REPORT ON THE

MOAPA VALLEY FLASHFLOOD

AUGUST 10, 1981

PREPARED BY:

WESTERN REGION HEADQUARTERS
NATIONAL WEATHER SERVICE
SALT LAKE CITY, UTAH

JANUARY 25, 1982

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PREFACE

In accordance with instructions contained in NOAA Directives Manual 28-17 and Weather Service Operations Manual, Chapter I-06, a National Weather Service Western Region Survey Team was dispatched to appraise National Weather Service Operations, public response to NWS watches and warnings, and flood damages in connection with August 10, 1981 flash flooding in the Moapa Valley of southern Nevada.

The Survey Team consisted of the following personnel:

Richard J. Hutcheon, Assistant Chief, MSD, WRH, Survey Team Leader
Joseph Ganser, MIC, WSFO, Reno
Ralph Hatch, Flash Flood Hydrologist, CBRFC
Frank Taylor, OIC, WSO, Las Vegas

Members of the Survey Team met in Las Vegas on August 13, 1981. The main objective of the survey was to determine the effectiveness of watch and warning services provided to the flood stricken area of southern Nevada. To accomplish this, the Survey Team examined, in detail, operations of NWS offices in the state and interviewed numerous state, county, and local officials, representatives of the news media and local citizens. The Survey Team thanks all those who kindly cooperated by consenting to interviews and freely gave information. Improvements in the National Weather Service's watch/warning program are dependent upon cooperation and feedback from the news media, public officials, and the general public.

FOREWORD

It is customary after a significant weather-related disaster for the NWS to evaluate the effectiveness of the total warning system. The flooding that occurred in the Moapa Valley area on August 10 was the highest of record. Extensive damage resulted from the flooding. In addition, strong winds associated with the storm caused massive power black-outs, numerous injuries, and damage to buildings in the Las Vegas area. A Presidential Disaster Declaration was made to provide Federal assistance to individuals located in Clark County, Nevada.

As a result of the extensive damage, a Regional Survey Team was dispatched to southern Nevada. The team visited sites of heaviest damage, interviewed people in the affected area to learn what actions, if any, they took in response to NWS watches and warnings, and evaluated the accuracy and timeliness of the advisories.

A flash flood watch was issued and a high wind warning was issued as the thunderstorm situation developed during the afternoon of August 10. The offices in the State of Nevada performed well during the storm situation, despite the tremendous increase in workload brought about by power outages, blowing dust lowering ceilings and visibility to zero/zero condition, the tremendous increase in public contacts, the need to amend forecasts, etc.

The Survey Team found that the flash flood watch and the high wind warning issued for the severe thunderstorm event did not reach the people in the affected area. This points out the need for the NWS and other preparedness organizations at the Federal, state, and local levels to continue efforts to educate the public concerning methods of obtaining weather information and the potential dangers of flash floods and to continue to improve methods of communicating watches and warnings.

H. H. Bedke, Director
Western Region Headquarters
National Weather Service

EXECUTIVE SUMMARY

Heavy thunderstorms moved over southern Nevada during the afternoon of August 10, 1981. Winds up to 68 MPH preceded the thunderstorms at Las Vegas' McCarran Field and heavy rain fell over the Moapa Valley (located 50 miles northeast of Las Vegas), where, in less than an hour, up to 6.5 inches of rain was reported. The area of heaviest rain centered over the California Wash, Logan Wash, Overton Wash, and Valley of Fire Wash. The heavy rain produced major flooding in the four washes, with runoff values calculated by the USGS as the highest of record. The flooding and high winds resulted in millions of dollars worth of damage to the Moapa Valley area, Lake Mead Recreation area, and Las Vegas. No deaths were associated with the flooding or high winds.

This report describes the meteorological conditions that resulted in the severe thunderstorm activity, the hydrological conditions associated with the flash flooding, operations of the National Weather Service prior to and during this disaster, and the dissemination of forecasts, watches, and warnings. The report also describes public response to the forecasts and warnings. The following are the major findings and recommendations of the Survey Team.

1. The potential for heavy thunderstorms in southern Nevada was recognized early in the day on August 10. WSO Las Vegas and WSFO Reno were ready for the unusual weather situation. WSO Las Vegas attempted to call in extra help on overtime, but were unable to reach staff members that were off duty. There appeared to be good coordination among the Nevada offices as this storm situation developed.

2. With the threat of high winds in the Las Vegas area, WSO Las Vegas issued a timely high wind warning. Procedures outlined in WSOM, Chapter C-42 specify that high winds associated with convective activity warrant a severe thunderstorm warning.

Recommendation: WSO Las Vegas and other WSOs that are faced with severe thunderstorms infrequently should ensure that spring drills include a situation which involves the issuance of a severe thunderstorm warning.

3. A flash flood watch was issued prior to the flooding event. A flash flood warning would have been appropriate; however, limited feedback from the affected area did not provide the proper amount of information necessary for the offices to issue a warning. The severity of the flooding was not known until the following day.

Recommendation: WSO Las Vegas with assistance from WSFO Reno and the Colorado Basin RFC should continue efforts to develop a spotter network throughout the southern counties of Nevada. Contact with a number of spotters had been made prior to the flooding of the Overton-Moapa Valley area, but these spotters were not responsive during the heavy rainfall. This points out clearly the need not only to develop the spotter network but also to maintain it through telephone or personal contacts on a routine basis.

4. Las Vegas' NOAA Weather Radio was off-the-air from 6:00 p.m. until 11:05 p.m. PDT, on Monday, August 10, because of a power outage at the transmitter site on Red Mountain.

Recommendation: The National Weather Service should examine ways to ensure that all NOAA Weather Radio consoles and transmitters have emergency power available. Outages of NOAA Weather Radios during unusual or severe weather have occurred in the past. As more and more county warning officials and other emergency officials come to rely upon NOAA Weather Radio as a primary means of obtaining their information during weather disasters, the need for emergency power to keep NWR operating in severe weather situations becomes imperative.

5. The watch and warning that were issued during the event did not reach the people in the affected area, even though WSO Las Vegas disseminated them in a timely manner.

Recommendation: This finding points out the need for offices with warning responsibility to trace the dissemination of warnings with county officials. This should begin with the issuance of the warning at a WSFO or WSO and include the communication channels that a warning will take to the individuals in the community.

6. While there were minor deficiencies with regard to the performance of offices involved in the flash flood and severe thunderstorm situation, the team found that during the late afternoon and evening of August 10, WSO Las Vegas had two people on duty during the storm. These two were extemely busy handling phone calls initially until incoming telephone calls were terminated by power outage, then taking observations during low and rapidly changing ceiling and visibility conditions, taking radar observations, issuing a number of statements to the public, amending the terminal forecast, coordinating with other offices, etc. Their performance under the circumstances was very good.

MOAPA VALLEY FLASH FLOOD
AUGUST 10, 1981

INTRODUCTION

During the afternoon and evening of Monday, August 10, 1981, an east-west line of thunderstorms moved southward across southern Nevada. At the point where this line intersected with a less well-defined north-south line of thunderstorms extending through Arizona and into southern Nevada, a large severe thunderstorm developed. Winds and rainfall from this thunderstorm were of relatively short duration, but the heavy rains and strong winds resulted in a major disaster for portions of southern Nevada.

Winds associated with the thunderstorm were estimated to be 70-80 MPH over much of Clark County in southern Nevada. At 5:00 p.m. PDT, wind gusts to 68 MPH were recorded at Las Vegas' McCarran Field. Heavy rain was confined to a relatively small area, about 50 miles northeast of Las Vegas (WSO LAS reported only .19 inch) where in less than an hour up to 6.50 inches fell.

