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SUPPLEMENT

TO

HYDROLOGIC REPORT

FOR

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

ELLIS, MURPHY & HOLGATE
CONSULTING ENGINEERS
6601 N. Black Canyon Highway
Phoenix, Arizona 85015

April 1976

EM&H #4876

A901.702

ellis, murphy, holgate & johnson
6601 N. Black Canyon Hwy., Phoenix, Arizona 85015 (602)242-4411

RECEIVED
Flood Control Dist.
Maricopa County
APR 22 1976

April 20, 1976

Mr. Charles Burm, Plant Services Manager
General Motors Desert Proving Ground
P. O. Box 1506
Mesa, Arizona 85201

Re: Supplement to
Hydrology Report
GM Desert Proving Ground
Ride & Structure Development Road

Dear Mr. Burm:

We submit herewith our Supplement to the Hydrologic Report regarding a diversion channel along the east boundary of the General Motors Proving Ground.

The report contains a drainage study, exhibits, data sheets and appropriate sections.

Very truly yours,

ELLIS, MURPHY & HOLGATE

Charles Edman, P.E.
Project Manager

CE/am

SUPPLEMENT

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HYDROLOGIC REPORT

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GENERAL MOTORS

DESERT PROVING GROUND

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ELLIS, MURPHY & HOLGATE
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INTRODUCTION

The purpose of this supplement to the Hydrologic Report is to investigate the possible diversion of storm runoff entering the Proving Ground along its east perimeter. This diversion is desirable in order to reduce runoff through a restricted area between the existing circle track and new test facilities and to protect a future planned development adjacent to the east property line. The hydrologic design method contained in the Hydrologic Report has been used.

DRAINAGE STUDY

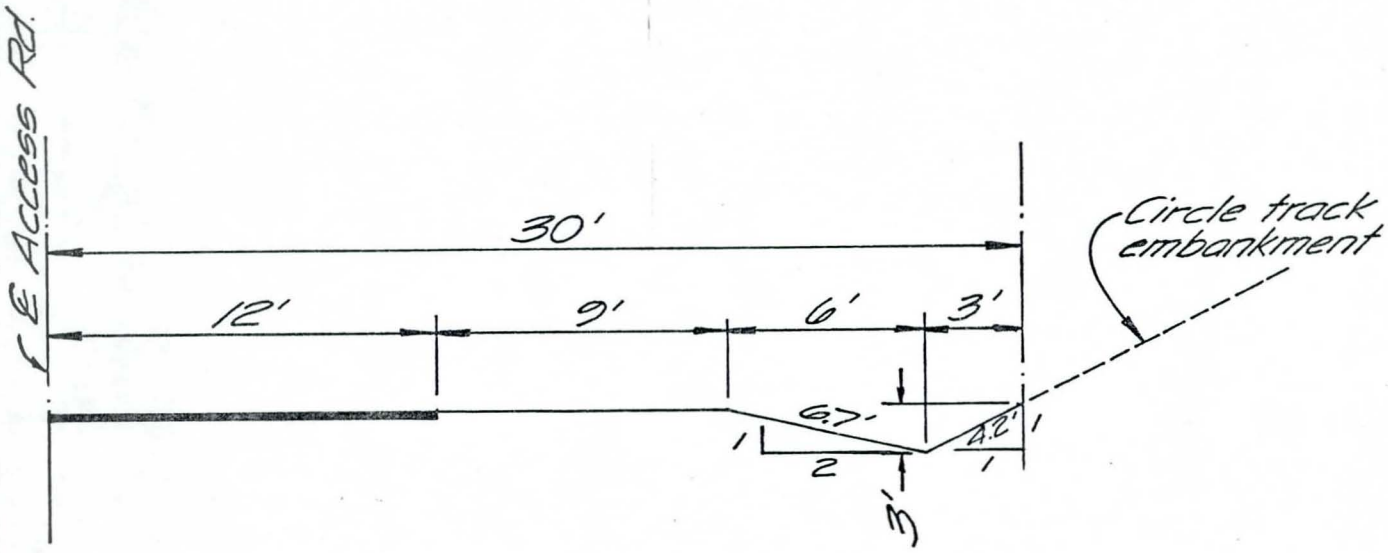
From topographic maps furnished by General Motors it was determined that sufficient north-south slope exists to warrant construction of an intercepting channel from the Powerline Floodway to the northeast portion of the Proving Ground.

Using a design storm frequency of 50 years, the total computed discharge from Areas IV through VIII as shown in the following computations would be 870 cfs at the Floodway. With an estimated 20 cfs in the Floodway, the combined total discharge would exceed design capacity determined by the Soil Conservation Service of 850 cfs.

