

Rainfall & Flood Event Report

August 25, 2013

prepared by
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On the afternoon of August 25, 2013 a severe rainfall event in the northwest sector of the Las Vegas Valley resulted in significant runoff, some of which damaged local roadways. This was the third and most severe rainfall event in the same area in the span of six weeks. Based on the data collected by the Regional Flood Control District's (District) Flood Threat Recognition System (FTRS) rain gages in the area, as well as National Weather Service weather radar, this may have been the most intense rainfall event in the Clark County area since the creation of the District. Existing flood control infrastructure in the area functioned as designed with the Kyle Canyon Detention Basin capturing an estimated 1300 acre-feet of runoff. Storm runoff and debris from the undeveloped parcels north of Grand Teton Drive and west of US-95 in combination with outflow from the Kyle Canyon Detention Basin caused significant inconvenience to residents and travelers in the area as the water and debris made several surface streets largely impassible for several days. Aside from the roadway flooding and damages, there have been no reports of structural damages to residences, businesses, or public infrastructure.

Runoff from the August 25 rainfall event is believed to have been exacerbated by the lack of vegetative cover in part of the upstream drainage area, notably the Carpenter 1 burn area. On July 1, a lightning strike in the Spring Mountains sparked a forest fire which ultimately burned nearly 28,000 acres within the Humboldt-Toiyabe National Forest, including portions of the Kyle Canyon drainage area. The Carpenter 1 fire was less than 50% contained by July 12 when rainfall over the burn area caused soot- and ash-laden runoff to flow into the Kyle Canyon DB. Discharge from the basin flowed through local streets downstream of the detention basin creating health and safety concerns. In response to these concerns, City of North Las Vegas staff installed a removable plug in the 24-inch hole at the base of the 7-foot wall that serves as a sediment control feature at this facility. The purpose of the plug was to restrict any soot- and ash-laden runoff from discharging from the basin until the depth of impounded water exceeded the height of the 7-foot wall. On August 18, a second rainfall event over the Carpenter 1 burn area resulted in additional runoff with entrained debris, soot, and ash. All of this runoff was successfully captured and retained at the Kyle Canyon DB, reaching a maximum depth of 5 feet at the outlet structure.

The National Weather Service (NWS) recognized the potential for a "gulf surge" that could bring "the most abundant moisture of the 2013 monsoon season" into the Clark County area and initiated outreach efforts on August 20th. The NWS efforts included a series of informational briefings with local emergency responders beginning on August 20, with additional webinar briefings conducted on August 22-23. The local office of the NWS issued a Flash Flood Watch on August 23 for the August 24-26 period.

While there were numerous isolated locally intense showers throughout the southern Nevada area beginning as early as August 23rd, rainfall in the northwest part of the Las Vegas Valley began after 1:30PM on August 25th and continued until approximately 6PM. During this event, at least 10 FTRS rain gages reported at least 1" of rainfall; 5 of those gages reported more than 2" of rain, and 2 reported at least 3" of rainfall. Rainfall intensities (Table 1) at several of these sites exceeded the rainfall standard adopted by the District and local governmental entities for the design of drainage infrastructure in the Clark County area.

The rainfall totals reported by the FTRS gages were in close agreement with the NWS's Total Storm Precipitation radar image (Figure 1). That radar image also indicates that the greatest rainfall depth was experienced in the low desert mountain spur located approximately 3 miles west of the Kyle Canyon DB. By the radar estimate, upwards of 6" of rain may have fallen in that area during this event.

The Grapevine Springs 1 rain gage reported 4.10" of rain during this event. According to NWS records, the average annual rainfall for Las Vegas is 4.19". Following this event, District staff verified that the accuracy of the Grapevine Springs 1 rain gage was within the vendor's tolerances; we believe the data is valid as reported.

However, not all of the FTRS gages were fully functional during this event. Following the August 18th runoff into the Kyle Canyon DB it was determined that the water level gage at that basin was not reporting correctly; it is believed that the silt and mud carried in the runoff clogged the air line for the sensor. District staff advised staff with the City of Las Vegas that the gage was not functioning reliably, and the City posted observers at the detention basin on August 25th to monitor conditions at the basin. In addition, the rain gage at Floyd Lamb South Environmental Enhancement Area (EEA) (Stn. ID 4019) under-reported rainfall owing to an electrical malfunction. All other FTRS gages are believed to have performed correctly.

The runoff from this very intense storm was significant, washing out a section of Kyle Canyon Road and inundating several other area roadways. Local press reported that there were at least 18 instances of drivers that required rescuing on flooded roadways.