The area of heaviest rain was centered over the California Wash, Logan Wash, Overton Wash, Valley of Fire Wash and the lower Muddy River. (Figure 1) The heavy rain produced major flooding in the four washes with runoff values calculated by the USGS as the highest of record.

The flooding and high winds caused 10's of millions of dollars worth of damage to the Moapa Valley area, Lake Mead Recreation area and Las Vegas.

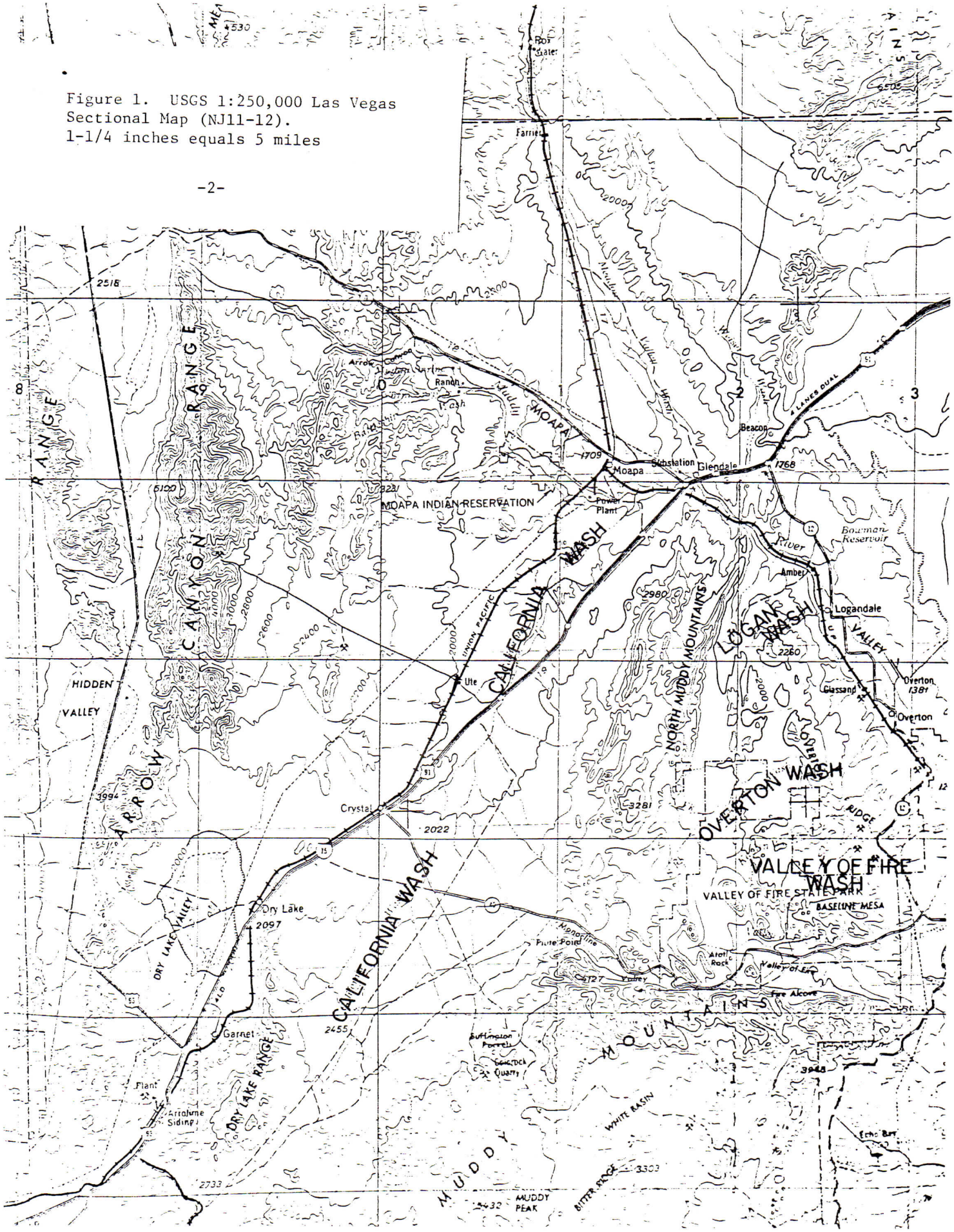
The strong winds Monday evening resulted in massive power blackouts, numerous injuries from flying debris, and damage to buildings in the Las Vegas area. More than 100,000 customers of Nevada Power Company in Las Vegas were without power for much of Monday night. Wind damage in the Las Vegas area included the destruction of a historic 53 year old Ford Tri-Motor plane, valued at $1.5 million. In addition, numerous residents reported roof damage and damage resulting from downed trees.

The high winds did considerable damage to boat harbors along the shores of Lake Mead. (Figure 2) Initial reports place damage at more than $1 million to boats and facilities of the heavily used recreation area. Reports indicate that the storm sank 20 boats at Temple Bar Marina and 14 more at Callville Bay. Five boats sank at the Las Vegas Boat Harbor and dozens of others were damaged as waves created by the strong winds ripped the crafts from their moorings and buckled the marina.

The most serious damage associated with the storm came from the record floods in the Moapa Valley area northeast of Las Vegas. Water flowing northward down the California Wash heavily damaged Hidden Valley Ranch, Nevada's largest dairy farm located about 3 miles southwest of Glendale. (Figure 3) Approximately 500 dairy cows died in the flood and a trailer court owned by the dairy was heavily damaged when up to 7 feet of water flowed through it. Twenty mobile homes were destroyed or damaged according to Red Cross estimates. The dairy manager estimated damage in the neighborhood of $3 million. The flooding began in Hidden Valley about 6:00 p.m. Monday, August 10.

Flood waters also spilled over the banks of the California Wash and over-flowed Interstate Highway 91 southwest of Glendale. Flood waters from the California Wash entered the Muddy River at Glendale, topping the bridge there by 5 to 6 feet.

Figure 1. USGS 1:250,000 Las Vegas Sectional Map (NJ11-12).
1-1/4 inches equals 5 miles



