City Ordinances and through public education.

Objective S4.2: Support the development and continued updating of public education programs on health and safety.

Policy S4.2.1: Prepare and disseminate educational information to residents and businesses on preparing for response to hazards of the area, including major earthquake, floods, hazardous waste spills, wildfire, etc.

Policy S4.2.2: Encourage and assist the school districts in teaching children to respond appropriately in an emergency, especially to situations unique to a desert environment. Such training should be repeated regularly to ensure that each child knows what to do in case of heat stroke, snake bites, floods, earthquakes, etc.

Policy S4.2.3: Promote the use of emergency water supplies or water filtration systems at point-of-delivery for acceptable water quality in emergency situations.

4.2 Hazard: Flooding

The flooding risk probability and risk severity assessment listed below was identified by the Palmdale Water District's Hazard Mitigation Working Group as related to the District.

Probability	Severity
Low	High

Hazard Definition

A flood is defined as an overflowing of water onto an area of land that is normally dry. Floods generally occur from natural causes, usually weather-related, often in conjunction with a wet or rainy spring or with sudden and very heavy rainfalls. Floods can, however, result from human causes as a dam impoundment bursting. Dam break floods are usually associated with intense rainfall, prolonged flood conditions, or earthquakes.

Dam failure may also be caused by faulty design, construction, and operational inadequacies. The cause can also be due to a flood event or earthquake larger than the dam was designed to accommodate. The degree and extent of damage depends on the size of the dam and circumstances of failure. A small dam retaining water in a stock pond may break resulting in little more damage that the loss of the structure itself. An even larger dam failure might bring about considerable loss of property, utilities, roads, and loss of life. Other consequences can include loss of income, disruption of services, and environmental devastation.

Floods are generally classed as either slow-rise or flash floods. Slow-rise floods may be preceded by a warning time lasting from hours to days, or possibly weeks. Evacuation and sandbagging for a slow rise flood may lessen flood-related damage. Conversely, flash floods are the most difficult for which to prepare due to the extremely short warning time, if there is any at all. Flash flood warnings usually require immediate evacuation. On some occasions in the desert areas, adequate warning may be impossible.

History

Rainfall in the Palmdale Water District planning area is relatively sparse due to its location on the leeward side of the Sierra Pelona and San Gabriel Mountains. Only a small section on the southwest side features south-facing slopes of the Sierra Pelona Mountains. The average annual rainfall is 5.15 inches in Palmdale and approximately 20 inches in the mountains.

Much of the Palmdale Water District Planning Area is susceptible to flooding because of its relatively flat topography. Flooding is primarily caused by runoff from the San Gabriel and Sierra Pelona mountains.

Sheetwash occurs along major drainages and adjoining areas on scattered sites. Areas with flood hazards are the natural drainage channels of Amargosa Creek (collects runoff from the Sierra Pelona Mountains and San Andreas Rift Zone at the southwest end of the Antelope Valley), Anaverde Creek (collects runoff from the Sierra Pelona Mountains and flows northeasterly through Anaverde Valley), Little Rock Wash, and Big Rock Wash. Flat plains and natural depressions are also subject to possible flooding. Heavy rainfall and summer thunderstorms increase the potential for flash floods.

Following short-term, low intensity rainfall, deep deposits of permeable sands absorb nearly all runoff by percolation as it flows out of the San Gabriel Mountains. However, following major storms, the sands become saturated and runoff from the mountains flows northward across the valley, sometimes overflowing natural drainage channels. Flash flooding or extended periods of rain can cause drainage channels such as Amargosa Creek and Little Rock Wash to overflow. Runoff also occurs over paved surfaces within the City of Palmdale and flows toward low-lying areas to the north. Currently, the City of Palmdale is installing storm drain facilities to alleviate problems in some areas.

Major floods in the Palmdale Water District Planning Area generally coincide with winter storms that occur between November and April. The highest frequency and greatest intensity of winter flooding normally occurs between December and March. Infrequent thunderstorms during the summer and fall may also produce major flash floods.

Urban development reduces the total ground absorption area by creating impermeable surfaces (structures, pavement, and streets). Storm runoff, increased by the presence of impermeable surfaces, flows from developed areas, contributing to street flooding. Moreover, developed areas generate irrigation water runoff from landscaping which may channel nuisance water flow into nearby undeveloped areas and street gutters. The amount and frequency of rain is variable, and although flood waters may be diverted, the lack of a completed regional drainage system will continue to result in local flooding problems.

Earthquake faults create vertical barriers to groundwater which may result in shallow groundwater conditions. They may also limit the amount of water which can percolate into the subsurface, thus increasing the amount, velocity, and erosive capacity of stormwater runoff on hillsides.

Extent of Flood Depth and Damage Potential

Surface rupture and groundshaking from earthquakes may result in the rupture of the Palmdale and Littlerock Dams, causing flooding. Flood waters could be as deep as 50 feet immediately downstream of the Littlerock Dam. Failure of the Littlerock Dam would result in the inundation of a 300-foot wide area for 0.25 mile north of the dam. Along this length, the water depth would vary from 50 to 15 feet. Ten minutes after failure, the flood water would veer eastward for 800 feet to Avenue U where the depth would be reduced to 10 feet. Trending north from Avenue U, the water would eventually dissipate so that the depth is no longer a risk to downstream developments.

In addition to dam failure and subsequent flooding, a seismic event could cause a water wave, or seiche to occur at Lake Palmdale, which could potentially overtop the dam. The design report for the dam considers a reflection of the wave on return unlikely. Also, wave volume above the dam would not be substantial (approximately 1 acre-foot), and would not result in damaging floods. Overpour on the downstream side of the dam will not cause any damage by erosion as the existing rockfill was designed to withstand it.

Flooding could occur either in floodplains or floodways. Floodplains are generally located adjacent to rivers and other bodies of water and in low lying areas near a water source. The external boundary of floodplains is defined by the predicted extent of inundation that would result from the most intense storm that occurs once every 100 years. Floodways are defined by discernible drainage channels. Floodways are more hazardous due to the anticipated velocities of the flood waters and expected damage to life and property.

Sheetwash occurs along major drainages and adjoining areas on scattered sites. Areas with flood hazards are the natural drainage channels of Amargosa Creek, Anaverde Creek, Little Rock Wash, and Big Rock Wash. Flat plains and natural depressions are also subject to possible flooding.

The following Table depicts the most recent flooding events in the Palmdale Water District Planning Area.

Table 4-4. Historical Flood Events

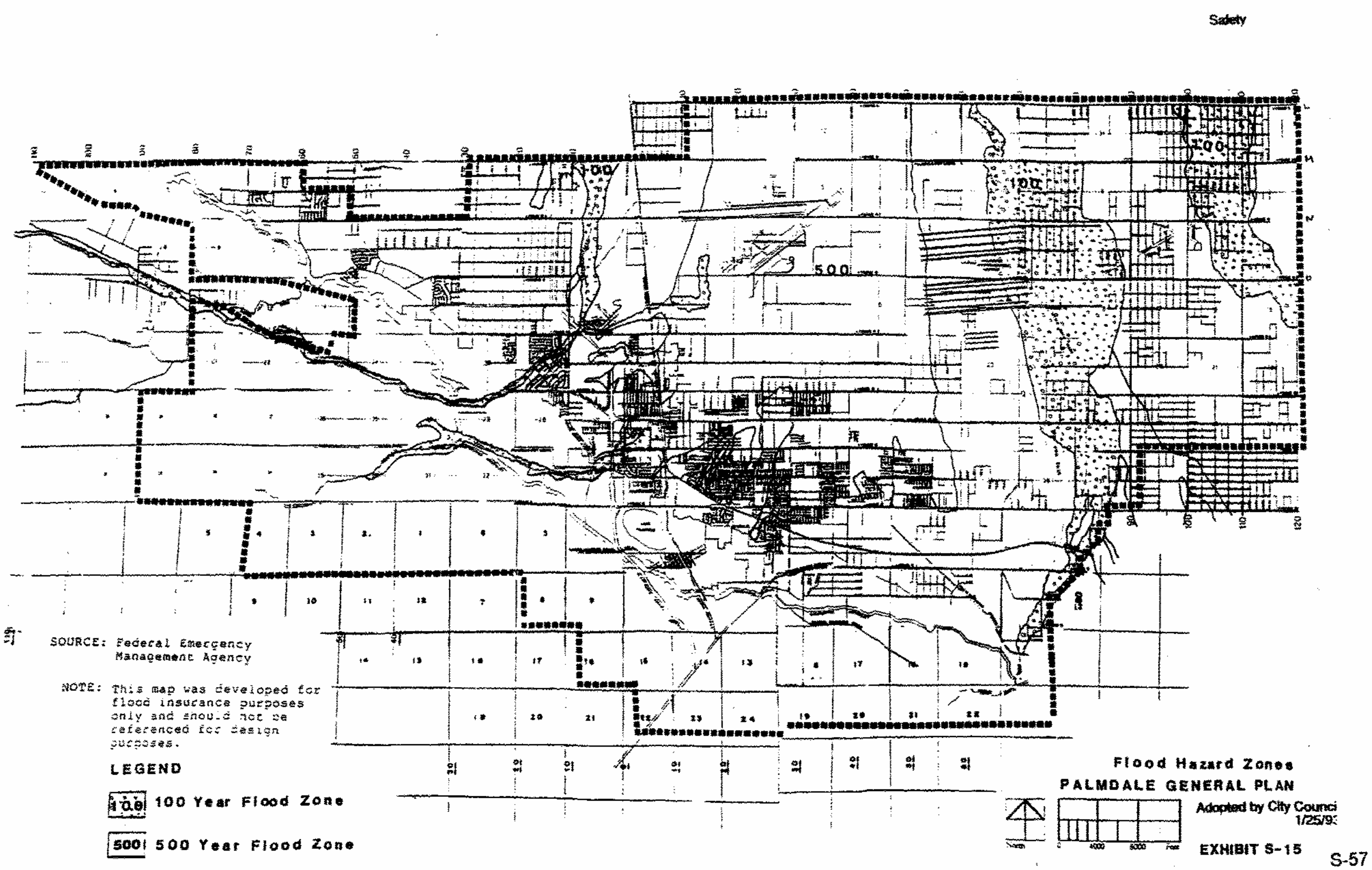
Location	Date	Type	Reported Property Damage
Palmdale	09/01/2007–09/02/2007	Flash Flood	Strong monsoonal thunderstorms produced heavy rain and flash flooding in the community of Palmdale. A trained spotter reported flash flooding near the intersection of Palmdale Boulevard and Avenue J. From September 1st through the 2nd, monsoonal moisture continued to produce strong thunderstorms across the mountains and deserts. The strongest storms were located at the foothills southwest of Palmdale along Highway 14 and just west of Highway 2 near the upper Big Tujunga Canyon. Some thunderstorms reached severe levels, producing wind damage including a weak tornado. Also, several reports of flash flooding were received.

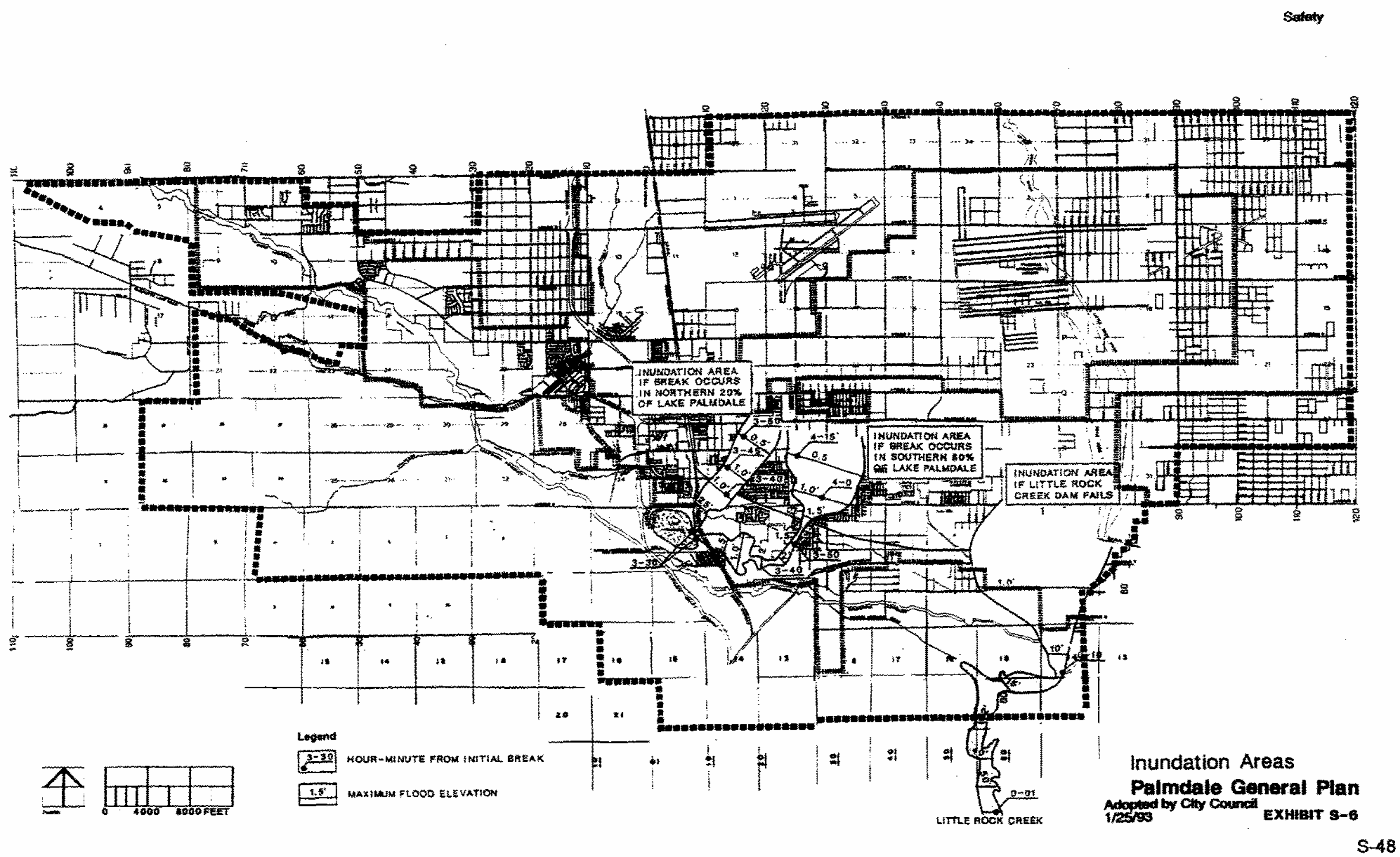
Location	Date	Type	Reported Property Damage
Palmdale	08/31/2007	Flash Flood	Strong monsoonal thunderstorms produced flash flooding across the Antelope Valley. A trained spotter in the Palmdale area reported flash flooding from the intersection of 180th St and Palmdale Boulevard to the San Bernardino County line. From August 29th through the end of the month, abundant monsoonal moisture produced strong thunderstorms across the mountains and deserts of Southern California.
Los Angeles County	07/20/2006	Flash Flood	National Weather Service in Oxnard issued a Flash Flood Warning for North Central Los Angeles County in Southwest California. This included the Antelope Valley cities of Palmdale and Lancaster. At 4:48 p.m. local law enforcement officials reported flash flooding between Highway 138 and Avenue K to the Kern County line.
Palmdale	07/24/2005	Flash Flood	Powerful monsoonal thunderstorms produced heavy rain and flash flooding in the Antelope Valley. In the city of Palmdale, a weather spotter reported flash flooding along Highway 14 at the intersection with Avenue D. The intersection was flooded with over two feet of water.
Los Angeles Countywide	01/09/2005–01/10/2005	Flash Flood	Fatalities: 1. A powerful Pacific storm brought heavy rain, snow, flash flooding, high winds and landslides to Central and Southern California. During the five day event, rainfall totals ranged from three to ten inches over coastal areas with up to 32 inches in the mountains. With such copious rainfall, flash flooding was a serious problem across Santa Barbara, Ventura and Los Angeles counties. Across Los Angeles County, flash flooding killed a homeless man in Elysian Park, flooded a mobile home park in Santa Clarita, closed Highway 1, and caused numerous problems in Palmdale. In the mountains, 4 to 12 feet of snowfall was recorded along with southeast winds between 30 and 50 MPH with higher gusts.
Palmdale	01/04/2005-01/05/2005	Flash Flood	Los Angeles, Ventura, Santa Barbara and San Luis Obispo Counties: No major damage, deaths or injuries were reported. Some trees and power lines were downed and a semi-truck was blown over near Palmdale.
Palmdale	08/20/2003	Flash Flood	Powerful monsoonal thunderstorms brought heavy rain and flash flooding to the Antelope Valley. California Highway Patrol reported flash flooding at several intersections in the community of Palmdale.
Palmdale	07/29/2003	Flash Flood, Severe Thunderstorm, Hurricane Force Winds	Severe thunderstorm formed in the eastern Antelope Valley that eventually produced hurricane force winds which downed trees and power lines in the cities of Palmdale and Lancaster.
Palmdale	07/13/1999	Flash Flood	Strong thunderstorms produced heavy rain, strong winds and dangerous lightning across the Antelope Valley and the mountains of Santa Barbara, Ventura and Los Angeles Counties. In Palmdale, lightning struck a steam-roller