The Kyle Canyon DB and other flood control facilities in the northwest functioned as designed and significantly reduced downstream flooding in the impacted area. Prior to the onset of the August 25th rainfall, it is estimated that the basin was holding less than 50 acre-feet of runoff from the August 18th event; the depth of the impounded water at the plugged 7 foot wall in the outlet works was approximately 5 feet. On August 25, the water level increased to approximately 30 feet over a 4 hour period, based on reports from on-site observers. The basin captured approximately 1300 acre-feet of runoff during this event; this is roughly 40% of the basin's design storage capacity. District staff has estimated that the peak inflow to the basin was between 8000-9000 cfs; the peak outflow was roughly 300 cfs, but persisted over a 2 ½ day period as the basin slowly drained. As the water level in the basin dropped below the 7 foot level, outflow from the basin reduced to insignificant levels.

The Kyle Canyon DB has three designed inflow locations along the west side of the basin. Post-event inspections of the facility determined that runoff entered the basin only at the northernmost

inlet and flow at that location was several feet deep and at least 550 feet wide. While there was significant erosion near this inlet, the functional integrity of the basin has not been compromised. It is estimated that this facility captured at least 70 acre feet of sediment and debris that were entrained in the flood flows.

This flood control facility did not capture all of the storm runoff. Un-attenuated debris-laden surface flow from the natural drainage areas north of the basin and south of Kyle Canyon Road caused street flooding and shoulder erosion in Grand Teton Drive east of Hualapai as well as in several other roadways. Most of the street flow in the area east of Ft. Apache Road and bounded by Racel Street and Iron Mountain Road was captured by the recently completed Floyd Lamb South EEA. The debris and extended flows (as the Kyle Canyon DB drained) created significant inconvenience and safety concerns for local residents and travelers through the area. However, aside from the roadway flooding and damages, there have been no reports of structural damages to residences, businesses, or public infrastructure.

Other flood control facilities also functioned as designed during this event. The Upper Las Vegas Wash DB, North Las Vegas DB, Red Rock DB and other regional detention basins all captured a significant amount of runoff and slowly released the attenuated flows through downstream areas. Table 2 presents a summary of depths and volumes of flood flows captured by these facilities.

Summary

A severe rainfall event in the northwest sector of the Las Vegas Valley on August 25, 2013 resulted in significant runoff, some of which damaged local roadways. This was the third and most severe rainfall event in the same area, which included the Carpenter 1 burn area in the Spring Mountains, in the span of six weeks. The local office of the National Weather Service accurately forecast the potential for the severe weather several days in advance of its occurrence. The NWS communicated well with local governments and emergency responders both before and throughout this event.

This may have been the most intense rainfall event in the Clark County area since the creation of the Regional Flood Control District. Some locations experienced rainfall totals in less than four hours that exceeded the average annual rainfall for Las Vegas. Existing flood control infrastructure in the area functioned as designed with the Kyle Canyon Detention Basin capturing an estimated 1300 acre-feet of runoff. Storm runoff and debris from the undeveloped parcels north of Grand Teton Drive and west of US-95 in combination with outflow from the Kyle Canyon Detention Basin caused significant inconvenience to residents and travelers in the area as the water and debris made several surface streets largely impassible for several days. Aside from the roadway flooding and damages, there have been no reports of damages to residences, businesses, or public infrastructure.

**Table1. Peak Rainfall Intensities (all units are inches)
August 25, 2013**

<u>Stn ID</u>	<u>5 min.</u>	<u>10 min.</u>	<u>15 min.</u>	<u>30 min.</u>	<u>1 hr.</u>	<u>2 hrs.</u>	<u>3 hrs.</u>	<u>TOTAL</u>
3914	0.28	0.51	0.71	1.02	1.57	2.28	2.28	2.32
3929	0.43	0.63	0.83	1.14	1.65	2.99	3.86	4.10
3949	0.12	0.28	0.31	0.59	0.94	1.06	1.42	1.46
3954	0.20	0.31	0.43	0.75	1.22	1.97	2.99	3.31
4009	0.47	0.83	1.10	1.73	2.52	2.52	2.52	2.68
4024	0.35	0.59	0.75	0.94	1.06	1.06	1.06	1.22
4049	0.47	0.63	0.83	1.10	1.69	1.69	1.69	1.89
4329	0.43	0.63	0.75	1.14	1.85	2.01	2.09	2.17
4504	0.51	0.94	1.22	1.65	1.81	1.81	1.81	1.89
4539	0.39	0.55	0.67	1.02	1.02	1.02	1.02	1.34
SDN3	0.33	0.58	0.83	1.19	1.54	1.92	2.16	