If reduction of total discharge is required by the Maricopa County Flood Control District it could be accomplished by use of retention basins with controlled discharge.

With runoff from Area IV intercepted by a channel, and runoff from Area B_1 combined with that from Area D_1, the total onsite discharge from Areas B_2 and B_3 in the vicinity where the access road, circle track and chatter loop converge would be 80 cfs. A channel to carry this amount of runoff can easily be located between the circle track and access road as shown on the channel section. The increased discharge through the circle track area is negligible.

For reference, Hydrologic Design Data Sheets for Areas VII and VIII are included in the Appendix.



GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area IV

DESIGN DATA:

Design Frequency		50	years
Drainage Area	A =	0.37	square miles
Drainage Length		6700	feet
Elevation			
Top of Drainage Area		1502	feet
At Structure (or Boundary)		1463	feet
Drainage Area Slope		0.58	%
Drainage Width		1547	feet
Width factor W_f		1.00	
Vegetative Cover Type		Herbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		2.69	inches
P = 24 hour =		3.20	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	2.10	inches
Curve Number		82	
Runoff	Q =	0.71	inches
Time of Concentration	Tc	0.81	hours
Time of Peak	$Tp = (Tc)(W_f)$	0.81	hours
Peak Discharge	$Qp = \frac{484\ AQ}{Tp} =$	$\frac{484(.37)(0.71)}{0.81}$	
	=	157	cfs

GENERAL MOTORS

DESERT PROVING GROUND

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HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation Area V

DESIGN DATA:

Design Frequency		50	years
Drainage Area	A =	0.30	square miles

DESIGN COMPUTATION:

Runoff	Q =		0.71	inches
Time in Channel			0.15	hours
Time of Peak	Tp		0.96	hours
Peak Discharge	$Qp = \frac{484\ AQ}{Tp}$	=	$\frac{484(.30)(.71)}{.96}$	
		=	107	cfs
Discharge at 18		+	157	cfs
Total Discharge at 19		=	264	cfs

GENERAL MOTORS

DESERT PROVING GROUND

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HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation Area VI

DESIGN DATA:

Design Frequency		50	years
Drainage Area	A =	1.12	square miles

DESIGN COMPUTATION:

Runoff	Q =		0.71	inches
Time in Channel			.10	hours
Time of Peak	Tp		1.06	hours
Peak Discharge	$Qp = \frac{484\ AQ}{Tp}$	=	$\frac{484(1.12)(.71)}{1.06}$	
		=	363	cfs
Discharge at 19		+	264	cfs
Total Discharge at 20		=	627	cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation Area VII

DESIGN DATA:

Design Frequency		50	years
Drainage Area	A =	0.26	square miles

DESIGN COMPUTATION:

Runoff	Q =		0.71	inches
Time in Channel			.14	hours
Time of Peak	Tp		1.20	hours
Peak Discharge	$Qp = \frac{484\ AQ}{Tp}$	=	$\frac{484(.26)(.71)}{1.20}$	
		=	74	cfs
Discharge at 20		+	627	cfs
Total Discharge at 21		=	701	cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation Area VIII

DESIGN DATA:

Design Frequency		50	years
Drainage Area	A =	0.66	square miles

DESIGN COMPUTATION:

Runoff	Q =		0.71	inches
Time in Channel			0.14	hours
Time of Peak	Tp		1.34	hours
Peak Discharge	$Qp = \frac{484\ AQ}{Tp}$	=	$\frac{484(.66)(.71)}{1.34}$	
		=	169	cfs
Discharge at 21		+	701	cfs
Total Discharge at 22		=	870	cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation B2

DESIGN DATA:

Design Frequency		10	years
Drainage Area	A =	0.21	square miles
Drainage Length		5600	feet
Elevation			
Top of Drainage Area		1460	feet
At Structure (or Boundary)		1430	feet
Drainage Area Slope		0.54	%
Drainage Width		1027	feet
Width factor W_f		1.10	
Vegetative Cover Type		Herbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		1.92	inches
P = 24 hour =		2.30	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	1.48	inches
Curve Number		82	
Runoff	Q =	0.33	inches
Time of Concentration	Tc	0.48	hours
Time of Peak	$Tp = (Tc)(W_f)$	-	hours