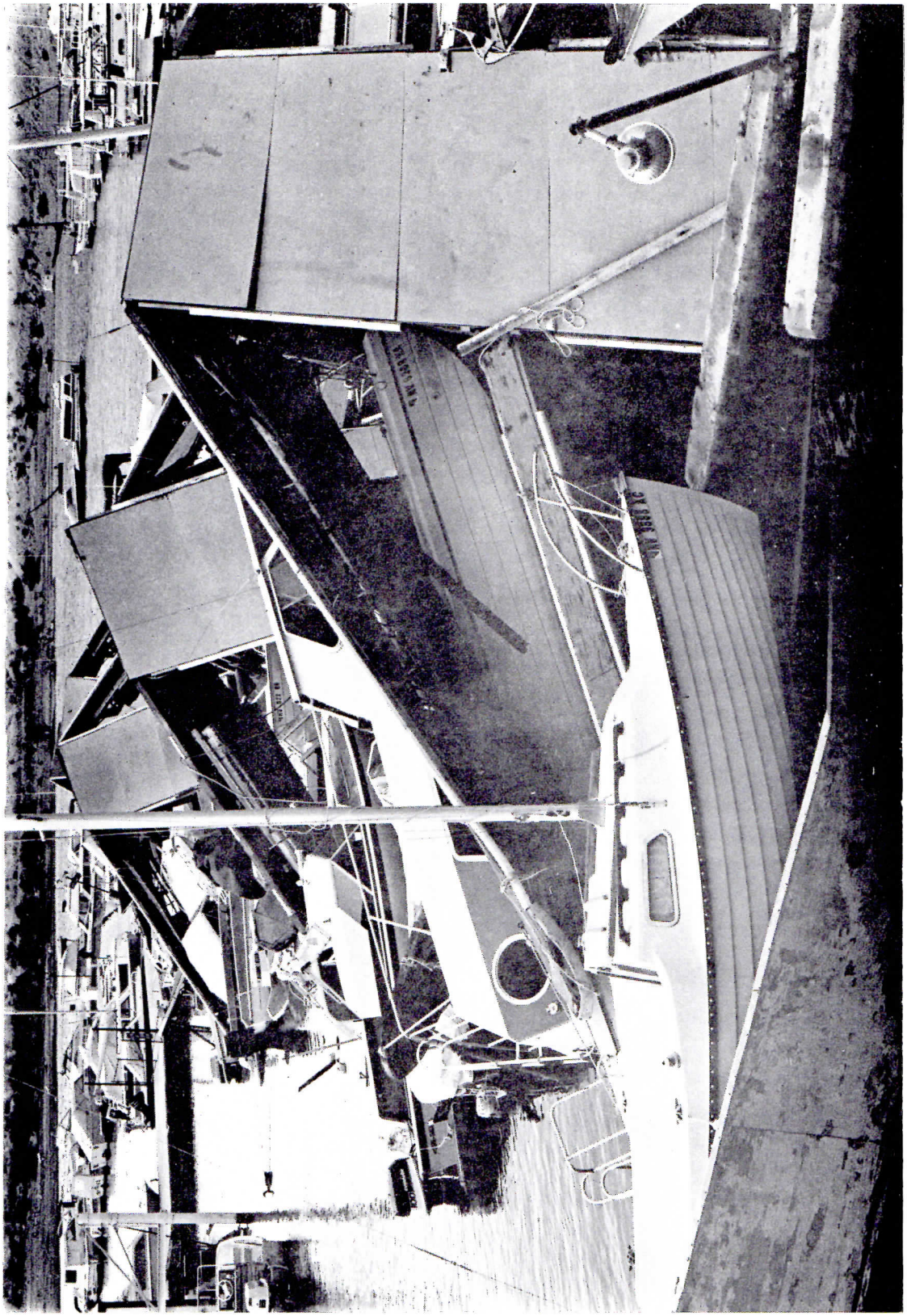


Figure 2. Lake Mead wind damages. (Photo: Bob McKeever)

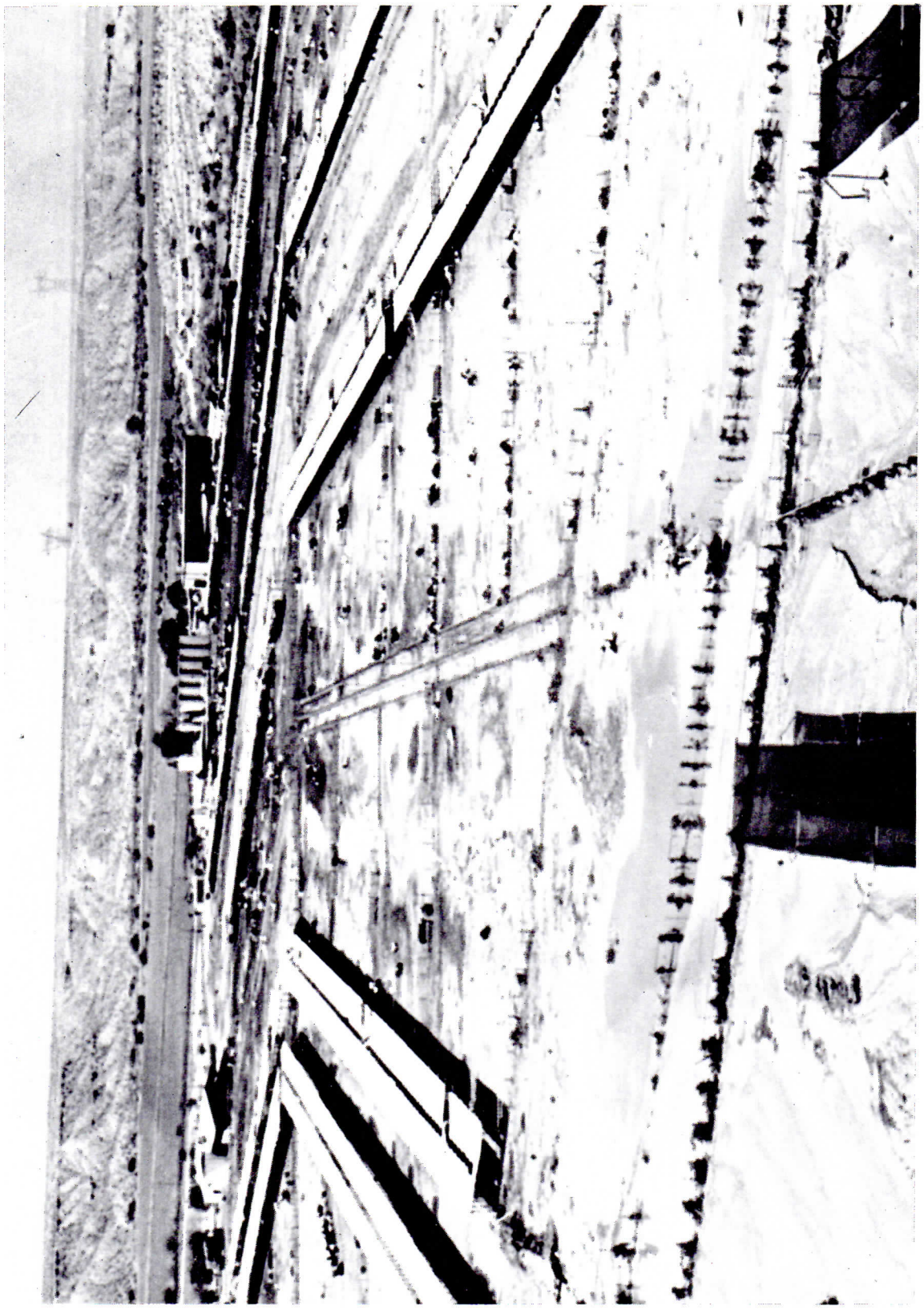


Figure 3. Damage by floods to Hidden Valley Ranch. More than 500 head of dairy cows died in the floods. (Photo: Ken Jones)

At approximately 6:00 p.m. Monday, flood waters were entering Overton from the west through Overton Wash. Overton, one of the communities hardest hit, had the entire southern portion of the town inundated, destroying or damaging 84 mobile homes and 37 single family dwellings. More than 700 Overton residents were evacuated Monday evening in the wake of the flooding. (Figure 4)

Water from the California Wash flowing down the Muddy River entered Logandale area about 11:00 p.m., topping the Logandale bridge by two feet and flooding portions of that community. The Red Cross reports that 24 single family dwellings in Logandale were destroyed or damaged as well as 7 mobile homes receiving damage.

At approximately midnight, flood waters from the Muddy River entered Overton contributing further to that community's flood problems.

In addition to damage to homes and farms in the Moapa Valley area, considerble damage was done to roads and railroads by the flooding. (Figure 5) Waters flowing down the Valley of Fire Wash cut a 200 foot section of roadway to a depth of 35 feet. Overall, the Director of County Public Works Department for Clark County estimated flood damage to roads, bridges and flood dikes at $5 million.

Despite the extensive damage affecting a number of communities, no deaths occurred during the storm. Numerous injuries were reported as well as many close calls. For example, Lillian Martin, 85, of Overton was swept from the porch of her mobile home by flood waters, swept downstream until she was able to grab a bush and then spent the night mired in hip deep mud. She was spotted by a helicopter and rescued nearly 12 hours later and survived with only bruises.