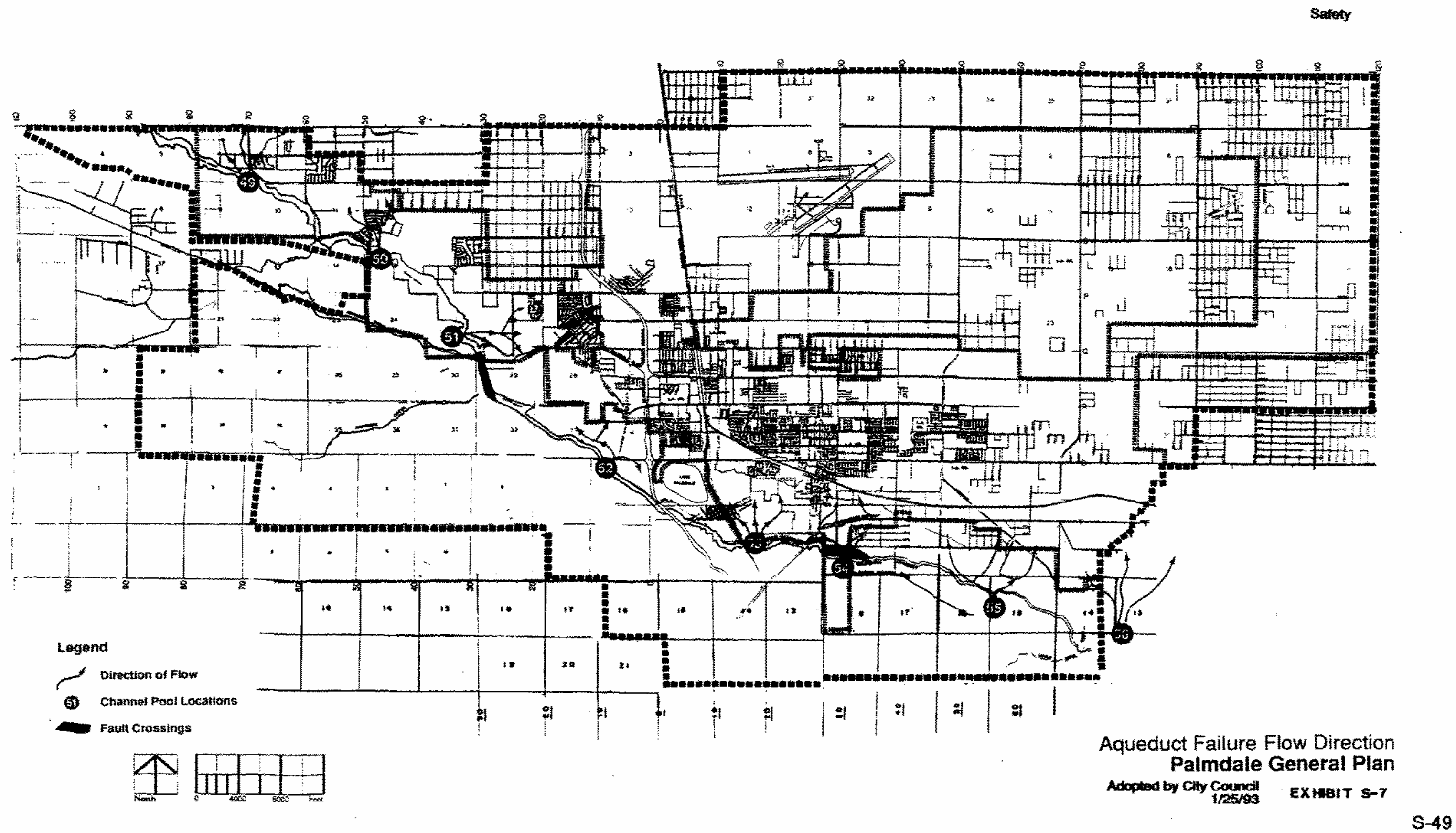
Location	Date	Type	Reported Property Damage
			operator while strong thunderstorm winds snapped small trees. Heavy rain resulted in many reports of flash flooding across the area. In the Antelope Valley, flash flooding was reported in both Palmdale and Lancaster.
Palmdale	07/12/1999	Flash Flood	Strong thunderstorms produced heavy rain and flash flooding in the Antelope Valley. California Highway Patrol reported flash flooding on Highway 138, near 165th Street East.
Palmdale	07/11/1999	Flash Flood	Strong thunderstorms produced heavy rain and flash flooding in the community of Palmdale. A spotter reported flash flooding near the intersection of 5th Street East and Avenue R4 as well as along Highway 14.
Antelope Valley	02/05/1998–02/06/1998	Flood/High Wind 61 knots	Strong winds, gusting up to 70 mph, knocked down many trees and power lines. Rainfall totals ranged from one to three inches over coastal areas, up to six inches in the mountains. Numerous flooding problems were reported across the area. Most highways, including the 1, 101, 126 and 154 were closed due to flooding or mudslides.
Antelope Valley	02/02/1998 - 02/03/1998	Flood/High Wind 78 knots	Powerful winds buffeted the entire area. Winds gusting in excess of 70 mph were reported. Hundreds of trees and power lines were blown down, resulting in numerous power outages. On average, rainfall totals ranged from two to eight inches over coastal areas, up to 12 inches in the mountains. Widespread flooding was reported in all areas. Flooding and mudslides closed parts of most major roadways across the area.
Palmdale/ Antelope Valley	02/23/1998-02/24/1998	Flood	Rainfall totals ranged from one to four inches over the coast with up to 14 inches in the mountains. Widespread urban and small stream flooding was reported. Most major highways reported closures due to flooding or mudslides. In Palmdale, up to three feet of water was reported at some intersections.
Palmdale	08/11/1998	Flash Flood	Heavy rain, from strong thunderstorms, produced flash flooding in the city of Palmdale. A spotter reported over two inches of rain in less than one hour. Severe street flooding was reported with water overflowing the street curbs.
Antelope Valley	08/31/1998	Urban/Small Stream Flooding	Strong thunderstorms produced heavy rain and street flooding across the Antelope Valley. Several spotters in the city of Lancaster reported widespread street flooding.
Palmdale	02/27/1991–03/01/1991	Flooding	In the first storm, which dumped nearly four inches of rain on the Quartz Hill area between Feb. 27 and March 1, the County report said five flood-control basins serving tracts in Palmdale failed, including one at Kaufman & Broad's California Chateau project that apparently flooded the others, causing them to fail too.

Source: NOAA National Climatic Data Center

The following maps from the City of Palmdale General Plan, Safety Element, indicate the Flood Hazard Zones, Inundation Areas, and Aqueduct Failure Flow Direction for the Planning Area.


Safety
100
500
SOURCE: Federal Emergency Management Agency
NOTE: This map was developed for flood insurance purposes only and should not be referenced for design purposes.
LEGEND
100 100 Year Flood Zone
500 500 Year Flood Zone
Flood Hazard Zones
PALMDALE GENERAL PLAN
Adopted by City Counci 1/25/93
EXHIBIT S-15
S-57


Safety
INUNDATION AREA IF BREAK OCCURS IN NORTHERN 20% OF LAKE PALMDALE
INUNDATION AREA IF BREAK OCCURS IN SOUTHERN 80% OF LAKE PALMDALE
INUNDATION AREA IF LITTLE ROCK CREEK DAM FAILS
Legend
3-30 HOUR-MINUTE FROM INITIAL BREAK
1.5' MAXIMUM FLOOD ELEVATION
0 4000 8000 FEET
LITTLE ROCK CREEK
Inundation Areas
Palmdale General Plan
Adopted by City Council 1/25/93
EXHIBIT S-6
S-48


Safety
Legend
Direction of Flow
Channel Pool Locations
Fault Crossings
Aqueduct Failure Flow Direction
Palmdale General Plan
Adopted by City Council 1/25/93
EXHIBIT S-7
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Watershed

The Palmdale Water District system consists mainly of man made waterways. Littlerock Reservoir and Lake Palmdale are the most prominent water supply and storage reservoirs in the watershed. Water is conveyed to Lake Palmdale from Littlerock Reservoir via the Palmdale Ditch and from the State Water Project via the California Aqueduct.

The Palmdale Water District uses Littlerock Creek as its local surface water supply source. The watershed is defined by the area tributary to Littlerock Reservoir, Palmdale Ditch, and Lake Palmdale. The watershed is located in North Los Angeles County on the northeastern foothills of the San Gabriel Mountains and the western edge of the Mojave Desert. It also lies between the seismically active San Andreas and Garlock Fault Zones. Running roughly from southeast to northwest in direction, its overall length is 20 miles and width varies from 2.5 miles to about 6.0 miles. The watershed is predominately non-urban, with more than 90 percent lying within the Angeles National Forest or unincorporated portions of Los Angeles County.

The upper reaches of Littlerock Creek begin at elevations around 8,000 feet in the San Gabriel Mountains. Littlerock Reservoir is at an elevation of 3,200 feet. From Littlerock Reservoir, Palmdale Ditch flows generally northwest for approximately eight miles to Lake Palmdale at an elevation of slightly more than 2,800 feet.

The area tributary to Littlerock Dam and Reservoir occupies 64 square miles, while the Palmdale Ditch, Lake Palmdale sub-basin occupy the remaining 24 square miles. The water area of Littlerock Reservoir and Lake Palmdale combined occupies only about 0.5 square miles.

Littlerock Dam and Reservoir is located on Littlerock Creek below the confluence of Santiago Canyon in the Angeles National Forest. The District operates the Littlerock Reservoir as a local surface water impoundment, and water is conveyed from the reservoir to Palmdale Lake. Inflow into the Reservoir is seasonal and varies widely depending on stream flows and snowmelt within the watershed. The Reservoir was constructed in 1924 with an initial design capacity of 4,300 acre-feet. By 1991, the capacity of the Reservoir had been reduced by siltation to approximately 1,600 acre-feet. As a result of the 1992 Littlerock Dam and Reservoir Restoration Project, the height of the Dam was raised to increase the reservoir capacity by approximately 1,723 acre-feet with a surface area of nearly 100 acres.

Littlerock Dam and Reservoir

Lake Palmdale is a raw water reservoir that supplies the adjacent Palmdale Water Treatment Plant. The lake also supports boating, fishing, and hunting; fire fighting aircraft tankers are allowed to draw water from the lake but it is designated as a ‘no body contact’ water body. Palmdale Lake surface area is 234 acres, maximum depth is 25 ft, average depth is about 18 feet, and the volume is 4200 acre-feet. The lake regularly experiences high winds.

Palmdale Ditch is used to transfer water from Littlerock Reservoir to Lake Palmdale. During periods when water is being transferred it flows by gravity through the eight mile long ditch from Littlerock Dam valve house via two velocity breaking cone valves into the south east end of Lake Palmdale.

Approximately 5,200 lineal feet of the open Palmdale Ditch will be replaced with a 48-inch diameter reinforced concrete pipe. The pipe will be placed within the bed of the existing ditch and will then be covered with fill dirt. Necessary access ports will be placed at strategic locations for pipeline maintenance. At the east end, the pipeline will connect to the Palmdale Ditch just west of Sierra Highway, and the pipe will terminate at Lake Palmdale at the western end.

Palmdale Ditch and Bar Screen

Each Season prior to running water through the ditch the entire ditch is walked and cleared of all debris. When the water flow is started, a crew walks the ditch again clearing debris from the bar screens as the flow reaches the individual screens. After the flow has begun, the ditch is checked twice daily on weekdays and weekends (morning and afternoon) by District personnel.

Floodplain Management

Historically, flooding has been the most common natural disaster in the U.S., costing more in property damages than any other natural disaster. The U.S Congress established the National Flood Insurance Program (NFIP) with the passage of the National Flood Insurance Act of 1968. The NFIP is a federal program enabling property owners in participating communities to purchase insurance as protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages.

Floodplain management is the operation of a community program of corrective and preventative measures for reducing flood damage. These measures take a variety of forms and generally include requirements for zoning, subdivision or building, and special-purpose floodplain ordinances.

A community's agreement to adopt and enforce floodplain management ordinances, particularly with respect to new construction, is an important element in making flood insurance available to home and business owners. Currently over 20,100 communities voluntarily adopt and enforce local floodplain management ordinances that provide flood loss reduction building standards for new and existing development.

The following table indicates that the City of Palmdale is currently participating in the FEMA NFIP. Also included is the date the Flood Hazard Boundary Map (FHBM) and Flood Insurance Rate Map (FIRM) for the community was identified. Compliance and ongoing participation in the NFIP ensures that the residents and businesses of the City can purchase flood insurance.

Community ID Number	Community Name	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Regular Phase Participation Date
060144#	City of Palmdale	10/18/1974	01/06/1982	03/30/1998	01/06/1982

Source: FEMA Community Status Book Report

Repetitive Loss Properties

According to the 2008 FEMA NFIP Statistics, the City of Palmdale has claimed a total of 17 losses totaling $275,660.80 since 1978. There are currently 142,488 written premiums in force and 174 policies in force, totaling $39,814,600.

The Palmdale Water District has not experienced any property damage due to flooding and has no repetitive loss properties.

The Palmdale Water District does not have direct regulatory or enforcement authority over its watershed. They rely on the regulatory powers of other agencies and through them are active in promoting watershed protection by means of a variety of different venues including: education, regulatory review, and participation in Best Management Practice (BMP) implementation. The District has taken an active role in protecting its sources of water supply from contamination, and in preparing to deal with accidents should they occur.

Risk Assessment

Flooding is a natural hazard present in Palmdale due to the geography, geology and climate. Floods that affect the Palmdale Water District can be attributed to three different types of storm events, namely:

- A general winter storm that combines high-intensity rainfall
- A tropical storm out of the southern Pacific Ocean
- A summer thunderstorm, particularly in the desert areas

There are two principal types of flood hazards that may affect the Palmdale Water District, namely:

- Stream flooding (including bridge scour and stream erosion)
- Flash flooding (including debris and mud flows)

Storms with high volumes of precipitation in a short period of time have occurred in Palmdale causing flash floods. In addition, land that has been stripped of foliage and trees due to fire or human activity has experienced serious erosion. Excessive precipitation can inundate soil in slopes causing mudslides and landslides. The City of Palmdale area is vulnerable to this type of flood damage. Heavy storms also can strand individuals playing near or crossing streams, rivers, flood control channels and intersections.

Areas subject to flooding are located throughout the Palmdale Water District Planning Area. Areas subject to flooding drain either naturally into flood controls or rivers, washes, and creeks. Most can handle normal flows. In the desert areas, flooding can be rapid and quite severe during the period of July and August. Winter rains are generally more widespread in the desert, but flashflood potential is less due to steady-state rain fall. Winter rains are nonetheless flood-prone, but may be slightly more predictable. There is a danger to motorists who may attempt to drive through flooded washes. Most flooding in the areas other than the desert is predictable and will provide time for evacuation and mitigation measures such as sandbags.

- **Effects on people and housing.** Direct impacts of flooding can include injuries and loss of life, damage to property and health hazards from ruptured sewage lines and damaged septic systems. Secondary impacts include the cost and commitment of resources for flood fighting services, clean-up operations, and the repair or replacement of damaged structures.

- **Effects on commercial and industrial structures.** Depending on the geographic area involved and the economic and demographic characteristics of the area, the effects on industry and commerce may be significant.

- **Effects on infrastructure.** A slow-rising flood situation will progress through a series of stages, beginning with minor rainfall and evolving to a major event such as substantial flooding. Flooding can cause power outages and damage to the District's dams, pipelines, water systems and drainage systems.