3914	Grapevine Springs 2
3929	Grapevine Springs 1
3949	Corn Creek NW
3954	Tule Springs NW
4009	Floyd Lamb North EEA
4024	Upper Las Vegas Wash DB
4049	Tule Springs
4329	Brownstone Canyon
4504	Beltway Channel at Cheyenne
4539	Beltway Channel at Alliant
SDN3	Storm Distribution Number 3, 100-yr design storm used for design of drainage infrastructure

Table 2. Maximum Depth and associated Storage Volumes

<u>Facility Name</u>	<u>Max Depth</u>	<u>Volume</u>
Kyle Canyon DB	30 feet	1300 acre-feet
Upper Las Vegas Wash DB	13.8 feet	400 acre-feet
North Las Vegas DB	14.4 feet (est.)	510 acre-feet (est.)
Lone Mountain DB	6.8 feet	85 acre-feet
Floyd Lamb North EEA	4.7 feet	70 acre-feet
Floyd Lamb South EEA*	8(S)/11(N) feet	154 acre-feet
Red Rock DB	7.6 feet	200 acre-feet

*Floyd Lamb South Environmental Enhancement Area (EEA) has two (2) cells separated by an elevated walking path. During the August 25, 2013 event, the south cell captured 84 acre-feet, and the north cell captured 70 acre-feet of storm runoff.

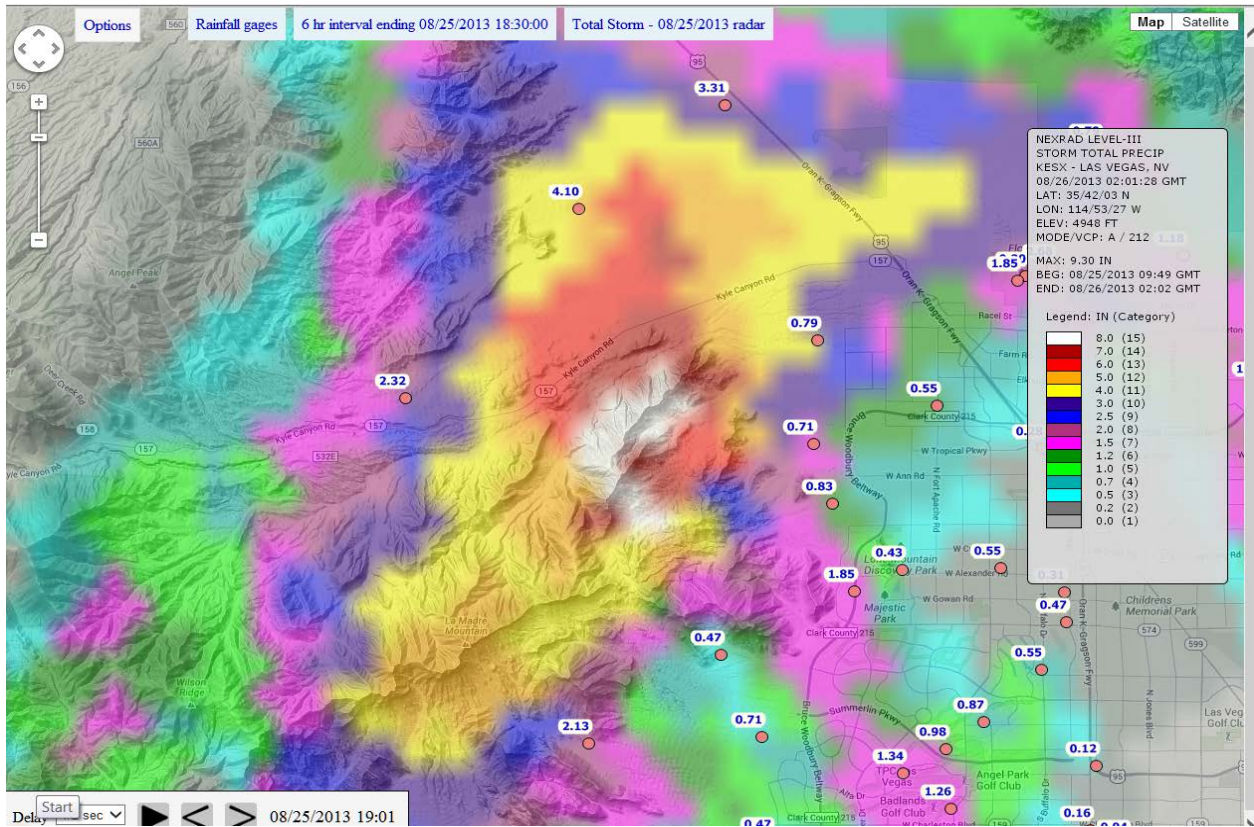


Figure 1. Radar image of Total Storm Rainfall August 25, 2013 with FTRS rainfall totals

