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SPECIAL FLOOD HAZARD STUDY

LUKE AIR FORCE BASE--GLENDALE, ARIZONA

PERFORMED BY: LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS

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1.0 ACKNOWLEDGEMENT

We like to express our appreciation to the Luke Air Force Base, Civil Engineering Department for their assistance in providing topographic maps and general information on past floods, which was useful in this study.

2.0 INTRODUCTION

On July 1977 the Luke Air Force Base Civil Engineer, Lt. Col., Robert O. Ferrell, requested from the Corps of Engineers, Los Angeles District, to evaluate the increased flood threat on the Base immediately following the breach of McMikan Dam.

The Flood Plain Management Section of Los Angeles District has prepared this Special Flood Hazard Report in response to the request from Luke AFB. Since the McMikan Dam has not been repaired after 5 years following the breach, the original study scope of work is expanded to include the level of flooding on the Base both with and without the Dam breached. This report presents the severity of flooding on the base and alternatives to remedy the situation.

2.1 Purpose

The purpose of this Special Flood Hazard Report is to determine the depth of flooding at Luke Air Force Base with and without the McMikan Dam repaired. The study included determining the following; (a) the discharge values at Luke AFB, (b) the perimeter channel capacities, (c) the residual flows overtopping the perimeter channels, (d) the depth of flooding on the base. As a result of this report, several alternatives are evaluated to decrease the chance of flooding at Luke Air Force Base.

2.2 Scope

This report presents a background information on Luke AFB and its present flood threat. The report provides the 100-year flood limits on the Base with flood depth values.

The existing perimeter channels are evaluated for flow convergence capacity and alternatives are suggested for improving the existing channels. The report also provides data on floodproofing of present and future structures by several conventional methods.

3.0 BACKGROUND INFORMATION

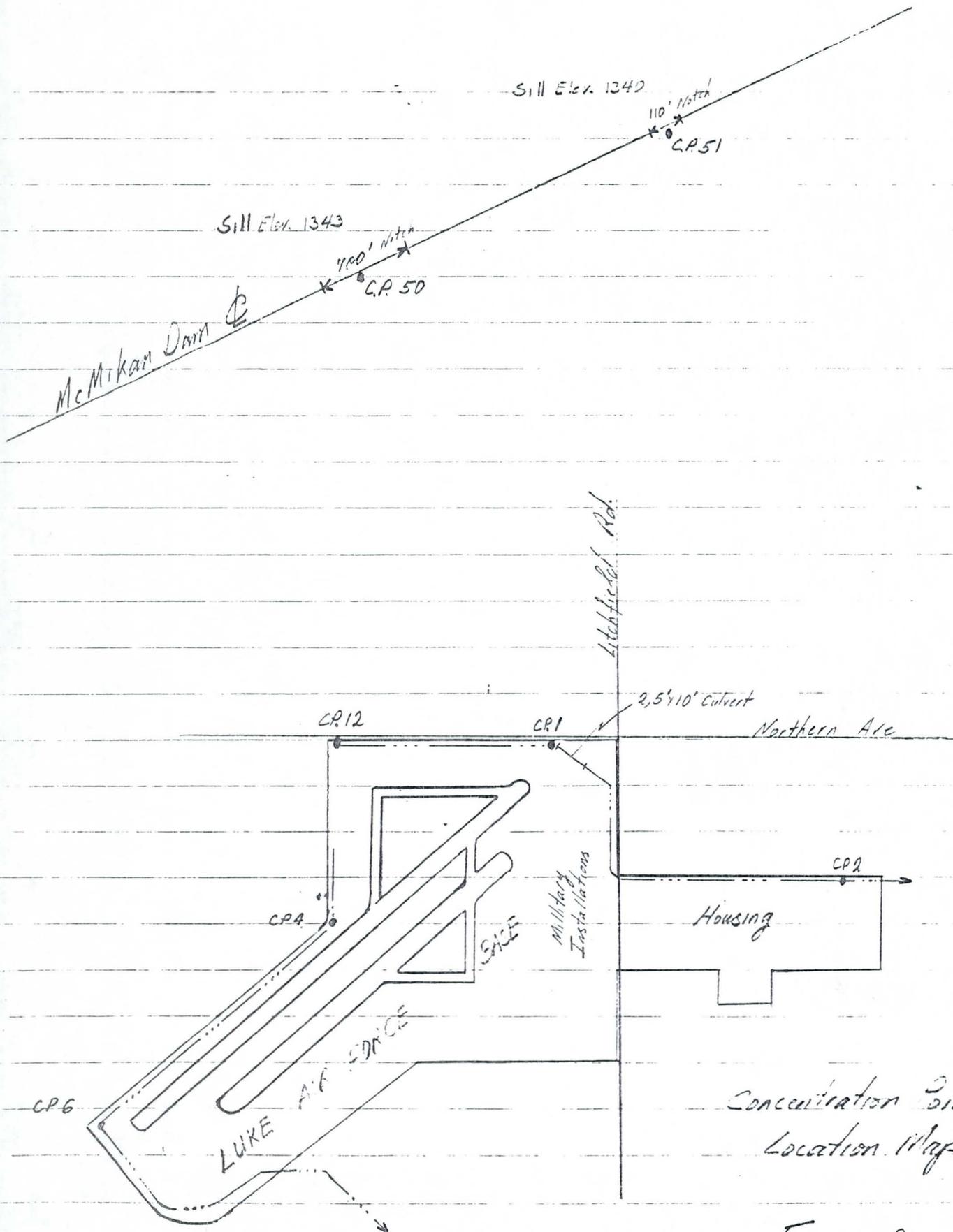
The McMikan Dam, which is also called the Trilby Wash Detention Basin, is located on Trilby Wash and adjacent streams about 4 miles west of Beardsley, and 10 miles northwest of Luke Air Force Base. The project location is shown on figure 1. The McMikan Dam controls drainage from 247 square miles. See table 1 for pertinent data on McMikan Dam which was built by the Corps of Engineers on July 1956. There is about 46 square miles of uncontrolled drainage area below the dam which also affects the flooding situation on Luke Air Force Base. In order to handle these flows, U.S. Army Corps of Engineers constructed perimeter channels to collect and convey the floodwater to the east and south of the base.