Relationship to Other Hazards – Cascading Effects

Although the Palmdale Water District is located in an area with very low precipitation, it is sometimes subject to heavy rains and subsequent flooding. Flooding could also result from damage to the Littlerock Dam and Reservoir and the California Aqueduct. Power outages and fires can break out as a result of dysfunctional electrical equipment. In many instances during a flood, the drinking water supply will be contaminated due to water purification systems not functioning fully.

Risk Assessment Conclusion

Flooding is a natural hazard to the Palmdale Water District due to the geography, geology and climate. There are various facets to flooding; all of which are relevant to the District. Flood hazards include: natural floodplains, seiches, and dam failure. Flooding due to heavy precipitation or dam failure is a potential hazard for the District with the resultant possibilities for damage to property. Severe flooding can be particularly costly.

In a relative sense, flooding due to precipitation does not present the degree of danger posed by other hazards such as major earthquakes. On the other hand, if there is flooding due to dam failure, the danger could be cataclysmic. Flooding, due to dam failure, is a factor which could seriously affect the District, however, inundation of communities is considered unlikely and hazard analysis suggest that dam failure would likely occur only if heavy precipitation was coupled with significant seismic activity near the dam.

In the event of a large magnitude local earthquake on the San Andreas Fault, some portions of the California Aqueduct are likely to fail. The east branch of the aqueduct is highly vulnerable to widespread damage from groundshaking hazards because it closely parallels the San Andreas Fault for over 100 kilometers. Moreover, the east branch crosses the fault at several locations near Palmdale (Leona Siphon and Barrel Springs) which are susceptible to surface rupture hazards. The California Department of Water Resources has installed flood control gates to mitigate any structural failure. By closing the gates upstream, the section of the Aqueduct in the Planning Area will be isolated and will not receive water. Aqueduct water present during failure will be diverted to eight pools with varying storage capacities and location, which serve as detention basins. The extent and rate of inundation is speculative since the amount of water in the Aqueduct varies between seasons and years. Various factors which affect the size and extent of flooding include structural failure of the Aqueduct and pools while the Aqueduct is operating at full capacity, adjacent pools outside the Planning Area draining, and emergency power failure which could result in the Aqueduct gates not closing fast enough.

Palmdale Water District Current Plans and Programs

- In the event of power loss, Palmdale Water District has permanent emergency power generation that automatically starts to maintain water treatment operations.
- Water Main Replacement Project. This replacement main project is in 11th Street East between Avenues Q and R, in Avenue R-12 between 47th and 55th Streets East, and in Avenue R-11 between 55th Street East and Park Forest.

The Palmdale Water District also supports the City of Palmdale's General Plan Safety Element which includes the following Flood Hazards Goals, Objectives and Policies.

GOAL S1: Minimize danger and damage to public health, safety, and welfare resulting from natural hazards.

Objective S1.2: Minimize hazards associated with flood plains in the area.

Policy S1.2.1: Require that new development shall not be exposed to flood hazards or contribute to an existing flood hazard, in accordance with the City's Floodplain Management Ordinance and related criteria within the City's Engineering Design Standards.

Policy S1.2.2: Require that building foundations be a minimum of one (1) foot above the 100-year flood elevation, unless alternative diversion methods are approved by the City Engineer.

Policy S1.2.3: Require that grading of floodways shall be in a manner which allows for groundwater recharge and protection of projects from flooding.

Policy S1.2.4: All required primary and secondary access and egress routes for all new development should be "dry" access located outside of the 100-year flood plain.

Policy S1.2.5: Consider the operability of natural gas, electric, water and sewer services during the occurrence of flooding in review of project design.

Policy S1.2.6: Require that grading and other methods of water diversion be used to retard water runoff, where appropriate.

Policy S1.2.7: Ensure that storm water drainage is designed for peak flow conditions.

Policy S1.2.8: Ensure that new development complies with floodplain zoning and watershed management regulations.

Policy S1.2.9: Preserve and restore the natural and beneficial values served by floodplains to the extent feasible, consistent with public health, safety and welfare.

Policy S1.2.10: Promote open space and recreational uses in designated flood zones, unless mitigation of the hazard can allow other types of development.

Policy S1.2.11: Implement the City's Master Drainage Plan, through the development review process and capital improvement program.

Policy S1.2.12: Monitor and require continued maintenance of drainage basins throughout the City to ensure maximum flood protection from existing facilities and prevent downstream flood hazards.

Policy S1.2.13: Implement public financing programs where feasible, to provide for required drainage improvements, and coordinate design and construction of flood control improvements with adjacent jurisdictions where appropriate.

Policy S1.2.14: Ensure that development near National Forest lands does not result in increased flows of water or debris on to forest land.

GOAL S2: Minimize damage associated with man-made hazards.

Objective S2.1: Minimize damage from catastrophic failure of infrastructure.

Policy S2.1.1: Evaluate potential hazards associated with rupture of the California Aqueduct, to ensure that development in areas threatened with inundation are designed to minimize the threat to life and property.

Policy S2.1.2: Evaluate the potential for inundation from failure of the Lake Palmdale or Littlerock dams when reviewing development proposals within potential inundation areas.

Policy S2.1.3: Evaluate potential hazards associated with detention basin facilities, water main or reservoir rupture and minimize possible threat of inundation to life and property through design measures applied during the development review process.

Policy S2.1.4: Require that development in areas near high-pressure natural gas lines be buffered from them and provided with alternative access/evacuation routes.

GOAL S4: Protect public safety through the implementation and enforcement of City Ordinances and through public education.

Objective S4.2: Support the development and continued updating of public education programs on health and safety.

Policy S4.2.1: Prepare and disseminate educational information to residents and businesses on preparing for response to hazards of the area, including major earthquake, floods, hazardous waste spills, wildfire, etc.

Policy S4.2.2: Encourage and assist the school districts in teaching children to respond appropriately in an emergency, especially to situations unique to a desert environment. Such training should be repeated regularly to ensure that each child knows what to do in case of heat stroke, snake bites, floods, earthquakes, etc.

Policy S4.2.3: Promote the use of emergency water supplies or water filtration systems at point-of-delivery for acceptable water quality in emergency situations.

4.3 Hazard: Dam Failure

The dam failure risk probability and risk severity assessment listed below was identified by the Palmdale Water District's Hazard Mitigation Working Group as related to the District.

Probability	Severity
Low	High

Hazard Definition

Dams are a critical part of our national infrastructure. Millions of Americans rely on dams for water supply, power generation, flood control, irrigation and recreation. But many of our dams are beyond their life-span and are in desperate need of repair. Despite efforts by States to improve dam conditions, far too many unsafe dams remain at risk of failure, threatening life and property.

A dam failure is the partial or complete collapse of an impoundment, with the associated downstream flooding. Flooding of the area below the dam may occur as the result of structural failure of the dam, overtopping, or a seiche. Dam failures are caused by natural and manmade conditions. The list of causes includes earthquake, erosion of the face or foundation, improper sitting, structural/design flaws, and prolonged rainfall and flooding. The primary danger associated with a dam failure is the swift, unpredictable flooding of those areas immediately downstream of the dam.

There are three general types of dams: earth and rock fill, concrete arch or hydraulic fill, and concrete gravity. Each of these types of dams has different failure characteristics. The earth and rock fill dam will fail gradually due to erosion of the breach; a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete arch or hydraulic fill dam will fail almost instantaneously; with a very rapid build-up to a peak and then a gradual decline. A concrete gravity dam will fail somewhere in between instantaneous and gradual, with corresponding build-up of flood wave.

History

The Palmdale Water District evolved from several private water companies. The first water agency, the Palmdale Irrigation Company, was established in 1886 to acquire land and water, and then rent, lease, and sell both as they were developed. As a means of providing water for these purposes, they constructed a six and a half mile irrigation ditch to divert water from nearby Littlerock Creek to Palmdale. Not long after, it became apparent that water storage facilities were needed.

Palmdale Lake. In 1895, the South Antelope Valley Irrigation Company constructed an earthen dam forming Harold Reservoir known today as Palmdale Lake. To connect the water from Littlerock Creek to Harold Reservoir, they constructed another earthen ditch, including a flume and wooden trestle, parallel to the ditch being used by the Palmdale Irrigation Company.

Littlerock Dam. Littlerock Dam is located on U.S. Forest Service land in the southern Antelope Valley. Construction of Littlerock Dam was completed in 1924; at that time, it was the highest reinforced concrete multiple arch dam in the world with a capacity of 4,200-acre feet of water. Much controversy surrounded the design of Littlerock Dam and in 1932 it was determined by the State of California that it was an unsafe structure in its then-present condition, and renovations were ordered. By 1938, renovations had still not been completed and a two-day storm caused major damage to the Dam and spillway as well as the flume from a handful to over 35 radio-equipped vehicles. By 1940 renovations were completed and re-construction of Littlerock Dam was considered once again complete; however, it was re-constructed again in 1966 after the State Division of Safety of Dams studies indicated that the dam would not withstand a major earthquake.

Littlerock Dam

In 1987, after years of study, Palmdale Water District and Littlerock Creek Irrigation District decided to rehabilitate the dam in three phases. The first phase involved reinforcing the original multiple-arch construction with a roller-compacted concrete buttress. At the same time, the original dam was raised 12 feet, which thereby doubled the reservoir's capacity. Shotcrete with steel reinforcement was applied to the upstream surface of the dam, further strengthening the structure, but also improving its appearance cosmetically. Larger outlet pipes and controls were installed to provide greater safety when releasing stored water.

The second phase of construction provided new recreational facilities around the reservoir including a new boat launching facility; improved picnic areas and campsites; an interpretive display center overlooking the dam; and improved parking and restroom facilities.

The final phase of construction included replacing a historic wooden trestle with an underground siphon.

Financed partly with funds from the Davis-Grunsky Act, California Department of Boating and Waterways, and the issuance of Certificates of Participation, the $22 million Littlerock Dam renovation project was completed. Key factors in its completion were cooperative efforts between local, state, and federal agencies.

Risk Assessment

Failure of the Littlerock Dam would certainly cause extensive flooding in the Planning Area. Hazard analysis suggests that dam failure would likely occur only if heavy precipitation was coupled with significant seismic activity near the dam. Flood waters could be as deep as 50 feet immediately downstream of the Littlerock Dam. Failure of the Littlerock Dam would result in the inundation of a 300-foot wide area for 0.25 mile north of the dam. Along this length, the water depth would vary from 50 to 15 feet. Ten minutes after failure, the flood water would veer eastward for 800 feet to Avenue U where the depth would be reduced to 10 feet. Trending north from Avenue U, the water would eventually dissipate so that the depth is no longer a risk to downstream developments.

In addition to dam failure and subsequent flooding, a seismic event could cause a water wave, or seiche to occur at Lake Palmdale, which could potentially overtop the dam. The design report for the dam considers a reflection of the wave on return unlikely. Also, wave volume above the dam would not be substantial (approximately 1 acre-foot), and would not result in damaging floods. Overpour on the downstream side of the dam will not cause any damage by erosion as the existing rockfill was designed to withstand it.

With major disruptions in power and communications systems, warning may not be received from dam or reservoir sites in time to initiate an organized evacuation or broadcast warnings via emergency radio stations. If a credible prediction is initiated, then preparation for a damaging earthquake could begin and residents and business owners within dam inundation areas could be directed to assembly areas to wait for official word regarding safe re-entry. This method of direction and control could substantially reduce potential loss of life if enough warning were available.

Increased knowledge of where faults are located now affects where and how dams are built. Building of dams across faults should be avoided. If the construction across a fault cannot be avoided, special measures need to be taken to ensure the structural stability of the dam. The Littlerock Dam was originally built across the San Andreas Fault in 1891. The dam was completely reconstructed in 1969 because of the possibility of faulting. The new dam was designed to accommodate 6.1 m of horizontal and 1 m of vertical fault displacement.

- **Effects on people and housing.** The effects on people and housing can be significant. Loss of life and loss of property are very real risks. The shelter requirements for displaced persons can be enormous.

- **Effects on commercial and industrial structures.** Similarly, commercial and industrial structures face risks running the gamut from significant damage to total loss.

- **Effects on infrastructure.** Dam failure may be a direct or indirect cause of power outages. These outages can be extensive in geographic area and numbers of persons affected. Flooding as a result of dam failures can cause damage to the District's dams, pipelines, water and drainage systems.

Relationship to Other Hazards – Cascading Effects

Dam failure obviously causes downstream flooding. It may also lead to power failures and downed power lines. The secondary effects of dam failure can include the disruption of the local and state economies by damage to buildings and roads, agriculture, the severance of communications, the disruption of supply and delivery mechanisms, additional welfare, and emergency aid to the recovering economy.

Earthquakes can endanger dams in several ways, including failure of the foundations or dams themselves due to ground failures, or through secondary effects such as seiches and landslides in the reservoir. Normal operations of dam facilities can also cause failure if any part of the dam is not operating according to the original design specifications or due to aging of the site.

Risk Assessment Conclusion

Dam failure incidents have not been a problem for the Palmdale Water District. However, due to the close location of the Littlerock Dam to the San Andreas Fault, the dam could experience a seismic incident. Seasonal flooding with failure of run-off storage reservoirs and canals could seriously compound the risks of dam failure and additional flooding.

Palmdale Water District Current Plans and Programs

- In the event of power loss, Palmdale Water District has permanent emergency power generation that automatically starts to maintain water treatment operations.

The Palmdale Water District also supports the City of Palmdale's General Plan Safety Element which includes the following Goals, Objectives and Policies.

GOAL S2: Minimize damage associated with man-made hazards.

Objective S2.1: Minimize damage from catastrophic failure of infrastructure.

Policy S2.1.1: Evaluate potential hazards associated with rupture of the California Aqueduct, to ensure that development in areas threatened with inundation are designed to minimize the threat to life and property.

Policy S2.1.2: Evaluate the potential for inundation from failure of the Lake Palmdale or Littlerock dams when reviewing development proposals within potential inundation areas.

Policy S2.1.3: Evaluate potential hazards associated with detention basin facilities, water main or reservoir rupture and minimize possible threat of inundation to life and property through design measures applied during the development review process.

Policy S2.1.4: Require that development in areas near high-pressure natural gas lines be buffered from them and provided with alternative access/evacuation routes.

GOAL S4: Protect public safety through the implementation and enforcement of City Ordinances and through public education.

Objective S4.2: Support the development and continued updating of public education programs on health and safety.

Policy S4.2.1: Prepare and disseminate educational information to residents and businesses on preparing for response to hazards of the area, including major earthquake, floods, hazardous waste spills, wildfire, etc.

Policy S4.2.2: Encourage and assist the school districts in teaching children to respond appropriately in an emergency, especially to situations unique to a desert environment. Such training should be repeated regularly to ensure that each child knows what to do in case of heat stroke, snake bites, floods, earthquakes, etc.

Policy S4.2.3: Promote the use of emergency water supplies or water filtration systems at point-of-delivery for acceptable water quality in emergency situations.

4.4 Hazard: Wildfire

The wildfire risk probability and risk severity assessment listed below was identified by the Palmdale Water District's Hazard Mitigation Working Group as related to the District.

Probability	Severity
Low	Low

Hazard Definition

A wildfire is an uncontrolled fire spreading through vegetative fuels, posing danger and destruction to property. Wildfires can occur in undeveloped areas and spread to urban areas where structures and other human development are more concentrated.

Fires that occur within the urban-wildland interface areas affect natural resources as well as life and property. This type of fire is described as "a fire moving from a wildland environment, consuming vegetation for fuel, to an environment where structures and buildings are fueling the fire" (California Resources Agency, 1996).

While some wildfires start by natural causes, humans cause four out of every five wildfires. Wildfires started by humans are usually the result of debris burns, arson, or carelessness. As a natural hazard, a wildfire is often the direct result of a lightning strike that may destroy personal property and public land areas, especially on state and national forest lands. The predominate dangers from wildfires are:

- the destruction of property, timber, wildlife; and
- injury or loss of life to people living in the affected area or using the area for recreational facilities

History

Wildfires are common in the hills throughout California and in the coastal communities of Southern California. Fire has always been a trait of the area's chaparral and grassland ecosystems. The largest fires in southern California have historically occurred in the autumn, when Santa Ana winds can develop with high temperatures (conditions are characterized by low relative humidity, high temperatures, and strong northeasterly winds). Conditions that are more conducive to fires can occur with hotter and drier summers and greater amount of vegetation resulting from wetter winters. Plant pests and pathogens can also raise the risk of fire by increasing the number of dead trees in an area.