A Presidental Disaster Declaration was made on August 28, 1981, to provide Federal assistance to individuals located in Clark County, Nevada. The FEMA/State Damage Assessment Team determined that a total of 252 residences were damaged, along with four rental units and 24 businesses. There was much agricultural damage, including 760 cattle, 20 hogs and 600 acres of farmland which will require reworking as a result of erosion and/or silting.

METEOROLOGICAL ASPECTS OF THE FLASH FLOOD

On Sunday, August 9, scattered thunderstorm activity developed in Nevada in advance of a 500 mb trough of low pressure moving southward from the Pacific Northwest. This thunderstorm activity followed a long, dry spell in Nevada. Thunderstorm activity of the 9th was concentrated in west central Nevada. It was high based due to the limited moisture in the air mass and produced little surface rainfall. A few thunderstorms developed in southeastern Nevada Sunday afternoon, but more importantly, precipitable water started increasing as a result of moisture from Arizona and southeast California.

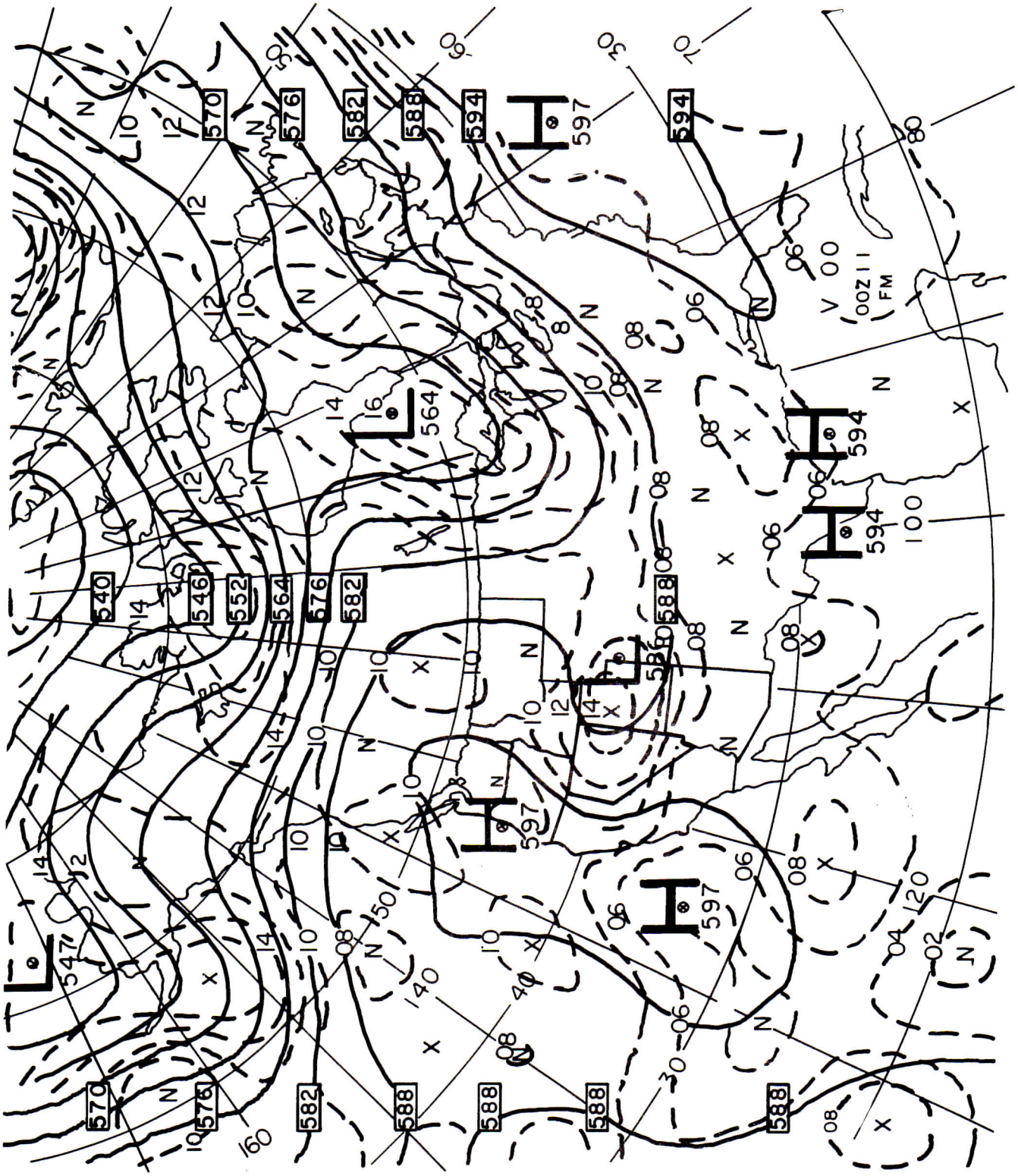
On August 10, an east to west line of convective activity developed from near Tonopah to a little south of Ely. This area coincides with LFM and spectral forecast of positive vorticity advection associated with southward moving 500 mb trough. (Figure 6) The line of convective activity moved south during the day and expanded. It remained well correlated with the positive vorticity advection area. A 500 mb wind maximum provided upper level divergence over the area.

Radar reported mostly VIP 3s but isolated VIP 4s and 5s were also observed. Storm movement was generally to the southeast at 20 to 25 knots. Satellite imagery (Figures 7 and 8) indicated a well-defined line of thunderstorms extending east-west through

Figure 4. Overton trailer court heavily damaged by flood waters.

Figure 5. Railroad damage in Moapa Valley.

Figure 6. LFM 500 mb Analysis
00Z Tuesday, August 11, 1981



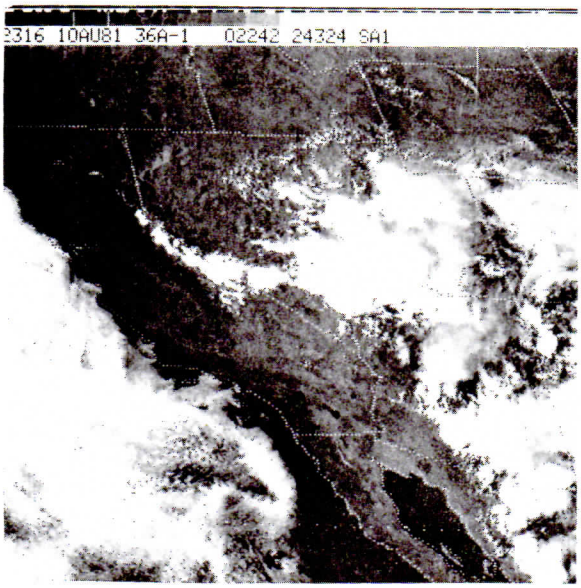


Figure 7. Infrared GOES Satellite imagery for 2316Z August 10, 1981.

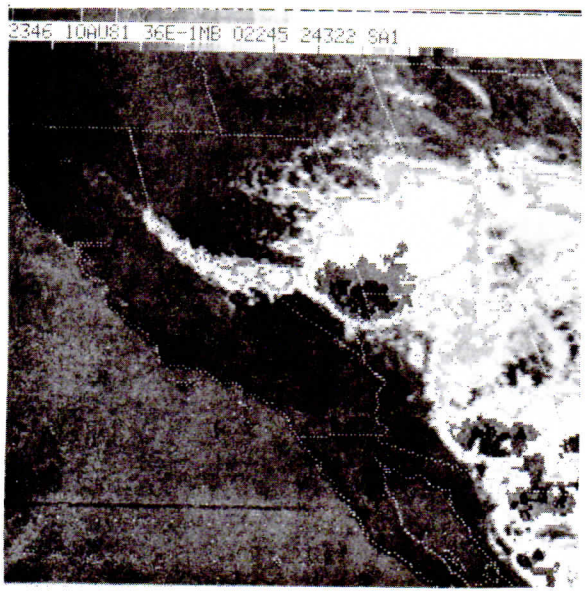


Figure 8. Enhanced infrared GOES Satellite imagery for 2346Z August 10, 1981.