Table 1. Summary of Discharges in CFS

With

McMikan Dam Repaired

Location and CP#	SPF	100-yr.	50-yr.	25-yr.
North Channel				
12	300	300	300	160
1	2600	1250	900	500
2	3100	1650	1250	700
West Channel				
4	1400	600	370	210
6	5800	2550	1300	700



Concentration Points
Location Map

Fig. 2

3.1 McMikan Dam

The McMikan Dam consists of an earth levee approximately twenty feet high and about nine miles long. The construction of the Dam was completed in 1956 which funds provided by the United States Congress following the devastating flood of 1951 that damaged nearly 200 buildings on Luke Air Force Base. In early 1977, several major cracks were discovered on the Dam embankment. Consequently, the Corps of Engineers determined that the dam was unsafe. Therefore, in July 1977, two large notches were cut into the Dam which essentially eliminated the flood protection which the Dam had originally provided for Luke Air Force Base, the agricultural fields, and communities downstream such as Goodyear, Litchfield Park and Avondale. Figure 2 shows the location of these two notches in the Dam. One notch is 700 feet wide, (Sta. 320+00 along the centerline of the Dam), with the sill elevation at 1343 feet. The other notch is 110 feet wide, (Sta. 481+25), with the sill elevation at 1340 feet (mean sea elevation). Only the 110 ft. notch has a concrete sill on the invert and up the side slopes to prevent expansion of the notch.

3.2 Perimeter Channels

In order to divert the local flows from the 46 square miles of drainage below the McMikan Dam, Corps of Engineers also constructed the North and West Channels at the perimeter of the Base. The North Channel provides flood protection to the Base residential and military structures. The North Channel is partly earth and partly concrete trapezoidal channel as shown on figure 3. The earth trapezoidal channel reach is from the west corner of the Base, along Northern Avenue up to the double 5' x 10' underground culvert, and the

concrete channel reach starts downstream of this culvert. The North Channel extends east all the way to the Agua Fria River. Table 2 shows the North Channel original and present channel convergence capacity.

The West Channel is an earth trapezoidal channel along the west side of the Base and mainly protect the runways from flooding. A typical channel configuration is shown on figure 4. The West Channel is larger than the North Channel can convey much higher flows because of its greater invert slope compared to the North Channel. Table 2 also shows the West Channel capacity.