The hot dry climate of the Planning Area keeps the grass dry and readily combustible. The Santa Ana winds can spread fires into adjacent areas. Steep slopes bring grass and brush within reach of upward flames while impeding the access of firefighting equipment. Within Palmdale, wildfire hazards areas exist within the southern and western portions of the area. The fire season in the Palmdale area occurs roughly from September to November when the Santa Ana winds blow. If rains are minimal, grass may dry as early as May and brush as early as July. From December to April, in the rainy season, wildfires rarely occur.

The Palmdale Water District and surrounding areas have had a history of wildfires. The following Table depicts some of the most recent incidents.

Table 4-5. Historical Wildfire Events

Location	Date	Type	Reported Property Damage/Description
Palmdale	04/12/2007	Wildfire	Brush fire fanned by heavy winds. 150 firefighters fought a 15- to 20-acre blaze in the desert City of Palmdale. Homes were threatened for a time before most of the active flames were knocked down.
Palmdale (Cheseboro Fire)	2006	Wildfire	Cause: arson; 142 acres burned.
Palmdale (Sierra Fire)	2005	Wildfire	Cause: playing with fire; 364 acres burned.
Palmdale (Tovey Fire)	2005	Wildfire	Wildfire burned 983 acres; cause unknown.
Los Angeles/South of Palmdale (Crown Fire)	07/21/2004 check dates	Wildfire	More than 900 personnel were assigned to fight this fire that threatening 500 homes near the town of Acton, about 10 miles southwest of Palmdale. More than 11,970 acres had burned. A Red Cross evacuation center was set-up in Palmdale.
Los Angeles/Leona Fire (12 miles west of Palmdale)	09/04/2002	Wildfire	Leona fire threatened the communities of Leona Valley, Quartz Hill, Ritter Ranch and Lost Valley, about 500 homes. The 3,200-acre fire has destroyed three or four homes and forced the mandatory evacuation of 200 people from Leona Valley and Lost Valley. One injury is related to the fire.
Palmdale	08/08/1998	Wildfire	Fire destroyed a home while blazing a 200-acre path across the north end of Palmdale. More than 200 Los Angeles County firefighters battled the blaze.

Source: NOAA National Climatic Data Center

Risk Assessment

The loss of ground surface cover and forest duff, such as needles and small branches, and the chemical transformation of soil caused by fire significantly increase the watershed's susceptibility to erosion. The increased rate of movement of soil, ash, and nutrients into waterways following a fire can result in significant increases in turbidity and total dissolved solids in raw water supplies. In addition, water yields can be drastically impacted. Immediately following large fire events, runoff peaks can increase significantly and can occur much earlier. Future overall yields can be lower, depending on the nature of the fire and characteristics of the watershed.

- **Effects on people and structures.** Wildfires are damaging to natural environments and wildfire smoke can create health hazards. Wildfires can injure and kill residents and firefighters, as well as damage or destroy structures and personal property. The quantity and quality of water supplies can be dramatically affected by fire.

- **Effects on infrastructure.** In addition to damaging residences and structures and injuring and killing residents and firefighters, wildfires also deplete water reserves, down power lines, disrupt telephone service, and block roads. They can also indirectly cause floods, if flood control facilities are inadequate to handle an increase in storm runoff, sediment, and debris that is likely to be generated from barren, burned-over hillsides.

Relationship to Other Hazards – Cascading Effects

Major wildfires can completely destroy ground cover. If heavy rains follow a major fire, flash floods, heavy erosion, landslides and mudflows can occur. The quantity and quality of water supplies can be dramatically affected by fire. Wildfires can also affect the air quality throughout the District's Planning Area. These cascading effects can have ruinous impacts on people, structures, and infrastructure.

Risk Assessment Conclusion

The potential for wildfires in the Palmdale Water District Planning Area is very low due to the desert topography. The potential for loss of life and property from urban fire hazards is greatest in places where large groups of people gather, such as offices, stores, hotels, and theaters. Uses which may suffer large monetary losses due to a major fire include businesses, factories, and shopping areas.

Palmdale Water District Plans and Programs

The Palmdale Water District supports the City of Palmdale's General Plan Safety Element which includes the following Goals, Objectives and Policies.

GOAL S1: Minimize danger and damage to public health, safety, and welfare resulting from natural hazards.

Objective S1.3: Ensure compatible development in areas within or adjacent to natural high fire risk areas (urban-wildland interface), and other high fire risk areas.

Policy S1.3.1: Ensure that structural setbacks from fire-prone vegetation for buildings near the National Forest are maintained in accordance with the standards and regulations established by the National Forest Service. Require that all necessary fire clearances be provided on private (not public) land.

Policy S1.3.2: Encourage dual access, particularly in mountainous and high fire risk areas, on approved all-weather surface roadways.

Policy S1.3.3: Provide fire-resistant landscaped buffer zones between high risk fire hazard areas and urban development, and restrict access from development into the open space areas during periods of high fire risk.

Policy S1.3.4: Evaluate the need for fire resistant landscape buffer zones for existing developments located in high risk fire hazard areas, and require fuel modification on a continuous basis where appropriate.

Policy S1.3.5: Require that all new development proposals near the designated wildfire hazard zones identify evacuation/emergency routes, and that the information be provided to all residents within the development.

Policy S1.3.6: Where appropriate, require preparation of a Fire Protection/Fuel

Management Plan for new urban development adjacent to natural high fire hazard areas, and ensure implementation of fire hazard mitigation measures.

Policy S1.3.7: Where feasible, require new development to pay for fire protection services and facilities needed to support it.

Policy S1.3.8: Coordinate fire prevention and protection service needs and facility planning with Los Angeles County Fire District.

Policy S1.3.9: Ensure that the requirements of the Los Angeles County Fire

Department are implemented on new development proposals, through the review process.

Policy S1.3.10: Require that all new development is served by a water system that meets the fire flow requirements established by the fire department.

GOAL S4: Protect public safety through the implementation and enforcement of City Ordinances and through public education.

Objective S4.2: Support the development and continued updating of public education programs on health and safety.

Policy S4.2.1: Prepare and disseminate educational information to residents and businesses on preparing for response to hazards of the area, including major earthquake, floods, hazardous waste spills, wildfire, etc.

Policy S4.2.2: Encourage and assist the school districts in teaching children to respond appropriately in an emergency, especially to situations unique to a desert environment. Such training should be repeated regularly to ensure that each child knows what to do in case of heat stroke, snake bites, floods, earthquakes, etc.

Policy S4.2.3: Promote the use of emergency water supplies or water filtration systems at point-of-delivery for acceptable water quality in emergency situations.

4.5 Hazard: Extreme Weather

The extreme weather risk probability and risk severity assessment listed below was identified by the Palmdale Water District's Hazard Mitigation Working Group as related to the District.

Probability	Severity
Medium - High	Medium

Hazard Definition

Extreme weather hazards for the Palmdale Water District include:
- Thunderstorms/Windstorms
- Heavy Rain/Hailstorms
- Extreme Heat/Drought

History

Palmdale Water District officials noted that 2006 was the driest in recorded history in the high desert, with a scant 1.4 inches of rainfall, about one-fifth of the normal precipitation. The Littlerock Reservoir, which normally catches rain and snow runoff from the north slopes of the San Gabriel Mountains, got no inflows that year at all. In June 2008, California's Governor declared the first statewide drought in 17 years – setting the State for drastic cutbacks and diverting supplies from the relatively water-rich to the water-poor. The Governor called for a 20 percent reduction in water use statewide and urged local agencies to bolster conservation programs and to work with federal and other authorities to help farmers who are suffering huge financial losses and abandoning crops in droves. California's Governor lacks the authority to impose statewide rationing; however, the State Department of Water Resources could slash water supplies to local agencies, which then would be forced to institute rationing.

The Governor's pronouncement follows the driest spring on record and two years of below-normal precipitation for the State. Snow pack in the Sierra Nevada, the backbone of the State's water supply, stands at two-thirds of normal; dusty banks line many important reservoirs; and environmental rulings have slashed water pumped from the crucial Sacramento-San Joaquin River Delta - all while California's booming population threatens to overwhelm some of the State's key infrastructure.

Drought, thunderstorms, heavy winds, and heavy rainfall have all caused damage to the Palmdale Water District Planning Area in the past and will no doubt occur again in the future. The Palmdale Water District Planning Area has had a history of extreme weather hazards. The following table depicts some of the most recent extreme weather incidents.

Table 4-6. Historical Extreme Weather Events

Location	Date	Type	Reported Property Damage/Description
Countywide	06/01/2008	Drought	In June 2008, following the driest spring on record and two years of below-normal precipitation for the State, California's Governor declared the first statewide drought in 17 years – setting the State for drastic cutbacks and diverting supplies from the relatively water-rich to the water-poor.
Antelope Valley	03/02/2008	High Winds	High winds knocked out power to over 23,000 customers in the Antelope Valley. Visibility was reported to be zero at times on the Antelope Valley Freeway between Palmdale and Rosamond, causing one truck to blow over and forcing CHP officials to escort traffic.
Antelope Valley	08/23/2006, 08/28/2006, 09/05/2006	Extreme Heat	The California Office of Emergency Services (OES) issued an "extreme heat advisory" for Antelope Valley where triple digit temperatures were expected for two or more days. Cooling centers were open. (CA OES)
Los Angeles Countywide	01/07/2005-01/11/2005	Heavy Rain	Property damage: $5M. A powerful Pacific storm brought heavy rain, snow, flash flooding, high winds and landslides to Central and Southern California. During the five day event, rainfall totals ranged from three to ten inches over coastal areas with up to 32 inches in the mountains. With such copious rainfall, flash flooding was a serious problem across Santa Barbara, Ventura and Los Angeles counties. Across Los Angeles County, flash flooding killed a homeless man in Elysian Park, flooded a mobile home park in Santa Clarita, closed Highway 1 and caused numerous problems in Palmdale. In the mountains, 4 to 12 feet of snowfall was recorded along with southeast winds between 30 and 50 MPH with higher gusts. Overall, damage estimates for the entire series of storms that started December 27th, 2004 and ended on January 11th, 2005 were easily over $200 million with the most damage incurred by agricultural interests in Ventura County.
Los Angeles Countywide	12/31/2004	Heavy Rain	A powerful Pacific storm brought more heavy rain, snow and flash flooding to Central and Southern California. Total rainfall amounts ranged from one to three inches on the coastal plain to between three and six inches in the mountains. The heavy rain resulted in numerous reports of urban and rural flooding. In the mountains of Ventura and Los Angeles counties, snow levels dropped to around 4500 feet, resulting in snow accumulations between 8 and 16 inches. Gusty south to southeast winds between 25 and 40 mph produced mountain visibilities near zero in blowing snow.
Los Angeles Countywide	12/27/2004-12/29/2004	Heavy Rain	A powerful Pacific storm brought heavy rain, snow and tornados to Central and Southern California. Total rainfall

Location	Date	Type	Reported Property Damage/Description
			amounts ranged from two to eight inches on the coastal plain to between six and thirteen inches in the mountains. With such heavy rain, there were many hydrologic problems. Urban flooding was widespread across all of San Luis Obispo, Santa Barbara, Ventura and Los Angeles counties. In Los Angeles County, flash flooding and debris flows in the mountains and Santa Clarita valley closed down Interstate 5 and Hasley Canyon Road. In the mountains of Ventura and Los Angeles counties, winter storm conditions prevailed. Between 12 and 36 inches of snow fell above the 5000 foot elevation while southeast winds between 30 and 50 mph with gusts to 75 mph resulted in near zero visibilities in blowing snow. On the coastal plain of Los Angeles County, weak tornados were reported in Long Beach, Inglewood and Whittier. The tornados only produced minor damage including downed trees and damaged roofs.
Los Angeles Countywide	03/04/2001-03/06/2001	Heavy Rain	A powerful and slow-moving storm brought heavy rain, strong winds and snow to Central and Southern California. Across Ventura and Los Angeles counties, rainfall totals were somewhat less, but still very significant. Los Angeles County received one to three inches of rain. Across Central and Southern California, strong southeasterly winds accompanied the storm. Widespread winds between 30 and 50 MPH with stronger gusts were reported from the coastal areas to the mountains. In the mountains of Ventura and Los Angeles counties, winter storm conditions developed with snowfall accumulations of 6 to 12 inches, gusty southeast winds and visibilities near zero in blowing snow and dense fog.
Los Angeles Countywide	02/24/2001	Heavy Rain	A Pacific storm brought rain, snow and wind to Central and Southern California. Overall, rainfall totals were between one to four inches, producing numerous reports of urban flooding. In the mountains, snowfall totals were 8 to 16 inches, mainly above 6000 feet. Along with the snow, south winds gusting to 50 mph developed in the mountains.
Los Angeles Countywide	02/11/2001–02/13/2001	Heavy Rain	A powerful Pacific storm brought heavy rain, heavy snow and gusty winds to Central and Southern California. Overall, two to eight inches of rain fell across the area, producing numerous reports of urban flooding. With the storm, snow levels fell to around 1500 feet in some areas. Ski resorts reported between three to seven feet of new snowfall. With such low snow levels, the Cuyama and Antelope Valleys reported between four to eight inches of snowfall. Along with the precipitation, gusty south winds of 40 to 60 mph developed in the mountains. Across coastal and valley areas of Ventura and Los Angeles counties, southeast winds of 30 to 50 mph developed and produced some damage.
Los Angeles Countywide	01/10/2001	Heavy Rain	A powerful winter storm brought heavy rain, heavy snow and strong winds to Central and Southern California. Total rainfall amounts ranged from two to five inches across coastal areas,

Location	Date	Type	Reported Property Damage/Description
			with between five to ten inches of liquid equivalent precipitation in the mountains. Due to very dry soil conditions, flash flooding did not occur. However, numerous reports of urban flooding were received. This storm also dropped snow levels down to around 3000 feet, producing very significant snowfall in the mountains. At resort levels, above 6000 feet, snowfall totals ranged between two and four feet. Between 3000 and 6000 feet, snowfall totals ranged from 8 to 24 inches. Along with the heavy snow, southerly winds of 30 to 40 mph with gusts to 60 mph produced widespread visibilities of one mile or less in blowing snow across the mountains.
Palmdale	07/13/1999	Thunderstorm/ Wind/Hail/ Lightning	Injuries: 1. Strong thunderstorms produced heavy rain, strong winds and dangerous lightning across the Antelope Valley and the mountains of Santa Barbara, Ventura and Los Angeles Counties. In Palmdale, lightning struck a steam-roller operator while strong thunderstorm winds snapped small trees. Heavy rain resulted in many reports of flash flooding across the area. In the Antelope Valley, flash flooding was reported in both Palmdale and Lancaster.
Palmdale	05/23/1999	Thunderstorm/ Lightning	Fatality: 1. A U.S. Forest Service firefighter was struck and killed by lightning as a pair of rare spring thunderstorms pummeled Palmdale and across the Southland. Thunderstorms also knocked out electricity throughout the area.
Antelope Valley	04/03/1999-04/04/1999	High Wind 56 knots	Strong northwest winds developed across Central and Southern California. Sustained wind speeds of at least 35 to 45 mph with gusts up to 65 mph were reported. Widespread power outages and felled trees were reported.
Los Angeles County	12/21/1998-12/24/1998	Freeze	$200K crop damage. An unseasonably cold air mass produced a three-night period of sub-freezing temperatures across Central and Southern California. Agricultural interests suffered heavy crop losses. The California Department of Food and Agriculture reported over $83 million in crop losses across the four-county area.
Palmdale Airport	08/31/1998	Thunderstorm/ Wind	The official observation from the Palmdale Airport reported a thunderstorm wind gust of 58 mph.
Palmdale	08/12/1998	Lightning/ Thunderstorm/ Rain	Lightning, thunder and rain cut a swath across the Antelope Valley, as residents were treated to an afternoon of muggy weather, power outages and flash flood warnings.
Palmdale/Antelope Valley	08/04/1998	Extreme Heat	For the 19th time since June 21, the areas has experienced temperatures in the triple digits, driving residents indoors and pushing statewide electricity use to new heights.
Antelope Valley	02/07/1998-02/08/1998	High Wind 61 knots	Strong winds, gusting up to 70 mph, knocked down many trees and power lines. Rainfall totals ranged from one to four inches over the coasts, up to seven inches in the mountains. Widespread reports of urban and rural flooding were reported.
Antelope Valley	02/05/1998–02/06/1998	High Wind 61 knots	Strong winds, gusting up to 70 mph, knocked down many trees and power lines. Rainfall totals ranged from one to three inches over coastal areas, up to six inches in the mountains. Numerous flooding problems were reported across the area. Most