Nevada. At the point where this line merged with a less well-defined line extending up from southern Arizona, severe thunderstorm activity developed. These thunderstorms developed over the Moapa Valley area during the afternoon and evening of August 10.

The flooding in the Moapa Valley resulted from thunderstorms that were associated with a small, well organized southward moving low pressure trough. The trough caused a significant increase in moisture over the area the day before the rain. The unusually strong dynamics for the season, combined with the hot desert air mass, resulted in strong convection that lasted long enough to produce heavy rainfall and flash flooding despite the relatively fast movement of the individual thunderstorm cells.

THE HYDROLOGY

The lower Muddy River Basin of Nevada (below the Moapa U.S.G.S. gaging station) drains into Lake Mead north of Las Vegas in the Moapa Valley. It drains an arid mountainous basin with farming on both sides of the river. The lower basin has a drainage area of 4,490 square miles with the majority of the area being drained from the north by the Meadow Valley Wash which enters the Muddy River at Glendale.

The lower basin elevation ranges from 1,200 feet MSL on the Muddy River at Overton Beach to 5,100 feet MSL in Arrow Canyon. The average slope of the river from Moapa to Overton Beach is about 20 feet per mile. However, the slope of the major contributing tributaries ranges from 120 - 150 feet per mile.

The storm on the afternoon of August 10, 1981, produced record flooding from four major washes in the Moapa Valley area: California Wash, Overton Wash, Logan Wash and Valley of Fire Wash. Eyewitness observations of flood damages in the Moapa Valley, interviews with personnel from other agencies and residents of Moapa Valley verified the major flood producing areas. The Soil Conservation Service in Las Vegas said their surveys indicate that Meadow Valley Wash contributed very little (about 20 cfs), even though it covers the largest area. Similarly, the confluence of Battleship Wash and the Muddy River, about 3 miles up stream from Moapa, was only about one foot above normal. Railroad employees and other residents in the Moapa-Glendale area confirmed these reports.

The highest flood waters came out of California Wash, (drainage area of about 268 square miles), which the U.S.G.S. has calculated, in their preliminary reports, as 50,000 cfs as it entered the Muddy River at Glendale about 6:30 - 7:00 p.m. Flood waters spilled over the banks of the California Wash and over-flowed Interstate Highway 91 in several areas about 8 - 10 miles southwest of Glendale. Further downstream, the flood washed out approximately five miles of Union Pacific Railroad tracks and devastated the community of Hidden Valley and Hidden Valley Dairy with up to seven feet of water. Flood waters entered the Muddy River at Glendale, where it reportedly topped the bridge on the Moapa Road by 5 to 6 feet and was about 1/4 mile wide. High water marks and debris in nearby trees indicate that the reports were fairly reliable. According to the SCS log, at 10:30 p.m. the flow of the Muddy River was 10 feet below the Logandale Bridge. At 11:06 p.m., the flow overtopped the bridge at Logandale and at 12:25 a.m. the flow was still two feet over the bridge. The flood waters continued down stream and entered Lake Mead east of Overton at about 12:30 to 1:30 a.m.

Overton Wash, 27.25 square miles, had a peak flow of about 13,000 cfs through the southeast portion of Overton. In establishing the peak flow on Overton Wash, the U.S.G.S. encountered several problems. The main obstacle was a constriction on the wash caused by Overton Ridge about 2 miles upstream, from town. This caused the flood

waters to pool to 20 feet deep or more and allow only about 13,000 cfs to pass down the channel into town. Flow above the constriction was established to be much higher. Water marks indicated water was at least 1-1/2 feet deep on many of the streets in Overton, including Main Street. Flood waters from the Muddy River were 2 feet deep along Highway 12 from Logandale to Overton, depositing bales of hay along the road between the two towns.

Mr. Harry Perkins, Director of the Overton Community Center and Overton Civil Defense Coordinator, stated that extremely heavy rains fell in Overton (Overton Fish and Game Refuge southeast of town reported 2.50 inches in 20 minutes; a bucket survey at the north end of town showed 0.70). This was accompanied by winds of 70-80 MPH. Rains ended about 5:15 p.m. At about 6:00 p.m., Mr. Perkins was standing on the Overton Wash diversion dike on the southeastern edge of town and saw an "eight foot wall of water" coming down the wash. He quickly got off the dike. When the water reached where he had been standing, it surged 30 feet into the air and continued down Perkins Street to the Muddy River. In 10 minutes, a 100 foot section was torn out of the dike. Flood waters picked up the railroad tracks and ties, on the west end of Perkins Street, and moved them laterally about 50 feet, placing them against a house and garage.

In another area, Logan Wash (a very small basin of about five square miles) flood waters of about 2,200 cfs caused considerable damage to homes and trailers along the railroad tracks.

Valley of Fire Wash, 26.5 square miles, had a flood wave of about 20,000 cfs. Mr. Newton Sikes, Chief Ranger of Lake Mead Recreational Area, National Parks Service, reported winds up to 80 MPH and very heavy rains for about 30 minutes. Shortly after the rains had stopped, flood waters came down the wash cutting out a 200 foot section of road (mile 42.5) to a depth of 35 feet, taking out four 4-foot diameter culverts and one 12-foot culvert.

The headwaters of three of the four washes (California, Overton and Valley of Fire) are in the same vicinity of the southern North Muddy Mountains. Logan Wash (Benson) is considerably smaller but also comes out of the North Muddy Mountains. Although the major flood waters hit Hidden Valley and Overton 1 - 2 hours after the rains in the Moapa Valley had ended, it is apparent that flood-producing rains occurred in an area from Ute to the headwater areas of the southern North Muddy Mountains, 10 - 12 miles south of Glendale. The extremely high precipitation values in the area of Ute help explain the record high flows in the lower portion of the California Wash.

The residents of Moapa Valley universally agreed that the very strong winds, 70 - 80 MPH, blew for about 15 minutes, when it rained extremely hard for approximately 20-30 minutes. Several precipitation reports indicate the spottiness of the storm: Logandale Experimental Station, 1.20"; Overton Fish and Game Refuge, 2.50", Echo Bay, .20"; Valley of Fire, 3.00"; and Bunkerville, .10". "Bucket Surveys" conducted in the Moapa Valley indicated .75 to 1.00" of precipitation. However, the survey was made 2-1/2 days after the event in an area where daytime temperatures reached 100, and significant evaporation was likely. In a "Bucket Survey" conducted by the U.S.G.S. measurements of 6.50 inches and 4.00 inches were found near Ute and there were indications of high amounts in the southern portion of the North Muddy Mountains.

The runoff values calculated by the U.S.G.S. are probably the highest of record in this area. NOAA Technical Memorandum NWS WR-130 indicates that the runoff values calculated by the U.S.G.S. could very easily be met with an average basin rainfall of 1.50 - 1.75 inches in about 30 - 35 minutes. (Tables 1-4)

The previous flow of record for California Wash was 10,000 cfs on August 11, 1941, and for Muddy River at Glendale, 12,000 cfs on August 11, 1941. U.S. Army Corps of Engineers had estimated intermediate regional flood (100-year flood) flow for the Muddy River near Glendale to 21,000 cfs, and the standard project flood (Probable Maximum Flood) flow to be 47,000 cfs. These values most likely will be raised.

BASIN - CALIFORNIA WASH
AREA 268.0 SQ MI SUB-AREA NUMBER 2

PRECIP (IN)	DURATION (MIN) 15	30	60	120	180
.50	10182.	8888.	*******	*******	*******
1.00	30671.	19372.	13553.	11866.	11115.
1.50	92955.	42360.	25165.	20451.	18095.
2.00	283171.	92893.	46819.	35301.	29496.
3.00	314857.	314857.	162908.	105631.	78652.