Table 2. Present Channel Capacity (in cfs)

	Original Design	Present Condition
<u>North Channel</u>		
Upstream of double culverts	520-800	400-700
5'x10' double culverts	1100	1250
Downstream of double culverts	1100	1250
East of Litchfield Road	1100	500
<u>West Channel</u>		
CPU South of Demolition Area	900	600
Near Waste Disposal site	1500	1650
Between Waste Disposal site and Picnic Grounds	2600	1850
Southwest of Picnic Grounds	3700	2550

4.0 PAST FLOODS

On March 2, 1982, Trilby Wash experienced its first major run-off after the breach of McMikan Dam. This event provided the opportunity to observe the flow path of the discharges from the notches at the Dam. Our field reconnaissance provided the following information. Floodwaters about one (1.0) foot deep had flow^{ed} over the 700 feet wide notch at McMikan Dam. These flows were interrupted temporarily by the Beardsley Irrigation Canal, which is located immediately below McMikan. Since this canal did not have sufficient convergance capacity, it was overtopped and floodwaters continued flowing southeast toward Luke Air Force Base. The flow path from McMikan Dam to Luke Air Force Base is vertually flat, with minor irrigation dikes which were easily erroded or overtopped by the flow from McMikan Dam and local run-off. The outflow from 700-foot notch could be only discerned about six miles downslope of the dam embankment.

The March 2, 1978 flow, reaching Luke Air Force Base, filled North Perimeter Channel within inches of overtopping it. To prevent the area from flooding, sand bags were placed at two locations on the south bank of the North Channel. One low point was at the unpaved segment of the channel, west of the double 5' x 10' culvert. The other one was along the paved segment, North of the Luke Air Force Base family housing area. Although the 1978 floodwaters did not break over the North Channel, it demonstrated the existance of a significant flood threat to the mission, equipment, facilities, personnel, and flooding potential of the 875 on-base family housing units. The West Channel functioned adequately during the 1978 floods.