Location	Date	Type	Reported Property Damage/Description
			highways, including the 1, 101, 126 and 154 were closed due to flooding or mudslides.
Antelope Valley	02/02/1998 - 02/03/1998	Flood/High Wind 78 knots	Powerful winds buffeted the entire area. Winds gusting in excess of 70 mph were reported. Hundreds of trees and power lines were blown down, resulting in numerous power outages. On average, rainfall totals ranged from two to eight inches over coastal areas, up to 12 inches in the mountains. Widespread flooding was reported in all areas. Flooding and mudslides closed parts of most major roadways across the area.
Antelope Valley	01/09/1998	Rain/Snow	A Pacific storm brought rain and snow to Central and Southern California. Rainfall totals were generally one to two inches, with up to four inches in the mountains. Minor urban and small stream flooding was reported. At higher mountain elevations, four to eight inches of snowfall was reported.
Antelope Valley	11/30/1997	Rain/Snow	A powerful Pacific storm brought more rain and snow to Southern California. Some mountain locations received three to six inches of snowfall. At lower elevations, moderate to heavy rain fell. Rainfall totals ranged from two to six inches over the coast; up to 12 inches in the mountains.
Antelope Valley	11/26/1997	Rain/Snow	A strong Pacific storm brought heavy rain, thunderstorms and snow to Southern California. With this storm, snow levels dropped to around 5000 feet. Snow accumulations up to six inches were reported in the mountains. At lower elevations, heavy rain and small hail fell. Rainfall totals ranged from 0.50 to 1.50 inches across the coast, up to four inches in the mountains. The heavy rain produced numerous street flooding.
Antelope Valley	11/10/1997	Rain	A strong Pacific storm produced rain and thunderstorms across Southern California. Rain totals ranged from 0.50 to 1.50 inches across the coast, up to three inches in the mountains. With these rains, numerous street flooding was reported.
Palmdale	09/02/1997	Thunderstorm Winds/Hail	A strong thunderstorm developed over the Antelope Valley affecting the communities of Palmdale and Lancaster. The storm produced three-eighths inch hail. Rainfall amounts around one inch and wind gusts up to 45 mph. The storm knocked out power to over 11,000 homes and produced local street flooding. Also lightning from the storm sparked a two acre brush fire.
Palmdale	04/01/1997	Dust Devil	A dust devil developed in the Palmdale area. Two storage sheds were destroyed by the dust devil. Strong northwest winds, gusting up to 65 mph, developed across the valleys of Los Angeles County. Numerous power outages were caused by falling branches.

Source: NOAA National Climatic Data Center

Risk Assessment

- **Effects on people, housing, commercial and industrial structures and infrastructure**. Extreme weather incidents as noted above can cause extensive and costly damage to housing, commercial and industrial structures, infrastructure and even injury or loss of life. The danger is multiplied by the risks of power line downing, floods, and landslides/mudslides.

Relationship to Other Hazards – Cascading Effects

Thunderstorms, heavy winds, and heavy rainfall, carry the risks of floods, power and communications outages, landslides and mudslides, as well as the possibility of wildfire ignitions from downed power lines.

Risk Assessment Conclusion

Drought, thunderstorms, heavy winds, and heavy rainfall have all caused damage to the Palmdale Water District Planning Area in the past and will no doubt occur again in the future.

Palmdale Water District Current Plans and Programs

- In the event of power loss, Palmdale Water District has permanent emergency power generation that automatically starts to maintain water treatment operations.
- Hydro-turbine at Palmdale Lake. Start-up and testing for this renewable energy resource located on the west side of Palmdale Lake has begun. The hydro-turbine generates electricity through the velocity of water released from the California Aqueduct into Palmdale Lake. This electricity will be used to operate the District's 6MG clearwell booster station on the north side of Avenue S when power is interrupted.

The Palmdale Water District also supports the City of Palmdale's General Plan Safety Element which includes the following Goals, Objectives and Policies.

GOAL S4: Protect public safety through the implementation and enforcement of City Ordinances and through public education.

Objective S4.2: Support the development and continued updating of public education programs on health and safety.

Policy S4.2.1: Prepare and disseminate educational information to residents and businesses on preparing for response to hazards of the area, including major earthquake, floods, hazardous waste spills, wildfire, etc.

Policy S4.2.2: Encourage and assist the school districts in teaching children to respond appropriately in an emergency, especially to situations unique to a desert environment. Such training should be repeated regularly to ensure that each child knows what to do in case of heat stroke, snake bites, floods, earthquakes, etc.

Policy S4.2.3: Promote the use of emergency water supplies or water filtration systems at point-of-delivery for acceptable water quality in emergency situations.

4.6 Hazard: Waterborne Diseases (Water Supply Contamination)

The waterborne diseases risk probability and risk severity assessment listed below was identified by the Palmdale Water District's Hazard Mitigation Working Group as related to the District.

Probability	Severity
Very Low	High

Hazard Definition

Water is basic to life and health. In the U.S., the drinking water supply is normally safe; yet diseases that spread through water are still a very real problem. Microorganisms are responsible for more than 90% of the reported waterborne disease outbreaks in the U.S.; enteric viruses, such as hepatitis A, are identified as causing almost 10% of these. However, in 50% of the outbreaks, no causative agent is identified due to limitations in the ability to isolate and detect viruses in water samples. Historically, consumption of contaminated ground water has been the source of one-half of the reported outbreaks; in recent years, that fraction has risen to more than two-thirds. The most frequently reported source of contamination in these outbreaks is domestic sewage from septic tanks, leaking sewer lines, and cesspools.

Waterborne diseases in the U.S. are caused by viruses, bacteria, and intestinal parasites. The burden of disease from waterborne pathogens is substantial. According to the Department of Health and Human Service's Centers for Disease Control and Prevention, during the period from 1920 to 2000, 883,806 illnesses related to waterborne diseases were reported – an average of 40,648 cases per year.

Following are descriptions of the types of waterborne diseases in the U.S.

Bacteria are microorganisms often composed of single cells shaped like rods, spheres or spiral structures. Prior to widespread chlorination of drinking water, bacteria like *Vibrio cholerae*, *Salmonella typhii* and several species of *Shigella* routinely inflicted serious diseases such as cholera, typhoid fever and bacillary dysentery, respectively. As recently as 2000, a drinking water outbreak of *E. coli* in Walkerton, Ontario sickened 2,300 residents and killed seven when operators failed to properly disinfect the municipal water supply. Developed nations have largely conquered waterborne bacterial pathogens through the use of chlorine and other disinfectants.

Viruses are infectious agents that can reproduce only within living host cells. Shaped like rods, spheres or filaments, viruses are so small that they pass through filters that retain bacteria. Enteric viruses, such as hepatitis A, Norwalk virus and rotavirus are excreted in the feces of infected individuals and may contaminate water intended for drinking. Enteric viruses infect the gastrointestinal or respiratory tracts, and are capable of causing a wide range of illness, including diarrhea, fever, hepatitis, paralysis, meningitis and heart disease.

Protozoan Parasites are single-celled microorganisms that feed on bacteria found in multicellular organisms, such as animals and humans. Several species of protozoan parasites are transmitted through water in dormant, resistant forms, known as cysts and oocysts. According to the World Health Organization, *Cryptosporidium parvum* oocysts and *Giardia lamblia* cysts are introduced to waters all over the world by fecal pollution. The same durable form that permits them to persist in surface waters makes these microorganisms resistant to normal drinking water chlorination (WHO, 2002). Water systems that filter raw water may successfully remove protozoan parasites.

Waterborne Disease Patterns

Several waterborne diseases show seasonal patterns, suggesting that they are subject to environmental influences. Specific environmental influences have been documented for several specific pathogens. Environmental changes have effects on pathogen replication, survival, and persistent rates; transmission rates; and disease ranges overall.

Temperature and precipitation, both of which will increase with climate change, affect the spread of waterborne diseases. In general, increased temperature results in higher pathogen replication, persistence, survival, and transmission for bacterial pathogens, and has mixed effects on viral pathogens but often reduces the overall transmission rate. Higher temperatures seem to produce a greater number of waterborne parasitic infections, as well.

Overall, increased precipitation is associated with increased burdens of disease for bacteria, viruses, and parasites, though the causes of these increases differ by pathogen and ecologic setting.

The U.S. is fortunate to have one of the best supplies of drinking water in the world. Although tap water that meets federal and state standards is generally safe to drink, threats to drinking water quality in the U. S. still exist. Outbreaks of drinking water-associated illness and water restrictions during droughts demonstrate that we cannot take our drinking water for granted. In the U. S., contaminated drinking water in homes and businesses is usually a result of water main breaks or other emergency situations.

History

According to the 2008 Watershed Sanitary Survey and Source Water Assessment Update, the following is a summary of available water quality data from the Palmdale Water Treatment Plant from 2002 through 2007. Data on both raw and treated water is presented, focusing upon microbial contaminants. Additionally, brief summaries of trace metals, physical constituents, and organic/inorganic contaminants monitored by DPH and/or the EPA, are included.

Total coliforms are a measure of the concentration of bacteria in a water sample. Bacteria are usually present in raw water samples. Their presence alone is not cause for concern but their source should be identified and controlled if possible. Daily coliform data for the District's Water Treatment Plant raw water were available from January 2000 through September 2007. Overall, total coliform counts were well below 200 most probable number (MPN) per 100 milliliters (mL), with coliform spikes above 200 MPN/100mL approximately eight percent of the time. Additionally, the spikes have decreased in frequency and magnitude over the last six years. The largest period of spikes occur during the latter portion of the winter months, primarily in February and March of each year, the cause of these spikes is unclear, but may be related to weather changes and migratory birds.

Fecal coliforms are also a measure of the concentration of bacteria in a water sample, but are focused on bacteria found in human (and other animals) intestinal tracts. Hence, it is assumed that the presence of these bacteria in water samples is indicative of the presence of fecal matter and possible pathogenic organisms, which may be of human origin (Tchobanoglous, 140). Much like the total coliform counts for the Lake Palmdale intake, fecal coliform counts have also been low. The data available for fecal coliforms span the same sampling dates as total coliforms, covering nearly six years. During this period of time, there was more than 40 percent incidence rate where fecal coliforms exceeded 20 MPN/100mL, with the percentage of incidents decreasing yearly. The spikes occur in the winter months and are most likely related to first flush events and weather.

Giardiasis and Cryptosporidiosis are both serious waterborne diseases caused by the protozoa *Giardia lamblia* and *Cryptosporidium parvum*, respectively. The protozoa are found in the intestinal tracts of infected humans and animals and can be passed in their stool. The protozoa can survive for a long period of time outside the body, making water an ideal medium for the protozoa to spread. Both show a fairly high resistance to typical disinfection chemicals, such as chlorine. Effects of the diseases can range from mild intestinal cramps in healthy individuals to serious and life threatening problems in persons with compromised immune systems. Palmdale Water District has maintained records of tests for Giardia and Cryptosporidium from the raw water intake. Data was available beginning in January 2003 through September 2007. Sampling and testing was performed on a monthly basis. The detection method used has always been the current Environmental Protection Agency prescribed method at the time of testing; currently Palmdale Water District uses EPA Method 1623. Overall, the data shows little to no evidence of any Giardia or Cryptosporidium problems or potential problems. In the period of available data there were no detects of Cryptosporidium, and only seven detects of Giardia all of which were four total oocyts per liter or lower.

Algae has historically been a water quality concern in Lake Palmdale and the District has taken steps to reduce algae production and the need for chemical treatment with Copper Sulfate. Lake Palmdale appears to be home to several species of diatoms year round. In 2002 the District applied 2,000 pounds of copper sulfate per week for 20 weeks from April through September. It is important to note that copper sulfate application dropped from this weekly application before the installation of the SolarBees to twice during the 2003 season after installation. Copper sulfate addition continues to remain infrequent and at low concentrations.

Waterborne Disease Incidents

In 2000, drinking water tested in the City of Palmdale had the third-highest level of the carcinogen chromium 6 found in a countywide study. Drinking water was sampled at 110 courthouses, medical clinics, libraries and other public facilities in 71 cities on orders of the County Board of Supervisors, who were prompted by newspaper articles about the presence of chromium 6 in drinking water in the San Fernando Valley.

The State has established a ”public health goal” of 0.2 parts per billion, or less than one-thirtieth the level found in Palmdale. The federal standard for total chromium is 100 parts per billion, and the State standard is 50 parts per billion. Palmdale water normally tests at 10 or 15 parts per billion of total chromium. The County test found 10.1 parts per billion of total chromium.

In 2003, Palmdale Water District notified customers that total trihalomethanes (THMs) measured during the spring had topped a recently stiffened maximum allowable level. THMs are a byproduct of the treatment plant disinfection process. They form through reaction of chlorine, used as a disinfectant, with organic material in the water. The District's increase use of well water brought the levels down. Unlike water from the California Aqueduct, which provides much of Palmdale's water, well water doesn't contain the quantities of organic materials and salt that react with chlorine used in water purification to form trihalomethanes.

The following Table is a list of selected reportable disease cases in Los Angeles County from February – March 2007 from the County of Los Angeles, Public Health Department.

Table 4-7. Historical Waterborne Disease Events in Los Angeles County

Outbreaks	Number	% of Total	Number of Illnesses	% of Total
Gastroenteritis (unknown etiology)	227	50.9	60,191	56.16
Giardiasis	81	18.16	22, 721	21.2
Viral Gastroenteritis	17	3.81	5, 734	5.35
Shigellosis	31	6.95	5, 827	5.34
Campylobacter Diarrhea	5	1.12	4,773	4.45
Chemical Poisoning	46	10.31	3,743	3.49
Salmonellosis	20	2.24	2, 300	2.15
E. coli Diarrhea	1	0.22	1,000	0.93
Hepatitis A	22	4.93	730	0.68
Typhoid	4	0.9	222	0.21
Cholera	1	0.22	17	0.02
Yersiniosis	1	0.22	16	0.01

Risk Assessment

Drinking water pathogens may be divided into three general categories: bacteria, viruses and parasitic protozoa. The combined effects of increased temperature and precipitation are likely to worsen the burden of waterborne disease, though the magnitude of this effect is difficult to project with certainty. Confidence in projections for climate change's effects on waterborne disease is medium to high, depending on the specific relationship examined. Long-term disease surveillance, coupled with weather and climate data, are needed to establish historical relationships more firmly. Those relationships can then be used to project future trends under a changing climate.

The U.S. is fortunate to have one of the best supplies of drinking water in the world. Although tap water that meets federal and state standards is generally safe to drink, threats to drinking water quality still exist. Outbreaks of drinking water-associated illness and water restrictions during droughts demonstrate that we cannot take our drinking water for granted. In the U.S., contaminated drinking water in homes and businesses is usually a result of water main breaks or other emergency situations.

Standards for safe drinking water have been established by the U.S. EPA and in the State of California by the Department of Health Services. Palmdale Water District meets or exceeds all these standards. Samples of water are taken regularly from selected points in the distribution system for bacteriological and chemical analysis to ensure that the water is safe for consumption at all times.

- **Effects on people, economics and housing**. Depending on levels of contamination and exposure, effects could range from minimal to devastating.

Risk Assessment Conclusion

The Palmdale Water District Operations and Production Department operates the Water Treatment Plant, Lake Palmdale, Littlerock Dam and Reservoir, and the Palmdale Ditch for surface water sources and treatment. The Operations and Production Department also monitors and maintains operational control of the Districts 23 active ground water wells, 17 reservoir sites, 15 booster stations, 14 pressure regulating stations, 9 hydro pneumatic tanks, and hypo-chlorite disinfection equipment at 32 of the above sites.

The Department is also responsible for maintaining compliance with all federal, state, and local regulations on water quality standards, updating the watershed sanitary survey and development of wellhead protection as a source water protection plan, energy management, pumping efficiency, as well as handling customer related water quality complaints and water quality analysis.

Although detection methods for recognizing intentional contamination of a water supply are improving, the most likely initial indication that a water contamination event has occurred in a community will be a change in disease trends and illness patterns. Early recognition, accurate diagnosis, and conscientious case reporting by community healthcare providers of suspected waterborne disease cases -- no matter what their clinical specialty -- will be critical to maintaining water security and safety and to protecting the public's health in the future.