*** WARNING 0.5 INCHES OF PRECIP TO SMALL TO COMPUTE ON GRAPH

Table 1.

BASIN - OVERTON WASH
AREA 27.2 SQ MI SUB-AREA NUMBER 2

PRECIP (IN)	DURATION (MIN) 15	30	60	120	180
.50	2614.	2198.	*******	*******	*******
1.00	10656.	5939.	3766.	3179.	2924.
1.50	43483.	16058.	8285.	6363.	5444.
2.00	81041.	43446.	18233.	12740.	10139.
3.00	81041.	81041.	81041.	51118.	35192.

*** WARNING 0.5 INCHES OF PRECIP TO SMALL TO COMPUTE ON GRAPH

Table 2.

BASIN - VALLEY OF FIRE WASH
AREA 26.5 SQ MI SUB-AREA NUMBER 2

PRECIP (IN)	DURATION (MIN) 15	30	60	120	180
.50	2557.	2148.	*******	*******	*******
1.00	10456.	5819.	3687.	3110.	2861.
1.60	42792.	15771.	8125.	6236.	5334.
2.00	79710.	42756.	17912.	12506.	9948.
3.00	79710.	79710.	79710.	50322.	34619.

*** WARNING 0.5 INCHES OF PRECIP TO SMALL TO COMPUTE ON GRAPH

Table 3.

BASIN - LOGAN (BENSON) WASH
AREA 5.0 SQ MI SUB-AREA NUMBER 2

PRECIP (IN)	DURATION (MIN) 15	30	60	120	180
.50	606.	493.	*******	*******	*******
1.00	3285.	1620.	938.	766.	693.
1.50	18376.	5411.	2421.	1760.	1459.
2.00	29615.	18357.	6319.	4081.	3092.
3.00	29615.	29615.	29615.	22441.	14158.

*** EQUATIONS MAYBE UNSTABLE FOR AREAS LESS THAN 5 SQ MI
*** WARNING 0.5 INCHES OF PRECIP TO SMALL TO COMPUTE ON GRAPH

Table 4.

PRECIPITATION REPORTS

Evening of August 10, 1981

Cooperative Observers.	INCHES
SPRING VALLEY STATE PARK	1.08
PIOCHE	.61
MODENA	1.42
ENTERPRISE BERYL JUNCT.	.80
NEW HARMONY	.92
ENTERPRISE	.39
CALIENTE	.14
ELGIN	.00
ST. GEORGE	.50
VEYO PH	.25
BEAVER DAMS	.55
VALLEY OF FIRE	3.00
LOGANDALE	1.20
PAHRUMP	.12
PAHRAUGAT W. L. REFUGE	.35
BUNKERVILLE	.10
FLASH FLOOD COOPERATIVE OBSERVERS.	
Key Pittman	1.50
Overton Fish and Wildlife Refuge	2.50
NATIONAL PARK SERVICE	
Echo Bay	.20
Willow Beach	.98
Las Vegas Beach	.05
BUCKET SURVEY (USGS)	
NORTH OF UTE	6.50
Near Ute	4.00
Near Moapa	0.70
South of Moapa	1.30

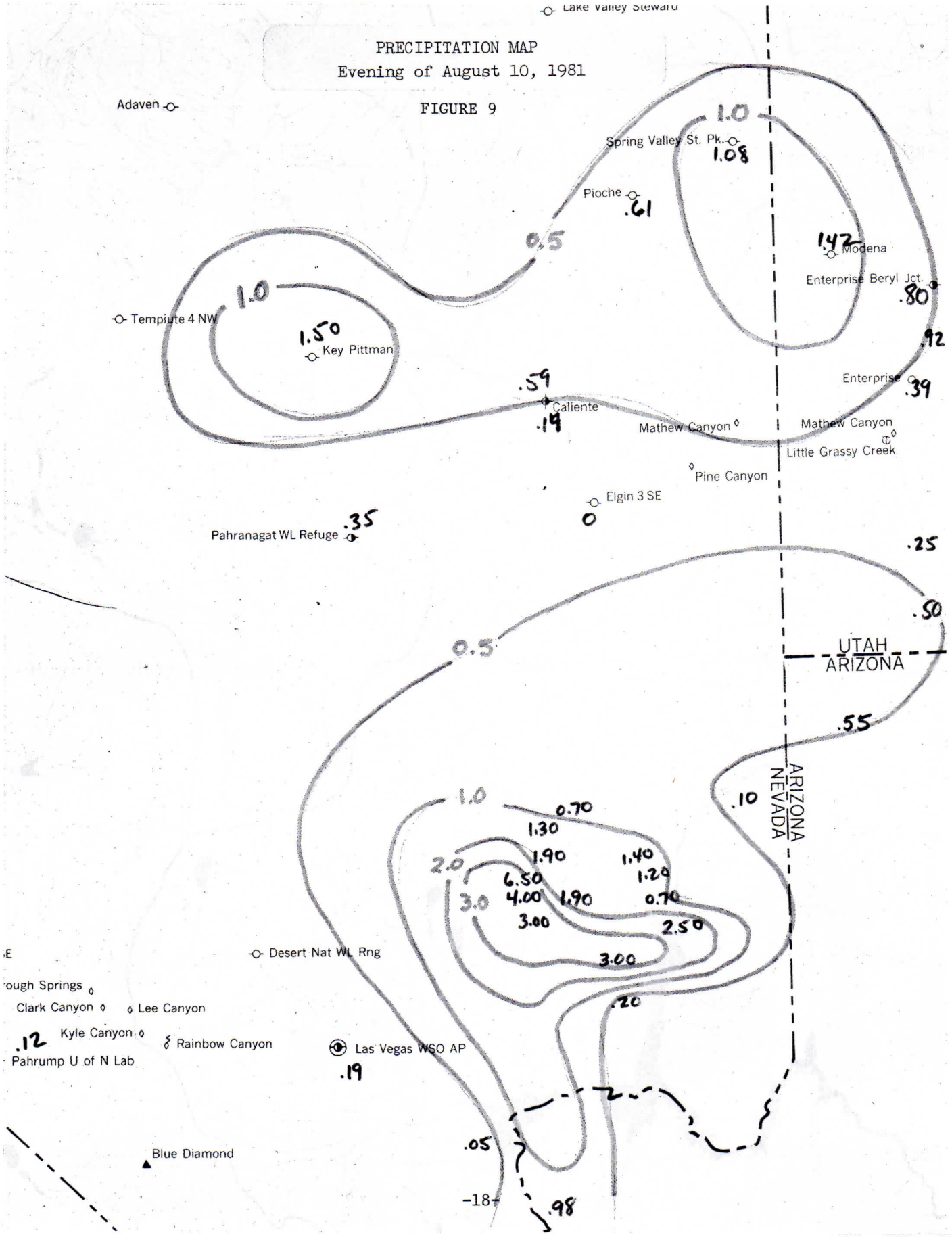
Table 5.

PRECIPITATION REPORTS (Continued)

Evening of August 10, 1981

BUCKET SURVEY (USGS) (Continued)	INCHES
Logandale	1.40
Overton	.70
5 miles south Moapa	1.90
1 mile SE Ute	3.00
2 miles south Moapa	1.90
LAS VEGAS WSO	.19
Caliente RAMOS	.59

Table 5. (Con't.)