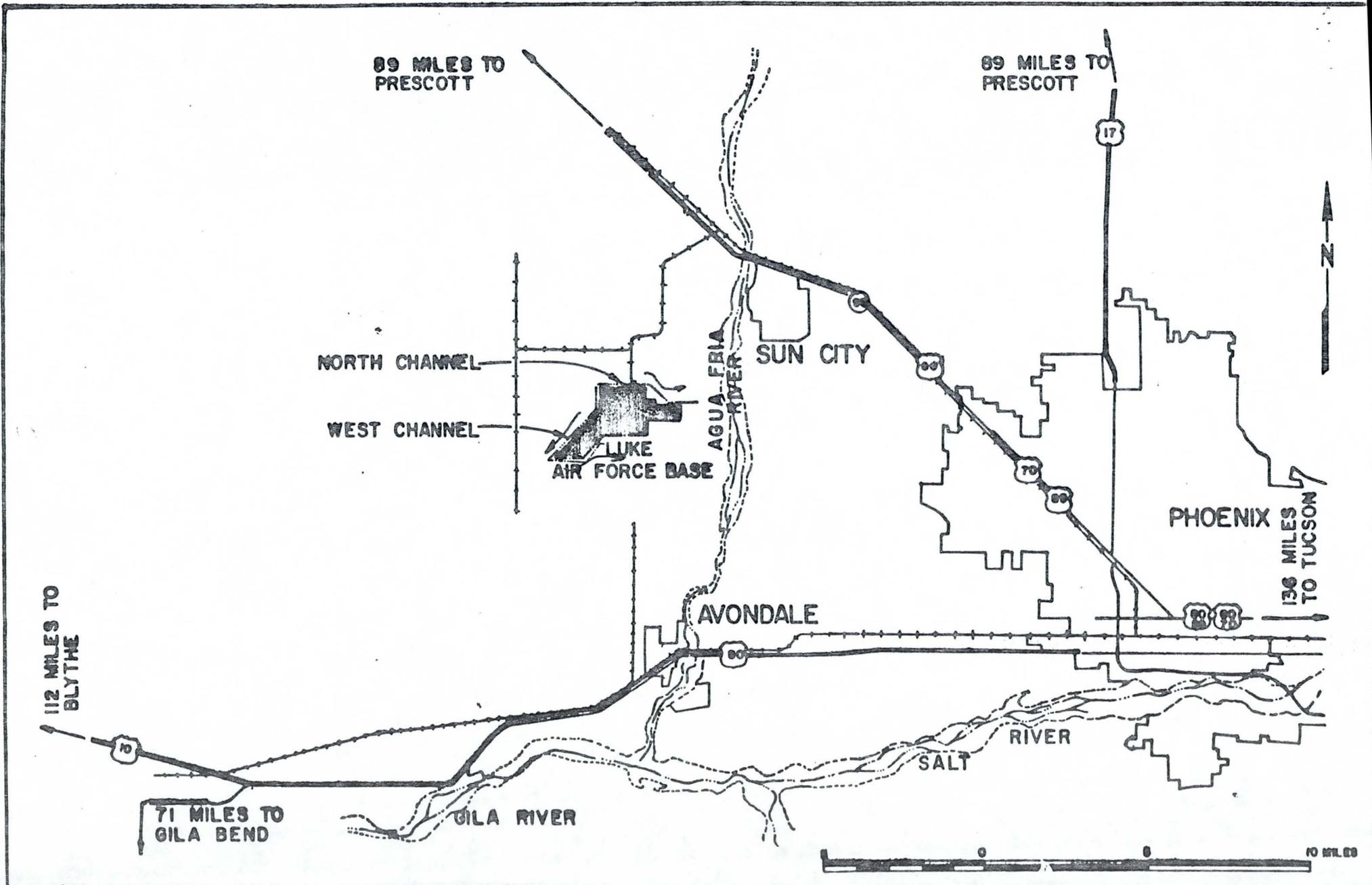


FIGURE 1

VICINITY MAP
 SPECIAL FLOOD HAZARD STUDY
 LUKE AIR FORCE BASE

Subsequent to the 1978 flood, the Luke Air Force Base personnel have observed that following a significant rainfall run-off would fill the North Channel more quickly now than before the Dam was breached. This condition can be explained by the fact that the present channel has gradually lost its original design capacity and is only adequate to convey very small flows.

5.0 FLOOD SITUATION

The flat terrain at Luke Air Force Base and its surrounding area leads itself to sheet flow type of flooding. Often shallow floodwaters can be controlled by collector channels, which divert flow away from an urban area. The existing North Channel at Luke Air Force Base is such a collector channel which has served its purpose adequately until March 1978, when it almost filled up to the top, and had it not been for the floodfighting efforts, it would have overtopped.

Investigations indicated that the capacity of the North Channel has decreased because of severe channel invert subsidance and poor channel maintenance. The North Channel invert, east of Litchfield Road, has experienced about 2.5 feet of settlement compared to its original design. This area has often ponded water in the channel and it is one of the weak points along the North Channel. In addition, the earth channel along North^{ern} Avenue is severely plugged with brush. Since the flow in this reach is severely hindered, the chance of floodwater overtopping the channel has greatly increased. Table 2 shows the present and original channel capacities along the North and West channels. If the earth channel along North^{ern} Avenue is cleared for increased conveyance, the concrete channel downstream would not be able to handle the extra flow. Therefore, the entire North Channel should be improved in order to provide a complete flood protection to the Base. To this end we have determined the discharge values reaching the Base and the extent of flood on the Base, with and without the McMikan Dam repaired.

5.1 Peak Flow Hydrology.

The flows reaching the Luke Air Force Base are computed under two separate conditions. The first case is assumed that McMikan Dam is repaired and only the flow below the Dam reach the Base. For this case, a special hydrology report was prepared and is shown in Appendix I. The second case is to calculate the outflow from the breached dam and combine it with the flow below the dam and route the flows to Luke Air Force Base. Appendix II contains the details on hydrology computation for the second case.

The discharges from McMikan Dam were routed down to Luke Air Force Base by modified puls reservoir routing procedure. The flood peaks were reduced substantially due to the fact that the floodwater would spread out in less than 2 feet depth and about 1 mile to 1 1/2 miles wide. Consequently the floods could not concentrate in any one defined channel and thus the peaks quickly diminish.

Figure 2 shows the location of various concentration points. The discharge values at these concentration points are shown in table 3. For discharge values with the Dam breached, the values include contribution from the drainage area below the Dam.

Table 3. Summary of Discharge in cfs

With

McMikan Dam Breached

Location and CP. #	SPF	100-yr.	50-yr.	25-yr
Flows from 110' notch				
51	5700	3500	2360	1460
Flows from 700' notch				
50	26000	14800	9300	4800
Flows at North Channel				
1	15000	6300	2300	500
2*	3100	1650	1250	700
Flow at West Channel				
4*	1400	600	370	210
Flow at West Channel				
6*	5800	2550	1300	700

*Flows not changed under the condition of McMikan Dam repaired.