Palmdale Water District Current Programs and Policies

- Palmdale Water District has maintained records of tests for *Giardia* and *Cryptosporidium* from the raw water intake. Sampling and testing are performed on a monthly basis. The detection method used has always been the current Environmental Protection Agency (EPA) prescribed method at the time of testing; currently the District uses EPA Method 1623.
- To date, Phase I improvements to the District's Water Treatment Plant have been completed and final testing of new chemical feed equipment installed in Phase I is underway. The following is a list of upgrades completed in this Phase:
    - Installation of a self cleaning automatic screen at the lake outlet structure as well as modifications to the outlet piping.

  - A carbon dioxide (CO_2) storage and feed system was installed which mixes CO_2 with water to form carbonic acid which is feed to the raw water line to maintain precise control of the raw water pH. A pH probe downstream of the injection point controls the feed rate via a process loop control and PLC.
  - Installation of a magnetic flow meter in the influent meter vault and subsequent modifications to the influent meter vault piping, flow control valve, chemical diffusers, and flash mix nozzle.
  - An additional stage was added to the flocculation basins, modifications were also made to the distribution control structure to facilitate even flow through all five basins and the original two speed flocculation units were replaced with variable frequency drive units.
  - New chemical storage, secondary containment, feed system and structure was added to accommodate the use of either Alum or Ferric chloride as the main coagulants. A caustic soda chemical storage, secondary containment, and feed system for pH readjustment if enhanced coagulation is practiced were also added. Additionally, a polymer feed system was added in the flocculation/sedimentation basin building that is capable of feeding an-ionic or non-ionic polymer to the flocculation basins.
  - The baffle walls between the flocculation stages and sedimentation were also modified.
  - The original chain and flight sludge removal system was replaced with a super scraper sludge removal system.
  - Inclined plate settlers were added to the sedimentation basins.
  - The flocculation/sedimentation basins were enclosed within a metal building.

- Work continues on Phase II – Water Treatment Process Improvements. This work, combined with Phase I construction improvements, will help Palmdale Water District meet future, stricter water quality standards.
- Two YSI Water Quality Probes have been installed in Palmdale Ditch. The data collected is transmitted via SCADA back to the treatment plant. The probes are to monitor for any significant changes in water quality as the water flows through the ditch. This could indicate some form of contamination in the water or contamination due to runoff intrusion or fires, etc. Water quality issues can then be traced back to contaminants introduced to the system along the Palmdale Ditch. Palmdale Water District has received a Proposition 13 grant to partially fund the cost associated with enclosing a portion of the ditch that has been identified as problematic.
- Completed Annual Laboratory re-certification including Bacteriological, Inorganic and General Chemistry analysis.
- Continued to utilize distribution system strategies to reduce TTHM levels.
- Complete installation of 1720E turbidimeters on individual filters.

- Diligently performed jar testing of chemical coagulants which in conjunction with Phase I flocculation/sedimentation basin improvements produced lower overall settled water and effluent water turbidities.
- Monitored all source water supplies for Lead, Copper, Radioactivity, Giardia, Cryptosporidium, MTBE, TTHM's and Hexavalent Chromium as well as other constituents required by law.
- Adopted the District's Wellhead Protection Plan. The goal of local source water protection is to identify, develop and implement local measures that provide protection to the drinking water supply. Wellhead protection provides one more barrier to contamination in a multi-barrier protection treatment train.
- The District maintains regular communications with the City of Palmdale and with the Forest Service. District staff review any proposed development and facilities in the watersheds to ensure that they do not adversely impact water quality, and that operation and maintenance of existing facilities is protective of water quality.
- Lake Palmdale is supplied by high-nutrient aqueduct water and has a history of intense algae blooms that required high doses of copper sulfate and reduced the percentage of total flows drawn from the lake. In November 2002 the District, installed six solar-powered SB10000s (SolarBees), with intake hoses set at an average depth of 20 feet to increase lake circulation and reduce algae growth. In June 2003 a seventh machine was installed. All seven machines were upgraded to the newest model in 2005 and copper sulfate addition has decreased.

The Palmdale Water District also supports the City of Palmdale's General Plan Safety Element which includes the following Goals, Objectives and Policies.

GOAL S4: Protect public safety through the implementation and enforcement of City Ordinances and through public education.

Objective S4.2: Support the development and continued updating of public education programs on health and safety.

Policy S4.2.3: Promote the use of emergency water supplies or water filtration systems at point-of delivery for acceptable water quality in emergency situations.

4.7 Hazard: Hazardous Material

The hazardous material (hazmat) risk probability and risk severity assessment listed below was identified by the Palmdale Water District's Hazard Mitigation Working Group as related to the District.

Probability	Severity
Low	Medium

Hazard Definition

A hazardous material is any material whose physical, chemical, or biological characteristics, quantity, or concentration may cause or contribute to adverse effects in organisms or their offspring; pose a substantial present or future danger to the environment; or result in damage to or loss of equipment, property, or personnel.

Hazardous materials consist of substances that by their nature, lack of containment, and reactivity, have the capability for inflicting harm. Hazardous materials poses a threat to health and the environment when improperly managed and can be toxic, corrosive, flammable, explosive, reactive, an irritant, or a strong sensitizer. Hazardous materials substances also include certain infectious agents, radiological materials, oxiders, oil, used oil, petroleum products, and industrial solid waste substances. Hazardous materials can pose a threat where they are manufactured, stored, transported or used. They are used in almost every manufacturing operation and by retailers, service industries, and homeowners.

Geologic resources (i.e., soil and groundwater) are susceptible to contamination from the surface. Releases of hazardous chemicals such as petroleum products and solvents have resulted in soil contamination at military installations. Contaminated soil or groundwater may require physical removal or extensive remediation to ensure the protection of public health and safety.

Hazardous material incidents are one of the most common technological threats to public health and the environment. Incidents may occur as the result of natural disasters, human error, and/or accident. Hazardous materials incidents typically take three forms:

- Pipeline incidents
    - Pipelines carry natural gas and petroleum. Breakages in pipelines carry differing amounts of danger, depending on where and how the break occurs, and what is in the pipe.
- Fixed facility incidents
    - It is reasonably possible to identify and prepare for a fixed site incident, because laws require those facilities to notify state and local authorities about what is being used or produced there.
- Transportation incidents
    - Transportation incidents are more difficult to prepare for because it is impossible to know what material(s) could be involved until an accident actually happens.

History

Numerous sites in the City of Palmdale area generate, use, or store hazardous substances, including USAF Plant 42, Lockheed Martin Aeronautics Company, and the Palmdale Water Reclamation Plant (PWRP).

The USAF Plant 42 operations include assembly of test aircraft and pilot training. Hazardous materials and wastes used and generated on site include various petroleum products, paints, solvents, and corrosives. USAF Plant 42 is listed on the EPA's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database as a potentially contaminated site. The California Department of Health Services (DHS) has also identified USAF Plant 42 as a hazardous waste site targeted for clean up. Twenty-eight contaminated areas have been identified; however, information available to date indicates that no hazardous waste exposure to public health or the environment exists at this time.

Lockheed Martin Aeronautics Company Joint Strike Fighter assembly area uses 54 hazardous materials in their operation; this is down from between four and five hundred hazardous materials that were used to support predecessor aircraft.

The Palmdale Water Reclamation Plant (PWRP) was constructed in 1953 in an unincorporated County area adjacent to the City of Palmdale. As the PWRP began operating, most of the effluent was managed using evaporation/percolation ponds. In 1959, PWRP District No. 20 began contracting with local farmers to provide effluent from the PWRP for agricultural irrigation. Throughout the 1960s, District No. 20 supported the use of effluent for agricultural irrigation, however, only a small portion of the total effluent managed was actually reused. By the 1970s, approximately one-third of the treated effluent from the PWRP was reused for crop irrigation with the remainder being sent to the evaporation/percolation ponds.

Major gas lines also come into Southern California over the San Andreas at several points, including Palmdale, Indio, the Cajon Pass and the Tejon Ranch. Officials at the Southern California Gas Company expressed confidence that the system could withstand a strong earthquake, noting they have been upgrading the pipeline for years.

Currently there are no hazardous waste landfills located in the Palmdale Water District Planning Area. The Palmdale Disposal Plant is a non-hazardous Class II landfill. Groundwater and surface water are protected from contamination by wastes deposited at the landfill through required waste management practices in place at the landfill.

Transport of Hazardous Materials

Transportation of hazardous materials/wastes and explosives through the Planning Area is regulated by the California Department of Transportation (DOT). SR-14 and SR-138 are State routes and are open to vehicles carrying hazardous materials/wastes. Palmdale City streets and unincorporated County areas are generally not designated as hazardous materials/wastes transportation routes, but a permit may be granted on a case-by-case basis. Transporters of hazardous wastes are required to be certified by the DOT and manifests are required to track the hazardous waste during transport.

Although no spills have been reported, the danger of hazardous materials/waste spills during transport exists and will potentially increase as industrial development in the Planning Area increases. At present, the Los Angeles County Fire Department is responsible for hazardous materials accidents at all locations within the Palmdale Water District Planning Area.

Hazardous Material Hazard Incidents

A review of the U.S. Department of Transportation's Hazardous Material Incident Reporting System (HMIRS) identified fifteen spills between 2002 and 2007 in the City of Palmdale but did not identify location with enough accuracy to determine if they were in the watershed.

There were two occasions between 2002 and 2007 (*as of October 26, 2007*), where vehicles crashed into Palmdale Ditch. Both occurred at bar screen No. 8, Pearblossom Highway Underpass (just off Pearblossom Highway to the south, approximately 150 feet west of Barrel Springs Road). Both vehicles were traveling east on Pearblossom Highway and unable to stop for traffic stopped at the traffic light.

The Palmdale Water District and surrounding areas have had a history of hazardous materials spill incidents. The following Table depicts some of the most recent recorded incidents.

Table 4-8. Hazardous Material Events

Date	Substance/Type	Reported Property Damage/Description
01/19/2008	Train vs. Pedestrian	Train ABRLC of the 17 hit a pedestrian at mile post 412.8 of the Mojave sub-division in Palmdale at the Sierra Hwy crossing.
11/05/2007	Cargo Fuel/Petroleum	40 gallons. Release occurred due to a traffic collision.
06/22/2007	Mineral Oil/Petroleum	5 gallons. Substance was released due to failure of a pad mounted transformer.
03/17/2007	Train vs. Vehicle/Railroad	Vehicle entered grade crossing and was struck by a train.
09/26/2006	Mineral Oil/Petroleum	50 gallons. A pad mounted transformer failed and spilled oil.
07/08/2006	Train vs. Vehicle/Railroad	Train struck an abandoned vehicle centered on tracks.
03/14/2006	Train vs. Vehicle/Railroad	Train struck a vehicle.
03/11/2006	Derailment/Railroad	Car ran over drawbar and derailed two wheels.
09/25/2003	Diesel/Petroleum	Released from a truck's saddle tanks as a result of a vehicle accident.
06/04/1999	Sodium Hydrochloride	An explosion tore open the roof of the Palmdale Water District treatment plant and burned a worker who had been installing a chlorine-generation system. An accumulation of hydrogen gas blew up while the worker was using a welding torch to install a vent for a bleaching-agent tank, causing first-degree and second-degree burns on the man's arms and cutting his face.
	Tank Leak	Tank leak at the Palmdale Regional Airport according to the California Regional Water Quality Control Board review of leaking underground storage tanks.
	Tank Leak	Tank leak at the Lockheed Martin facility according to the California Regional Water Quality Control Board review of leaking underground storage tanks.

Source: California Office of Emergency Services

Risk Assessment

If a railway derailment or hazardous spill on the Interstate should occur the local jurisdiction's concerns would be evacuation of the neighboring communities, water canal/source contaminations, and the containment of escaping gases or liquids. September 11 and subsequent news reports indicating that some terrorists in the U.S. have obtained drivers licenses for transporting hazardous materials, including hazardous wastes, called attention to a new form of hazmat threats.

- **Effects on people and housing.** People may be evacuated when a hazmat incident occurs. Relative to some of the other natural hazards assessed earlier in this LHMP, the numbers of people affected by hazmat incidents are usually less.

- **Effects on commercial and industrial structures.** There may be economic consequences due to hazmat incidents, but the damage is generally limited to clean-up of facilities and grounds, or simply interruption of business due to evacuation.

- **Effects on infrastructure.** Hazmat incidents involving transportation may result in downed power lines. Also, hazmat materials may impact waterways and drainage systems, and incidents can lead to the evacuation of schools, business districts, and residential areas.

Relationship to Other Hazards – Cascading Effects

The release of hazardous material into the environment could cause a multitude of problems. The release of explosive and highly flammable materials have cause fatalities and injuries, required large-scale evacuations, and destroyed millions of dollars worth of property. Toxic chemicals in gaseous form have caused injuries and fatalities among emergency response teams and passerby. Serious health problems have occurred where toxins have entered either surface or groundwater supplies. Releases of hazardous chemicals have been especially damaging when they have occurred in highly populated areas, or along heavily traveled transportation routes. The degree of threat posed to life and property is dependent on the type, location, and concentration of the material released, in addition to prevailing weather conditions such as precipitation, wind speed, and wind direction.

The San Andreas Fault, flooding, railroads and highways, including the Antelope Valley Freeway (State Route 14), the Sierra Highway, and the Pearblossom Highway, are significant contamination risks to the Palmdale Water District water supply.

Risk Assessment Conclusion

Hazardous material incidents are one of the most common technological threats to public health and the environment. Incidents may occur as the result of natural disasters, human error, and/or accident. Accidents can occur in the production, use, transport, and disposal of hazardous materials. Hazardous waste spills pose a direct or potentially direct threat to water quality. All spills must be reported to the State of California Office of Emergency Services (OES). During major emergencies, OES may call upon all State agencies to help provide support.

Development of industrial land in the Planning Area could increase risks associated with hazardous materials/wastes use. Programs for proper storage, handling, and disposal need to be developed according to state, federal, and local guidelines to reduce those risks.

The Palmdale Water District has taken an active role in protecting its sources of water supply from contamination and in preparing to deal with hazmat accidents should they occur.

Palmdale Water District Current Plans and Programs

- The District has encased a portion of the Palmdale Ditch from the Sierra Highway to Lake Palmdale. The segment is approximately one mile and will prohibit drainage into the canal from an area that has been a common source of pollution for the District.
- In an effort to discourage dumping in the area around the Palmdale Ditch, the District has blocked access to three common dumping areas and posted no trespassing signs. The District is in the process of obtaining permission from property owners to block several more common access points. In addition, the Sheriffs Department has increased patrols along the Ditch and in the area around Palmdale Lake.
- The District posted signs at Littlerock Reservoir informing visitors that water is used for drinking. Signs were designed as a part of a poster competition involving area schools.
- The District has hired Security to make random patrols every two to four hours (day and night) of Littlerock Dam. They are to check the valve house, dam and parapet, any illegal dumping or any other unusual activities or vandalism. They have contact for District staff and are also instructed to contact the local Sheriff when necessary. As of January 2008, there have been no major incidents reported.
- The water level behind the dam is monitored via SCADA. The dam is monitored monthly by District personnel who check and record the flow from the piezometers, exfiltration pump run hours and condition of the valve- house.
- The District maintains regular communications with the City of Palmdale and with the Forest Service. District staff review any proposed development and facilities in the watersheds to ensure that they do not adversely impact water quality, and that operation and maintenance of existing facilities is protective of water quality.

- The District produces a seasonal newsletter, 'Water News' to update users on water quality, use restrictions and activities taking place in the watershed.

The Palmdale Water District supports the City of Palmdale's General Plan Safety Element which includes the following Goals, Objectives and Policies.

GOAL S2: Minimize damage associated with man-made hazards.

Objective S2.3: Protect the public from hazardous materials and the hazards associated with the transport, storage or disposal of such materials.

Policy S2.3.1: Coordinate with Los Angeles County Fire Department to develop a listing of all hazardous waste generators that could affect City residents.

Policy S2.3.2: Continue to support and encourage state, City and County efforts to identify existing or previously existing hazardous waste generators or contaminated sites.

Policy S2.3.3: Require that soils containing toxic or hazardous substances be cleaned up to the satisfaction of the agency having jurisdiction, prior to the granting of any permits for new development.

Policy S2.3.4: Restrict or prohibit land uses and activities that generate excessive amounts of hazardous materials or wastes that cannot be properly maintained or disposed.

Policy S2.3.5: Promote the routing of vehicles carrying potentially hazardous materials along transportation corridors that reduce the risk to the public and sensitive environmental areas. Cooperate with regional agencies in developing such routing systems.