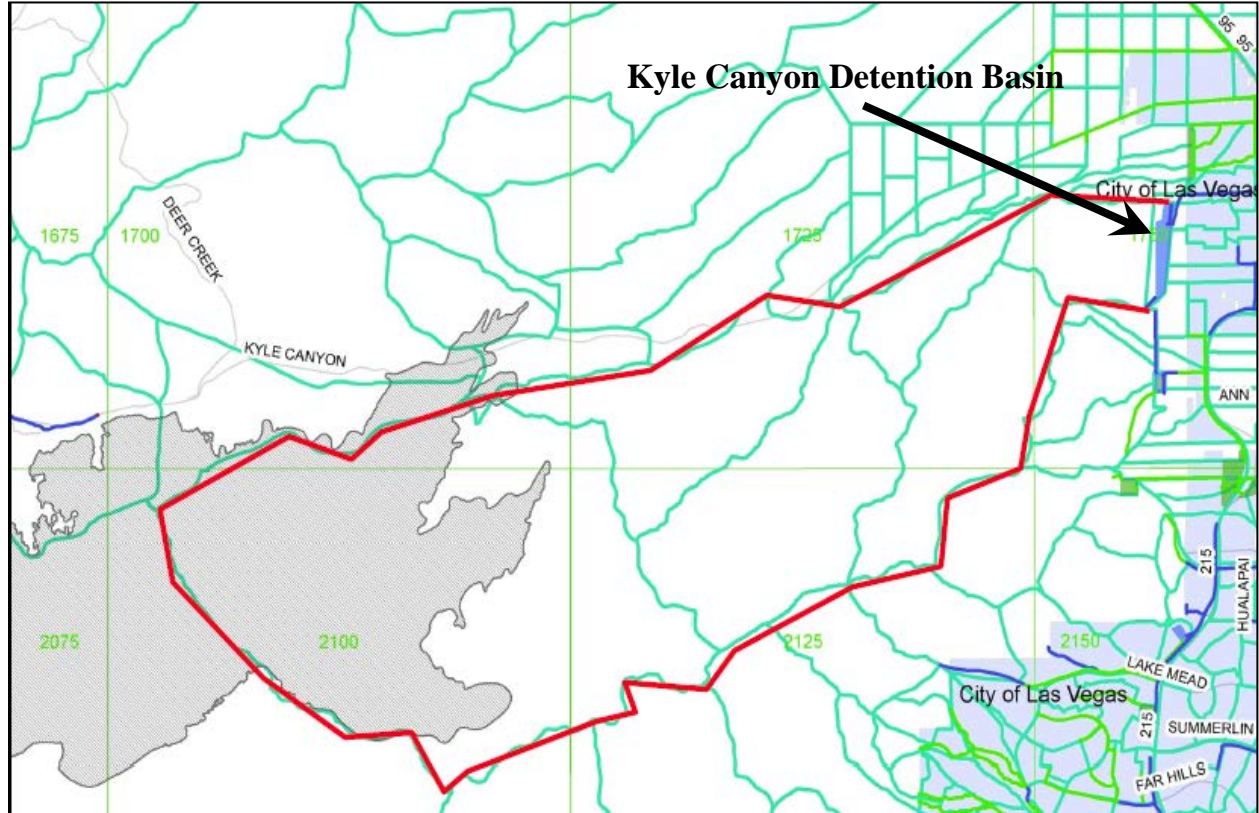


Figure 2. 57 sq. mile Kyle Canyon DB watershed (highlighted in red) and Carpenter 1 burn area (shaded grey)



Figure 3. Grand Teton Drive west of US-95, August 25, 2013



Figure 4. Grand Teton Drive at Grand Canyon Drive, August 25, 2013



Figure 5. Kyle Canyon Detention Basin (August 26, 2013)



Figure 6. Debris washed into Kyle Canyon Detention Basin (August 28, 2013)



Figure 7. Debris washed into Kyle Canyon Detention Basin (August 27, 2013)



Figure 8. Damage to Grand Teton Drive resulting from August 25, 2013 flooding



Figure 9. Northernmost inlet structure at Kyle Canyon DB, resulting from August 25, 2013 flooding



Figure 10. Erosion along inlet structure at Kyle Canyon DB, resulting from August 25, 2013 flooding