Lake Valley Steward
PRECIPITATION MAP
Evening of August 10, 1981
FIGURE 9
Adaven
Spring Valley St. Pk.
1.08
Pioche
.61
1.0
0.5
1.42
Modena
Enterprise Beryl Jct.
.80
.92
Tempiute 4 NW
1.0
1.50
Key Pittman
.59
Caliente
.19
Enterprise
.39
Mathew Canyon
Mathew Canyon
Little Grassy Creek
Pine Canyon
Elgin 3 SE
0
Pahranagat WL Refuge
.35
.25
.50
0.5
UTAH
ARIZONA
.55
ARIZONA
NEVADA
.10
1.0
0.70
1.30
1.90
2.0
1.40
1.20
6.50
4.00
1.90
0.70
3.0
3.00
2.50
3.00
.20
Desert Nat WL Rng
ough Springs
Clark Canyon
Lee Canyon
.12
Kyle Canyon
Rainbow Canyon
Pahrump U of N Lab
Las Vegas WSO AP
.19
Blue Diamond
.05
-18-
.98

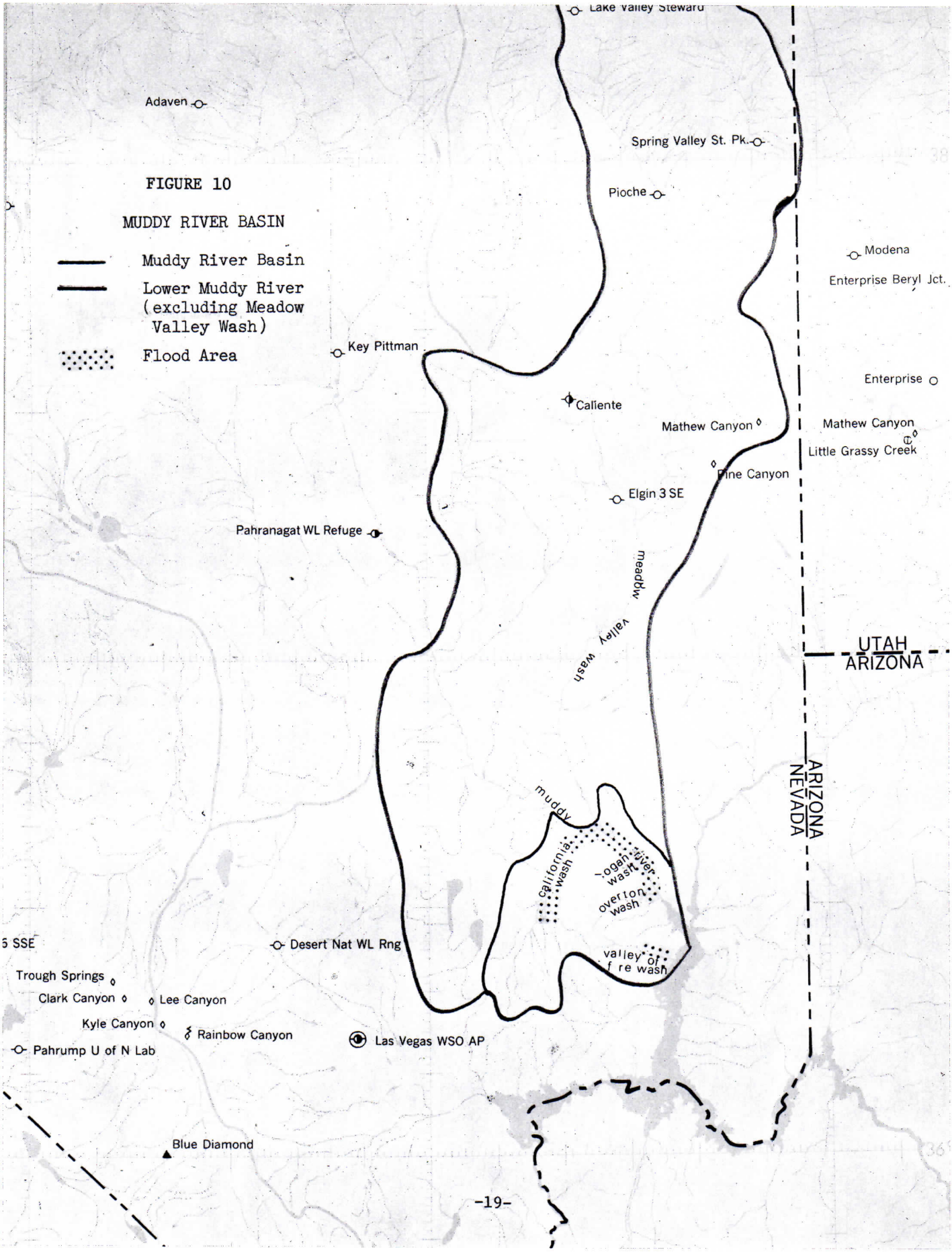


FIGURE 10
MUDDY RIVER BASIN
Muddy River Basin
Lower Muddy River (excluding Meadow Valley Wash)
Flood Area
Lake Valley Steward
Adaven
Spring Valley St. Pk.
Pioche
Modena
Enterprise Beryl Jct.
Key Pittman
Enterprise
Caliente
Mathew Canyon
Mathew Canyon
Little Grassy Creek
Pine Canyon
Elgin 3 SE
Pahranagat WL Refuge
meadow valley wash
UTAH
ARIZONA
ARIZONA
NEVADA
muddy
california wash
logan wash
overton wash
valley of fire wash
Desert Nat WL Rng
Trough Springs
Clark Canyon
Lee Canyon
Kyle Canyon
Rainbow Canyon
Pahrump U of N Lab
Las Vegas WSO AP
Blue Diamond

RESPONSE

The potential for heavy thunderstorm activity was recognized early in the day by WSFO Reno and WSO Las Vegas. In addition, a severe thunderstorm watch was issued by the National Severe Storms Forecast Center in Kansas City for the possibility of severe thunderstorms in areas of Utah adjacent to southern Nevada.

Logs kept at WSFO Reno and WSO Las Vegas, as well as WSO(R) Palmdale and WSO(R) Salt Lake City, indicate a number of coordination calls between offices occurred during the early afternoon of August 10, 1981. As the thunderstorm intensity increased, the offices began to take action. Beginning at 3:29 p.m. and because of the intensity of the storms appearing on local warning radar, WSO Las Vegas telephoned the National Park Service and advised them that gusty winds, possibly to 50 knots, would be moving into the Lake Mead area in approximately 20 minutes. At 4:55 p.m. PDT, the lead forecaster at WSFO Reno called a spotter at Key Pittman who reported that 1-1/2 inches of rain had fallen in the past hour and 20 minutes and that some minor road flooding was occurring. The lead forecaster immediately coordinated with WSO Las Vegas and at 5:10 p.m. PDT, issued a Flash Flood Watch for Lincoln County and Clark County, north of Las Vegas. The watch stated in part:

> RADAR AND SATELLITE DATA INDICATES STRONG THUNDERSTORMS IN THE AREA. THEY ARE MOVING TO THE SOUTHEAST AT 25 MPH. KEY PITTMAN LOCATED EAST OF CALIENTE HAS RECEIVED 1.50 INCHES OF RAIN SO FAR THIS AFTERNOON. SOME HIGHWAYS HAVE BECOME FLOODED NEARBY. MOTORISTS SHOULD STAY OUT OF FLOODED STREAM CROSSINGS AND HIGHWAY DIPS. AVOID NARROW, STEEP WALLED CANYONS.

The watch was immediately disseminatd by WSO Las Vegas on NWR; on NAWAS, which goes to Clark County Metro, the Nevada Highway Patrol at Las Vegas, and the Nye County Sheriff's Office; and on the Convention City News Service, a teletype circuit to all the media in the Las Vegas area. In addition, the National Park Service serving the Lake Mead Recreation Area and the Clark County Fire Department were telephoned and given the Flash Flood Watch.