Policy S2.3.6: Require that all proposed hazardous waste facilities comply with the City's hazardous waste management plan and Chapter 9 Article 96 (hazardous Waste Facilities) of the Palmdale Zoning Ordinance.

Policy S2.3.7: Review proposed development in proximity to any existing or proposed hazardous waste facility, to ensure that future development and land use decisions consider and incorporate site design, setbacks and buffering techniques appropriate for the site and provide adequate mitigation of any potential adverse impacts to such development from hazardous waste facilities.

GOAL S4: Protect public safety through the implementation and enforcement of City Ordinances and through public education.

Objective S4.2: Support the development and continued updating of public education programs on health and safety.

Policy S4.2.1: Prepare and disseminate educational information to residents and businesses on preparing for response to hazards of the area, including major earthquake, floods, hazardous waste spills, wildfire, etc.

Policy S4.2.2: Encourage and assist the school districts in teaching children to respond appropriately in an emergency, especially to situations unique to a desert environment.

Such training should be repeated regularly to ensure that each child knows what to do in case of heat stroke, snake bites, floods, earthquakes, etc.

Policy S4.2.3: Promote the use of emergency water supplies or water filtration systems at point-of-delivery for acceptable water quality in emergency situations.

4.8 Hazard: Terrorism

The terrorism risk probability and risk severity assessment listed below was identified by the Palmdale Water District's Hazard Mitigation Working Group as related to the District.

Probability	Severity
Very Low	High

Hazard Definition

Terrorism is defined in 28 CFR Section 0.85) as "…the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives." Since September 11, 2001, terrorism has become a fact of life for all Americans. Planning for response to potential terrorist incidents has long been part of California's Emergency Preparedness Planning effort. California provides a target-rich environment for terrorists, with many facilities and venues and an easy place to hide in California's diverse population.

Until recently, contamination of water with biological, chemical or radiological agents generally resulted from natural, industrial or unintentional man-made accidents. Unfortunately, recent terrorist activity in the U.S. has forced the medical community, public health agencies, and water utilities to consider the possibility of intentional contamination of U.S. water supplies as part of an organized effort to disrupt and damage important elements of our national infrastructure. In his 2002 State of the Union Address, President Bush noted that confiscated Al Qaeda documents included detailed maps of several U.S. municipal drinking water systems. Apprehension regarding a terrorist assault on drinking water has also been reinforced by news reports and recent arrests of suspects charged with threatening to poison water supplies in the U.S. In addition, the National Academy of Sciences reported to Congress that water supply system contamination and disruption should be considered a possible terrorist threat in the U.S. As a result of these reports, there continues to be concern that water may represent a potential target for terrorist activity and that deliberate contamination of water is a potential public health threat.

Terrorists often use threats to create fear among the public, to try to convince citizens that their government is powerless to prevent terrorism, and to get immediate publicity for their causes. Terrorist acts or acts of war may cause casualties, extensive property damage, fires, flooding, and other ensuing hazards. Terrorism takes many forms, including:

Chemical. Chemical weapons have been used primarily to terrorize an unprotected civilian population and not as a weapon of war. This is because of fear of retaliation and the likelihood that the agent would contaminate the battlefield for a long period of time.

Some analysts suggest that the possibility of a chemical attack would appear far more likely than either the use of nuclear or biological materials, largely due to the easy availability of many of the necessary precursor substances needed to construct chemical weapons. Additionally, the rudimentary technical knowledge needed to build a working chemical device is taught in every college level chemistry course in the world. Some chemical agents are odorless and tasteless and are difficult to detect. They can have an immediate effect (a few seconds to a few minutes) or a delayed effect (several hours to several days).

A terrorist would not have to build a complicated chemical release device. During favorable weather conditions an already existing chemical plant could be sabotaged or bombed releasing a toxic cloud to drift into a populated area. The result could be just as dangerous as having placed a smaller chemical device in a more confined space. This type of incident would cause the maximum amount of fear, trepidation, and potential panic among the civilian population, and thus achieve a major terrorist objective.

Biological. Biological weapons are defined as any infectious agent such as a bacteria or virus used to produce illness or death in people, animals, or plants. This definition is often expanded to include biologically-derived toxins and poisons. Biological agents can be dispersed as aerosols or airborne particles. Terrorists may use biological agents to contaminate food or water because the agents are extremely difficult to detect. The agents are cheap, easy to make, and simple to conceal. Even small amounts, if effectively deployed, could cause massive injuries and overwhelm emergency rooms. The production of biological weapons can be carried out virtually anywhere — in simple laboratories, on a farm, or even in a home.

However, experts say it remains very difficult to transform a deadly virus or bacterium into a weapon that can be effectively dispersed. A bomb carrying a biological agent would likely destroy the germ as it explodes. Dispersing the agents with aerosols is challenging because biomaterials are often wet and can clog sprayers. Most agree that, while a biological attack could be devastating in theory, in reality, the logistical challenges of developing effective agents and then dispersing them makes it less likely a terrorist could carry out a successful widespread assault.

Radiological. A radioactive material is a material made up of unstable atoms which give off excess energy in the form of radiation through the process of radioactive decay. Radiation cannot be detected by human senses. Wherever radioactive materials are used, transported, or stored there is a potential for a radiological accident to occur. Under extreme circumstances an accident or intentional explosion involving radiological materials can cause very serious problems. Consequences may include death, severe health risks to the public, damage to the environment, and extraordinary loss of, or damage to, property. Some of their most common uses include use:

- by doctors to detect and treat serious diseases
- by educational institutions and companies for research
- by the military to power large ships and submarines
- by companies in the manufacture of products
- as a critical base material to help produce the commercial electrical power that is generated by a nuclear power plant
- as one of the critical components in nuclear weapons, which are relied upon to help deter the threat of war

Nuclear. The possibility exists that a terrorist organization might acquire the capability of creating a small nuclear detonation. A single nuclear detonation in the United States would likely produce fallout affecting an area many times greater than that of the blast itself. There is also the possibility that a terrorist will construct a “dirty bomb”, a bomb that is used to distribute nuclear contaminated materials. It would have less of an effect than a “traditional” nuclear bomb, but the terror effect on the population would be great.

Explosive. The possibility exists that a terrorist may attack with conventional explosives, particular in a public setting. Innumerable incidents have occurred around the world involving car bombs, truck bombs, and bombs attached directly to terrorist individuals. Explosive terrorist attacks may have consequences including death and damage to property.

Cyber-terrorism. Cyber-terrorism is the use of computer network tools to shut down critical government infrastructures such as energy, transportation, and government operations, or to coerce or intimidate a government or civilian population. The premise of cyber-terrorism is that as nations and critical infrastructure became more dependent on computer networks for their operation, new vulnerabilities are created. A hostile nation or group could exploit these vulnerabilities to penetrate a poorly secured computer network and disrupt or even shut down critical public or business operations.

The goal of cyber-terrorism is believed to be aimed at hurting the economy of a region or country, and to amplify the effects of a traditional physical terrorist attack by causing additional confusion and panic.

History

September 11 and subsequent news reports indicating that some terrorists in the U.S. have obtained drivers licenses for transporting hazardous materials, including hazardous wastes, called attention to a new form of hazardous material threat.

Fortunately, the Palmdale Water District has no history of incidents of chemical, biological, radiological, nuclear, or explosive terrorism.

Risk Assessment

Since September 11, some type of extreme militant foreign or domestic attack on the water sources, populated areas, agriculture chemicals and local military bases whether it is a direct attack or some type of contamination, could occur.

Many terrorist events have occurred in California. The majority of these incidents have been bombings. However, there is also a concern for the potential of Weapons of Mass Destruction (WMD) use in future terrorist events. The use of WMDs increases the potential for mass casualties and damage.

One of the special considerations in dealing with the terrorist threat is that it is difficult to predict. One must know the minds and capabilities of various terrorists and terrorist groups. These are characteristics terrorist organizations strive to conceal. Because all terrorists are not the same, the calculation is even more difficult. Two things are clear from the perspective of hazard mitigation. The most often used weapon of terrorists is bombs and the greatest potential for loss is from WMDs.

Because of the dynamic nature of the terrorist threat and the open nature of California society, all jurisdictions within California are vulnerable to terrorist attack.

- **Effects on people, economics, housing commercial and industrial structures**. Depending on levels of contamination and exposure, effects could range from minimal to devastating.

- **Effects on infrastructure.** Biological, nuclear, radiological, and cyber-terrorism can have profound effects on infrastructure. Terrorists may use biological agents to contaminate water supplies because the agents are extremely difficult to detect and are cheap, easy to make, and simple to conceal. Even small amounts, if effectively deployed, could cause massive injuries and overwhelm emergency rooms.

Risk Assessment Conclusion

Although detection methods for recognizing intentional contamination of a water supply are improving, the most likely initial indication that a water contamination event has occurred in a community will be a change in disease trends and illness patterns. Practicing healthcare providers are likely to be the first to observe these unusual illness patterns and must understand their critical role as "front-line responders" in detecting water-related disease resulting from biological, chemical or radiological terrorism. Healthcare practitioners provide an "early detection system" for possible exposure to weapons of mass destruction -- since humans continue to remain the most sensitive and often the only "detector" of a covert terrorist attack on our population. Early recognition, accurate diagnosis, and conscientious case reporting by community healthcare providers of suspected waterborne disease cases -- no matter what their clinical specialty -- will be critical to maintaining water security and safety and to protecting the public health in the future.

A coordinated and effective response to acts of water terrorism will depend upon cooperation among a multidisciplinary team of healthcare providers, public health and water utility practitioners, law enforcement professionals and community leaders in order to mitigate the potential impact of an intentional contamination event. In order to respond to a potential act of waterborne terrorism, healthcare providers must have access to immediately accessible and constantly updated information.

Due to events such as the 9/11 attack and the declared war against terrorism, national and local governments have assigned high priority to terrorist attack preparedness.

Palmdale Water District Current Plans and Programs

- Complete design and award a contract for the construction of a new perimeter fence around the Lake Palmdale property.
- Installed and utilized second Security Camera at the District's Water Treatment Plant site.
- The District has hired Security to make random patrols every two to four hours (day and night) of Littlerock Dam. They are to check the valve house, dam and parapet, any illegal dumping or any other unusual activities or vandalism. They have contact for District staff and are also instructed to contact the local Sheriff when necessary. As of January 2008, there have been no major incidents reported.
- The District maintains regular communications with the City of Palmdale and with the Forest Service. District staff review any proposed development and facilities in the watersheds to ensure that they do not adversely impact water quality, and that operation and maintenance of existing facilities is protective of water quality.

The Palmdale Water District supports the City of Palmdale's General Plan Safety Element which includes the following Goals, Objectives and Policies.

GOAL S2: Minimize damage associated with man-made hazards.

Objective S2.5: Minimize potential hazards related to crime through the development review process and through on-going public education programs.

Policy S2.5.1: Through the development review process, ensure that sites are designed so as to maximize safety and security of users. Site design should consider the following factors, at a minimum:

1. Visibility of user areas from the public right of way and/or adjacent properties;
2. Lighting of user areas;
3. Accessibility for patrol and emergency vehicles;
4. Legible Street numbers from both front and rear, where appropriate;
5. Use of open fencing where needed for site visibility;
6. Avoidance of dead ends or tunnel-like passageways in the pedestrian circulation system;
7. Visibility of parking areas by site users and/or the public right-of-way;
8. Use and maintenance of appropriate landscaping to maintain visibility and accessibility;
9. Security fencing to prevent trespass;
10. Prohibition of exterior ladders to permit roof access by trespassers;
11. Siting of laundry rooms, play areas and other accessory uses for maximum visibility and security; and
12. Designation of "defensible space" within project areas for site users.

Policy S2.5.2: Require all commercial and industrial projects to provide adequate lighting for buildings and parking areas, and visibility for patrol vehicles, to assist in law enforcement surveillance.

Policy S2.5.3: Where appropriate, require provisions of security within new developments on a continuing basis.

Policy S2.5.4: Encourage the formation and continued education of neighborhood and business watch groups, to assist the Sheriff Department in crime prevention and detection.

Objective S4.2: Support the development and continued updating of public education programs on health and safety.

Policy S4.2.1: Prepare and disseminate educational information to residents and businesses on preparing for response to hazards of the area, including major earthquake, floods, hazardous waste spills, wildfire, etc.

Policy S4.2.2: Encourage and assist the school districts in teaching children to respond appropriately in an emergency, especially to situations unique to a desert environment. Such training should be repeated regularly to ensure that each child knows what to do in case of heat stroke, snake bites, floods, earthquakes, etc.

Policy S4.2.3: Promote the use of emergency water supplies or water filtration systems at point-of-delivery for acceptable water quality in emergency situations.

5. Goals, Plans, and Mitigation Strategies

The Palmdale Water District Hazard Mitigation Working Group held a workshop to review and analyze the risk assessment. The Working Group developed goals and plans based on the risk assessment studies and selected those that were determined to be of greatest benefit in hazard reduction to the District. The goals and plans for the Palmdale Water District are as follows:

GOALS / PLANS	HAZARDS
Earthquake	
Goal	To mitigate access issues and improve survivability.
Plan 1	Fit potable water tanks with seismically triggered valves.
Plan 2	Increase stockpile of replacement materials (pipes, fittings, valves, etc.).
Plan 3	Purchase additional generators for remaining critical sites.
Plan 4	Implement back-up communication capability.
Flooding/Dam Failure	
Goal	Reduce possibility of damage and loss due to flooding.
Plan 1	Acquire additional heavy equipment and pre-position near vulnerable assets and population.
Plan 2	Establish a program to regularly turn rock stockpiles as they get compacted.
Wildfire	
Goal	Reduce impact of wildland fire to infrastructure.
Plan 1	Install sprinklers at remote booster stations.
Plan 2	Re-roof remote sites with fire retardant materials.
Plan 3	Install back-up generators at remote sites.
Extreme Weather	
Goal	Improve public education regarding survivability and continuing functionality during a weather event.
Plan 1	Consider new City Ordinances regarding water conservation requirements.
Plan 2	Continue to educate the public regarding water conservation.
Waterborne Diseases	
Goal	Increase detection, preparedness and responsiveness to potential waterborne disease contamination.
Plan 1	Acquire portable disinfecting units.
Plan 2	Acquire back-up incubator/laboratories to run water-borne disease tests.

GOALS / PLANS	HAZARDS
Hazardous Materials	
Goal	Minimize the impact of a hazardous materials incident.
Plan 1	Acquire additional hazmat removal equipment and pre-position at plant or as an alternative, store in a mobile trailer.
Plan 2	Update the Emergency Response Plan to note who has been trained in hazardous materials and to what extent, i.e., 8 hours, 24 hours or 40 hours of training courses.
Terrorism	
Goal	Increase deterrence and prevention measures.
Plan 1	Tie-in the SCADA security system into law enforcement agency.
Plan 2	Acquire improved/higher quality CCTV system.

6. Action Plans

The process used to prioritize mitigation strategies involved lengthy discussions with various stakeholders, followed by citizen and community review. The end result is a hazard mitigation Action Plan with a prioritized list of strategies that the Palmdale Water District expects to carryout during the next five years.

Prioritizing Strategies

The process used was to first prioritized goals and their respective objectives based on priority maps created during the risk assessments. Available resources and public input were also considered. The Palmdale Water District next assessed each strategy listed under the prioritized list of goals. The District then prepared a draft Action Plan that listed goals followed by a prioritized list of strategies.

In assessing and evaluating each strategy, the District considered the following factors:

1. The cost was justified
2. Financial resources were available; local or outside resources
3. Staff resources were adequate
4. Minimal impact on District departmental functions
5. Strategies mitigate risks for the riskiest hazard events
6. Strategies reflect the goals and objectives

Implementation/Administration

The Action Plan includes the principal contact and cooperating parties, timeframe and estimated cost and/or resource involved in carrying out the strategy. The use of FEMA's Benefit-Cost Analysis (BCA) software (FEMA Mitigation BCA Toolkit CD Version 3.0) will be used to identify the cost-effectiveness of each activity/project undertaken.

Each year the Action Plan will be revisited and the first year will be dropped as those activities are completed and another year will be added so that the Action Plan always reflects a five-year timeframe and remains current. Strategies undertaken and completed will be evaluated as to their effectiveness.

For the planning areas subject to flood hazards, the mitigation actions and projects that reduce flood risk and deal with repetitive loss structures will be in compliance with the NFIP. Those activities not completed during the first year will be re-evaluated and included in the first year of the new Action Plan if still appropriate.