At 5:15 p.m., PDT, WSO Las Vegas issued a limited FT ammendment for gusty winds and limited visibilities at Las Vegas' McCarran Field.

At 5:30 p.m., PDT, a high wind warning was issued for Las Vegas and surrounding areas of Clark County. It stated:

> ....HIGH WIND WARNING FOR LAS VEGAS AND SURROUNDING AREAS OF CLARK COUNTY...
> HEAVY THUNDERSTORMS NORTH OF LAS VEGAS ARE MOVING SOUTHEAST TOWARD ARIZONA. THESE THUNDERSTORMS WILL CAUSE GUSTY WINDS TO 60 MPH IN THE LAS VEGAS...NORTH LAS VEGAS...HENDERSON AND BOULDER CITY AREAS FOR THE NEXT FEW HOURS.
> REPEAT...HIGH WIND WARNING FOR THE LAS VEGAS AREA FOR THE NEXT FEW HOURS.

This warning was immediately disseminated through the same communication channel as the Flash Flood Watch.

At 5:40 p.m., strong winds moved into the Las Vegas area. Ceiling and visibility at McCarran Field dropped immediately to zero/zero. At approximately this same time, flood waters from the California Wash were flowing into Hidden Valley and water from Overton Wash was flowing through the southern section of Overton.

The strong winds caused a massive power outage in the Las Vegas area and at 6:00 p.m. power failed at the WSO. The WSO had backup power, but teletype circuits service A and C were not on it. In addition, incoming telephone calls were effectively terminated because the bells and lights on the telephone were not on backup power. In addition, the power outage at the NWR transmitter site knocked the Las Vegas NWR off the air from 6:00 p.m. until 11:05 p.m. There was no backup power at the transmitter site on Red Mountain.

At 7:20 p.m., PDT, WSO Las Vegas issued a special weather statement, continuing the high wind warning and the Flash Flood Watch. The thunderstorm intensity diminished during the evening and WSFO Reno cancelled the Flash Flood Watch at 9:00 p.m. The High Wind Warning was cancelled by WSO Las Vegas at 9:10 p.m., but qualified the cancellation with the statement:

> PEOPLE SHOULD STAY ALERT FOR A FEW MORE HOURS AS THESE THUNDERSTORMS MOVE ACROSS SOUTHERN NEVADA. WINDS UP TO 40 MPH AND URBAN FLOODING IS STILL POSSIBLE FOR A FEW MORE HOURS.

A survey team, visiting the affected area three days after the flood, interviewed both Federal, state, county and local officials as well as citizens affected by the flooding. In general, the team found that the watch and warning was effectively disseminated to officials such as the Nevada Highway Patrol, the Sheriff's Office, and the National Park Service. Additionally, the Park Service official interviewed indicated that the threat of high winds was received at 3:29 p.m., according to his log, and this information was relayed to Park Rangers on Lake Mead.

However, the interviews with people in the affected area of Hidden Valley, Glendale and Overton, whose homes had been destroyed and lives threatened, indicated that they received no information that the thunderstorms moving into the area would be anymore threatening than normal. They were taken completely by surprise by the intensiy of the storm and the severity of the flooding.

FINDINGS AND RECOMMENDATIONS

Finding #1. The potential for heavy thunderstorms in southern Nevada was recognized early in the day on August 10. WSO Las Vegas attempted to call in extra help on overtime, but were unable to reach any staff members that were off-duty. There appeared to be good coordination among the Nevada offices as this storm situation developed.

Finding #2. With the threat of high winds in the Las Vegas area, WSO Las Vegas issued a timely high wind warning. Procedures outlined in WSOM Chapter C-42 specify that high winds associated with convective activity warrant a severe thunderstorm warning.

Recommendation: WSO Las Vegas and other WSOs that are faced with severe thunderstorms infrequently, should ensure that their spring drills include a situation which involves the issuance of a severe thunderstorm warning.

Finding #3. A flash flood watch was issued prior to the flooding event. A Flash Flood Warning would have been appropriate. However, limited feedback from the affected area did not provide the proper amount of information necessary for the offices to issue a warning. The severity of the flooding was not known until the following day.

Recommendation: WSO Las Vegas, with assistance from WSFO Reno and the Colorado Basin RFC, should continue efforts to develop a spotter network throughtout the southern counties of Nevada. Contact with a number of spotters had been made prior to the flooding in the Overton - Moapa Valley area, but these spotters were not responsive during the heavy rainfall. This points out clearly the need, not only to develop the spotter network, but also to maintain it through telephone or personal contacts on a routine basis.

Finding #4. Las Vegas' NOAA Weather Radio was off the air from 6:00 p.m. until 11:05 p.m., PDT, because of the power outage of the transmitter site on Red Mountain.

Recommendation: The National Weather Service should examine ways to ensure that all NOAA Weather Radio consoles and transmitters have emergency power available. Outages of NOAA Weather Radios during unusual or severe weather have occurred in the past. As more and more county warning officials and other emergency officials come to rely upon NOAA Weather Radio as their primary means of obtaining their information during weather disasters, the need for emergency power to keep NWR operating in severe weather situations becomes imperative.

Finding 5. The watch and warning that were issued during this event did not reach the people in the area affected, even though WSO Las Vegas disseminated them in a timely manner.

Recommendation: This finding points out the need for offices with warning responsibility to trace the dissemination of warnings with county officials. This should begin with issuance of the warning at the WSFO or WSO and include the communications channels that the warning will take to individuals in the community.

Finding #6. While there were minor deficiencies with regard to the performance of the offices involved in this flash flood and severe thunderstorm situation, the team found that during the late afternoon and evening of August 10, WSO Las Vegas had two people on duty during the storm event. These two were extremely busy, handling phone calls initially until incoming telephone calls were terminated by the power outage, then taking observations during low and rapidly changing ceiling and visibility conditions, taking radar observations and issuing a number of statements to the public, amending the terminal forecast, coordinating with other offices, etc. Their performance, under the circumstances, was very good.

THE SURVEY

As information concerning the magnitude of the Moapa Valley disaster was received, WRH determined the necessity of conducting a disaster survey. As with all significant disasters, an on-site investigation is the most efficient method of determining the effectiveness of the NWS's watch/warning system. The purpose of a survey is to identify deficiencies in the services the NWS provided during the disaster and recommend solutions for correcting the deficiencies.

A Regional Survey team was dispatched to the Las Vegas-Moapa Valley area August 12, 1981. The team consisted of Richard Hutcheon, Assistant Chief, MSD WRH; Joe Ganser,

MIC WSFO Reno; Ralph Hatch, Flash Flood Hydrologist CBRFC; and Frank Taylor OIC WSO Las Vegas. On August 13, the team visited the affected area and interviewed a number of citizens directly affected by the flood. On August 14, the team inspected WSO Las Vegas and reviewed actions taken by that office and problems encountered. The team also interviewed a number of officials in the area to determine effectiveness of watch/warning disseminations.

Persons interviewed during the survey included:

William Leake, Station Master Union Pacific Railroad, Moapa, Nevada
John Collie, SCS, Las Vegas, Nevada
Kathey Whitney, Red Cross, Las Vegas, Nevada
Major Walter Hines, Nevada Highway Patrol, Las Vegas, Nevada
Newton Sikes, Chief Ranger Lake Mead Recreational Area, Boulder City, Nevada
Ken Ryckman, Clark County Civil Defense Director
Terry Katzer, U.S.G.S., Carson City, Nevada
Pat Glancy, U.S.G.S., Carson City, Nevada
Harry Perkins, Overton Civil Defense Director, Overton, Nevada

The team would like to thank these and others for their cooperation and assistance in determining the effectiveness of NWS service.