Even though individual strategies will be assigned a principal contact to ensure implementation, overall responsibility, oversight, and the general monitoring of the Action Plan has been assigned to the District's Risk Management and Safety Officer who will provide periodic updates to the Water District's Board of Directors.

This Action Plan serves as a guide to spending priorities but will be adjusted annually to reflect current needs and financial resources. Some strategies will require outside funding for implementation. If outside funding is not available, then the strategy will be set aside until new sources of funding can be identified.

Palmdale Water District Action Plans

Hazard	Goal / Strategy	Mitigation Action	Priority	Responsible Party	Timeframe/ Schedule	Cost / Resources
Earthquake	To mitigate access issues and improve survivability.	Implement back-up communication capability.	1	Facilities Manager	6 months after FEMA funding approved	50,000-100,000 FEMA/ General Fund
Earthquake	To mitigate access issues and improve survivability.	Purchase additional generators for remaining critical sites.	2	Maintenance Supervisor	18 months after FEMA funding approved	$500,000/ FEMA/ General Fund
Earthquake	To mitigate access issues and improve survivability.	Fit potable water tanks with seismically triggered valves.	3	Maintenance Supervisor	6-12 months after FEMA funding approved	$100,000 FEMA/ General Fund
Earthquake	To mitigate access issues and improve survivability.	Increase stockpile of replacement materials (pipes, fittings, valves, etc.)	4	Construction Supervisor	3-6 months after FEMA funding approved	$200,000-$300,000 FEMA
Flooding/ Dam Failure	Reduce possibility of damage and loss due to flooding.	Acquire additional heavy equipment and pre-position near vulnerable assets and population.	1	Lead Equipment Mechanic	3-6 months after FEMA funding approved	$200,000 - $300,000 FEMA/EWP
Wildfire	Reduce impact of wildland fire to infrastructure.	Re-roof remote sites with fire retardant materials.	1	Maintenance Supervisor	6-12 months after FEMA funding approved	$5000 per site FEMA/NRCS /EWP
Waterborne Diseases	Increase detection, preparedness and responsiveness to potential waterborne disease contamination.	Acquire portable disinfecting units.	1	Maintenance Supervisor	12 months after FEMA funding approved	$10,000 per unit FEMA/EWP

Hazard	Goal / Strategy	Mitigation Action	Priority	Responsible Party	Timeframe/ Schedule	Cost / Resources
Hazardous Material	Minimize the impact of a hazardous materials incident.	Acquire additional hazmat removal equipment and pre-position at plant or as an alternative, store in a mobile trailer.	1	Risk Management & Safety Coordinator	12 months after FEMA funding approved	50,000-100,000 FEMA/ General Fund
Terrorism	Increase deterrence and prevention measures.	Tie-in the SCADA security system into law enforcement agency.	1	Maintenance Supervisor	Unknown at this time	Unknown FEMA/HSG
Terrorism	Increase deterrence and prevention measures.	Acquire improved/ higher quality CCTV system.	2	Maintenance Supervisor	6-12 months after FEMA funding approved	$1000 per site FEMAHSG

How the Mitigation Actions Identified Address Existing and New Buildings and Infrastructure

The table below cross references the proposed mitigation actions enumerated above to the specific hazards, buildings and infrastructure that are addressed by the actions.

Palmdale Water District	Existing Infrastructure			New Infrastructure	
	Water Management Structures	Public Structures	Lakes/ Reservoir	Water Management Structures	Lakes/ Reservoir
Earthquake Goal 1: To mitigate access issues and improve survivability. ***Earthquake Mitigation Action Plan:*** *a) Implement back-up communication capability.* *b) Purchase additional generators for remaining critical sites.* *c) Fit potable water tanks with seismically triggered valves.* *d) Increase stockpile of replacement materials (pipes, fittings, valves, etc.)*	X	X	X	X	X
Flooding Goal 1: Reduce possibility of damage and loss due to flooding. *Flooding Mitigation Action Plan:* *a) Acquire additional heavy equipment and pre-position near vulnerable assets and population.*	X	X	X	X	X
Hazardous Material Goal 1: Minimize the impact of a hazardous materials incident. *Hazardous Material Mitigation Action Plan:* *a) Acquire additional hazmat removal equipment and pre-position at plant or as an alternative, store in a mobile trailer.*	X		X	X	X
Waterborne Diseases Goal 1: Increase detection, preparedness and responsiveness to potential waterborne disease contamination. *Waterborne Diseases Mitigation Action Plan:* *a) Acquire portable disinfecting units.*	X		X	X	X

Palmdale Water District	Existing Infrastructure			New Infrastructure	
	Water Management Structures	**Public Structures**	**Lakes/ Reservoir**	**Water Management Structures**	**Lakes/ Reservoir**
Terrorism Goal 1: Increase deterrence and prevention measures. *Terrorism Mitigation Action Plan:* *a) Tie-in the SCADA security system into law enforcement agency.* *b) Acquire improved/higher quality CCTV system.*	X		X	X	X
Wildfire Goal 1: Reduce impact of wildland fire to infrastructure. *Wildfire Mitigation Action Plan:* *a) Re-roof remote sites with fire retardant materials.*	X		X		

7. Assets at Risk

List of Palmdale Water District's Assets at Risk for All Applicable Hazards
(Including Potential Dollar Losses)

Methodology used to prepare estimates: Assessor's values, replacement costs, insurance coverage, estimated costs based on recent construction procurements and/or local standard construction costs per square foot. There is no way to make an accurate estimate of the potential limits one hazard may cause. % denotes the approximate damage / loss to the identified asset as a result of each relevant hazard. The method used to establish each % was to logically assess the practical extent of loss or damage to each asset as balanced by the vulnerability of the asset to each hazard.

Type	Name	Latitude	Longitude	Structure Value	Contents Value	Earthquake	Flooding	Dam Failure	Wildfire	Extreme Weather	Water Supply Contamination	Hazmat	Terrorism
Structure	District Administrative Office	34.58746	-118.09297	$ 2,698,176	$ 378,000	75%	25%	20%	25%	25%	0%	20%	25%
Structure	Auto Repair/Metal Fabrication	34.58746	-118.09293	$ 289,933	$ 186,016	75%	25%	20%	25%	25%	0%	50%	25%
Structure	Warehouse	34.58746	-118.09293	$ 277,891	$ 449,600	75%	25%	20%	25%	25%	0%	50%	25%
Structure	Dock Building	34.58746	-118.09293	$ 39,737	$ 10,000	75%	25%	20%	25%	25%	0%	50%	25%
Structure	Vehicle Storage Building	34.58746	-118.09293	$ 315,889	$ 430,965	75%	25%	20%	25%	25%	0%	50%	25%
Structure	Office Building	34.58746	-118.09348	$ 665,550	$ 85,000	75%	25%	20%	25%	25%	0%	50%	25%
Lake	Palmdale Lake (Solar Bee Pond Circulators)	34.54846	-118.12527	n/a	$ 306,653	25%	0%	25%	0%	50%	0%	0%	25%
Structure	Water Treatment Plant Control Building	34.57948	-118.11659	$ 1,400,578	$ 3,178,607	75%	0%	0%	0%	20%	25%	50%	25%
Structure	Flocculation and Sedimentation Basins – Concrete Structure	34.57948	-118.11659	$ 7,718,633	n/a	75%	0%	0%	0%	20%	25%	50%	25%
Structure	Headworks and Influent Meter Structure – Reinforced Concrete	34.57948	-118.11659	$ 162,312	n/a	75%	0%	0%	0%	20%	25%	50%	25%

Type	Name	Latitude	Longitude	Structure Value	Contents Value	Earthquake	Flooding	Dam Failure	Wildfire	Extreme Weather	Water Supply Contamination	Hazmat	Terrorism
Structure	Emergency Generator Building	34.57948	-118.11659	$ 141,938	$ 107,226	75%	0%	0%	20%	20%	25%	50%	25%
Structure	Waste Water Basin	34.57948	-118.11659	$ 332,613	$ 5,927,964	75%	0%	0%	0%	20%	25%	50%	25%
Structure	Garage	34.57948	-118.11659	$ 164,969	$ 21,300	75%	0%	0%	20%	20%	25%	50%	25%
Structure	Equipment/Vehicle Storage Building	34.57948	-118.11659	$ 93,790	$ 41,707	75%	0%	0%	20%	20%	25%	0%	25%
Structure	Wind Turbine Tower	34.57948	-118.11659	$ 1,540,664	$ 302,176	75%	0%	0%	0%	50%	0%	0%	0%
Structure	25th Street Booster	34.55310	-118.08864	$ 206,860	$ 2,057,423	75%	0%	0%	20%	20%	25%	25%	25%
Structure	Lakeview Booster Station	34.54227	-118.14135	$ 4,950	$ 71,143	75%	0%	0%	20%	20%	25%	0%	25%
Structure	3 MG Booster – Building A	34.57959	-118.11443	$ 89,939	$ 178,506	75%	25%	0%	20%	20%	25%	0%	25%
Structure	3 MG Booster – Building B	34.57959	-118.11443	$ 53,964	$ 149,553	75%	25%	0%	20%	20%	25%	0%	25%
Structure	3 MG Booster – Building C	34.57959	-118.11443	$ 15,739	$ 28,689	75%	25%	0%	20%	20%	25%	0%	25%
Structure	Valve House	34.48558	-118.02448	$ 72,543	$ 279,502	75%	100%	100%	25%	25%	25%	0%	25%
Structure	6 MG Clearwell Pump Station	34.48558	-118.02448	$ 644,306	$ 746,187	75%	0%	0%	25%	25%	25%	0%	25%
Structure	Emergency Generator Building	34.48558	-118.02448	$ 153,173	$ 360,772	75%	0%	0%	25%	25%	25%	0%	25%
Structure	45th Street Pump Station	34.54527	-118.04970	$ 31,223	n/a	75%	10%	0%	25%	25%	25%	25%	25%
Structure	45th Street Emergency Generator Building	34.54527	-118.04970	$ 1,645,888	n/a	75%	10%	0%	25%	25%	25%	25%	25%
Structure	5 MG Booster Station	34.53208	-118.08439	$ 7,645	$ 71,182	75%	0%	0%	25%	25%	25%	0%	25%
Structure	Lower El Camino Booster Building	34.54934	-118.13252	$ 67,454	$ 181,956	75%	25%	0%	25%	25%	25%	25%	25%
Structure	T-8 Booster Building	34.53547	-118.06394	$ 71,951	$ 113,433	75%	10%	0%	25%	25%	25%	25%	25%
Structure	Underground Booster Building	34.54024	-118.13269	$ 147,557	$ 160,532	75%	25%	0%	25%	20%	25%	25%	25%
Structure	Upper El Camino 3900 Booster Building	34.53856	-118.13279	$ 7,195	$ 57,172	75%	25%	0%	25%	20%	25%	25%	25%

Type	Name	Latitude	Longitude	Structure Value	Contents Value	Earthquake	Flooding	Dam Failure	Wildfire	Extreme Weather	Water Supply Contamination	Hazmat	Terrorism
Structure	Well #2A Building	34.61072	-118.09431	$ 110,625	$ 620,785	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #3A Building	34.58017	-118.08983	$ 121,418	$ 410,677	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #3A Generator Building	34.58017	-118.08983	$ 272,066	$ 1,677,512	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #4A Building	34.58021	-118.08466	$ 32,378	$ 285,174	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #5A Building	34.54592	-118.10812	$ 38,854	$ 225,612	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #5A Chlorine Shed	34.54592	-118.10812	$ 16,819	$ 43,489	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #6A Building	34.59985	-118.11205	$ 17,988	$ 16,727	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #7A Building	34.59815	-118.08537	$ 33,727	$ 403,776	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #8A Building	34.58006	-118.08953	$ 53,289	$ 463,611	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #10 Building	34.58036	-118.06317	$ 25,633	$ 120,883	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #11A Building	34.60056	-118.10319	$ 25,295	$ 568,702	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #11A Chlorine Building	34.60056	-118.10319	$ 3,598	n/a	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #11A Sodium Hypochlorite Feed Building	34.60056	-118.10319	$ 40,473	$ 39,557	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #14A Building	34.61072	-118.09431	$ 46,768	$ 356,668	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #15 Building	34.61093	-118.11200	$ 47,780	$ 602,154	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #15 Chlorine Building	34.61093	-118.11200	$ 3,598	n/a	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #15 Sodium Hypochlorite Feed Building	34.61093	-118.11200	$ 40,473	$ 24,139	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #16 Building	34.55392	-118.07052	$ 4,415	$ 56,366	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #17 Building	34.56009	-118.14503	$ 7,195	$ 65,131	75%	25%	0%	10%	20%	25%	25%	25%

Type	Name	Latitude	Longitude	Structure Value	Contents Value	Earthquake	Flooding	Dam Failure	Wildfire	Extreme Weather	Water Supply Contamination	Hazmat	Terrorism
Structure	Well #18 Building	34.54292	-118.10754	$ 5,037	$ 75,568	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #18 Chlorine Shed	34.54292	-118.10754	$ 5,037	$ 42,285	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #20 Building	34.54125	-118.02933	$ 7,626	$ 56,478	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #20 Chlorine Shed	34.54125	-118.02933	$ 7,915	$ 27,878	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #21 Building	34.56215	-118.03649	$ 18,887	$ 40,569	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #22 Building	34.63161	-118.11548	$ 8,994	$ 84,660	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #23 Building	34.58006	-118.08948	$ 30,917	$ 238,150	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #23 Chlorination Building	34.58006	-118.08948	$ 5,756	n/a	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #23A Sodium Hypochlorite Feed Building	34.58006	-118.08948	$ 40,473	n/a	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #24 Building	34.58023	-118.08114	$ 59,360	$ 152,023	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #25 Building	34.56269	-118.00677	$ 66,105	$ 123,334	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #26 Building	34.56500	-118.04465	$ 26,982	$ 73,852	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #29 Building	34.56524	-118.00936	$ 250,000	$ 250,000	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #30 Building	34.57270	-118.09397	$ 75,886	$ 86,462	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #32 Building	34.56048	-118.06723	$ 26,982	$ 74,188	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #33 Building	34.57270	-118.09397	$ 50,591	$ 88,006	75%	25%	0%	10%	20%	25%	25%	25%
Structure	Well #35 Building	34.56615	-118.02282	$ 50,591	$ 91,483	75%	25%	0%	10%	20%	25%	25%	25%

8. Plan Maintenance

The Palmdale Water District's Local Hazard Mitigation Plan is a living document that reflects the District's ongoing hazard mitigation activities. The process of monitoring, evaluating, and updating the Plan will be critical to the effectiveness of hazard mitigation for the District.

The Palmdale Water District's Risk Management & Safety Officer has the responsibility for maintaining, evaluating, monitoring, and updating the Plan. He has developed a method to ensure that regular review and update of its LHMP occurs. FEMA regulations require an update every five years. Palmdale Water District will utilize the Hazard Mitigation Working Group to poll District participants to see if they want to continue to participate and if their elements of the Plan are up-to-date.

Factors that will be considered in evaluating whether a Plan update or revisions are required are:

- Relevance of LHMP goals and objectives to the evolving situation of the Palmdale Water District (i.e., significant changes in structures/buildings due to implementation of hazard mitigation projects).
- Consistency of LHMP goals and objectives with changes in state and federal laws, regulations or policies.
- Relevance of LHMP goals and objectives to current and expected conditions.
- New technologies.
- New information.

The risk assessment portion of the Plan will be reviewed to determine if the information should be updated or modified. The parties responsible for the various implementation actions will report on:

- Status of their projects
- Implementation processes that worked well
- Any difficulties encountered
- How coordination efforts are proceeding
- Which strategies should be revised

Palmdale Water District is committed to involving the public in the continual reshaping and updating of the LHMP. The Hazard Mitigation Working Group members are responsible for the annual review and update of the Plan. Although they represent the public to some extent, the public will be able to directly comment on and provide feedback about the Plan.

The hazard mitigation strategies of the Palmdale Water District's Urban Water Management Plan, Strategic Plan, and Watershed Sanitary Survey and Source Water Assessment, have been integrated into this LHMP. This LHMP will be provided to those responsible for the District's various Plan development and update mechanisms to insure that consistency is maintained.

This LHMP will serve as an important document in the above mentioned Plans update processes.

Copies of the Local Hazard Mitigation Plan will be kept on hand at the Palmdale Water District Administration Office. These copies will include the address and phone number of the District's staff member responsible for tracking public comment.