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.21)(.33)}{.48}$

= 70 cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

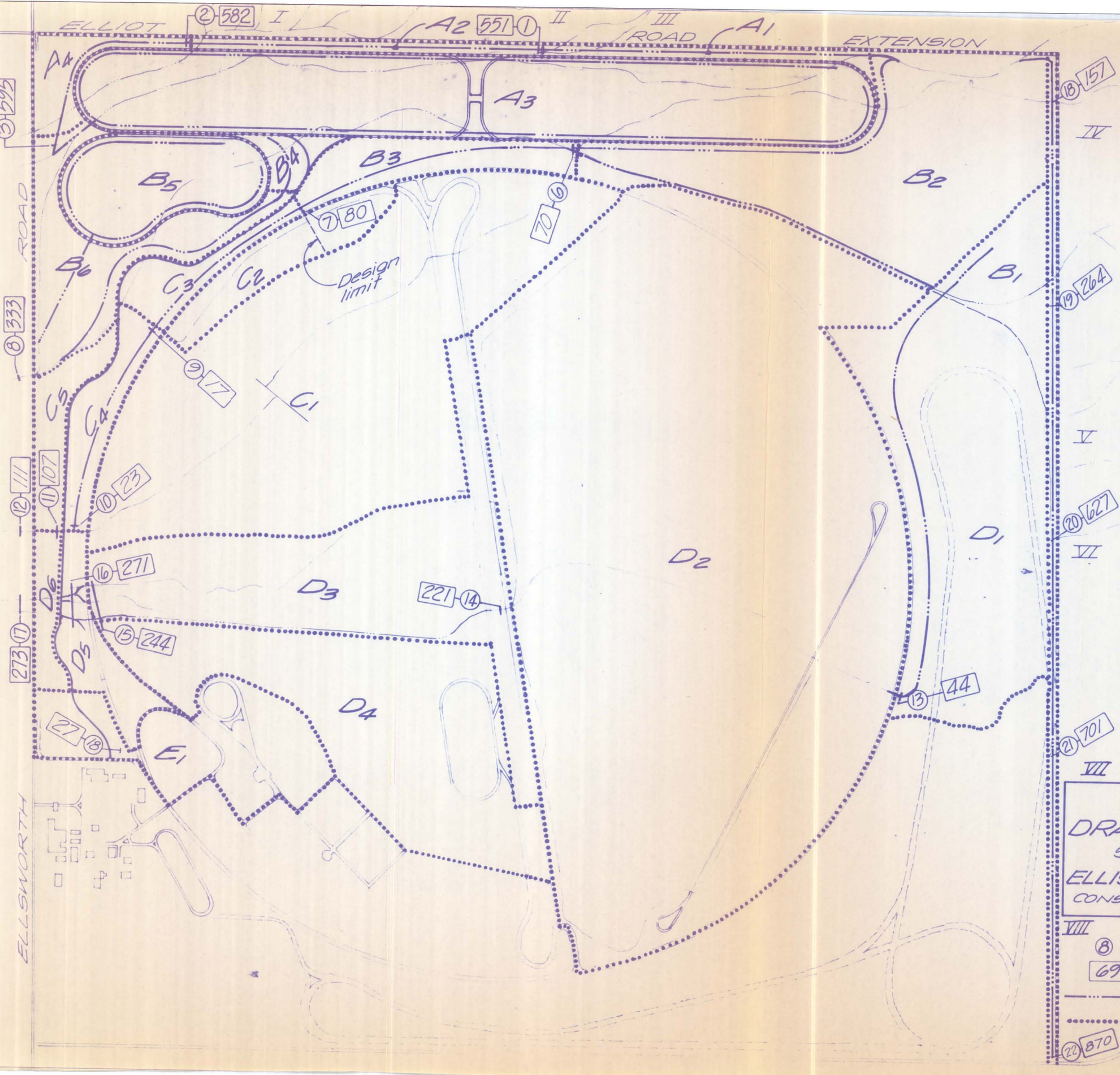
Designation B3

DESIGN DATA:

Design Frequency		10	years
Drainage Area	A =	0.04	square miles

DESIGN COMPUTATION:

Runoff	Q =		0.33	inches
Time in Channel			0.18	hours
Time of Peak	Tp		0.66	hours
Peak Discharge	$Qp = \frac{484\ AQ}{Tp}$	=	$\frac{484(.04)(.33)}{.66}$	
		=	10	cfs
Discharge at 6		+	70	cfs
Total Discharge at 7		=	80	cfs



AREAS (ACRES)	
A1	14
A2	14
A3	348
A4	15
B1	40
B2	132
B3	27
B4	7
B5	42
B6	47
C1	260
C2	28
C3	15
C4	21
C5	14
D1	147
D2	781
D3	119
D4	129
D5	18
D6	11
E1	76

ONSITE DRAINAGE AREAS

SCALE: 1" = 1000'

ELLIS, MURPHY & HOLGATE

CONSULTING CIVIL ENGINEERS

(8) Point designation

[69] Accumulated runoff (c.f.s.)

—·····— Proposed channel

····· Drainage area boundary

EXHIBIT A

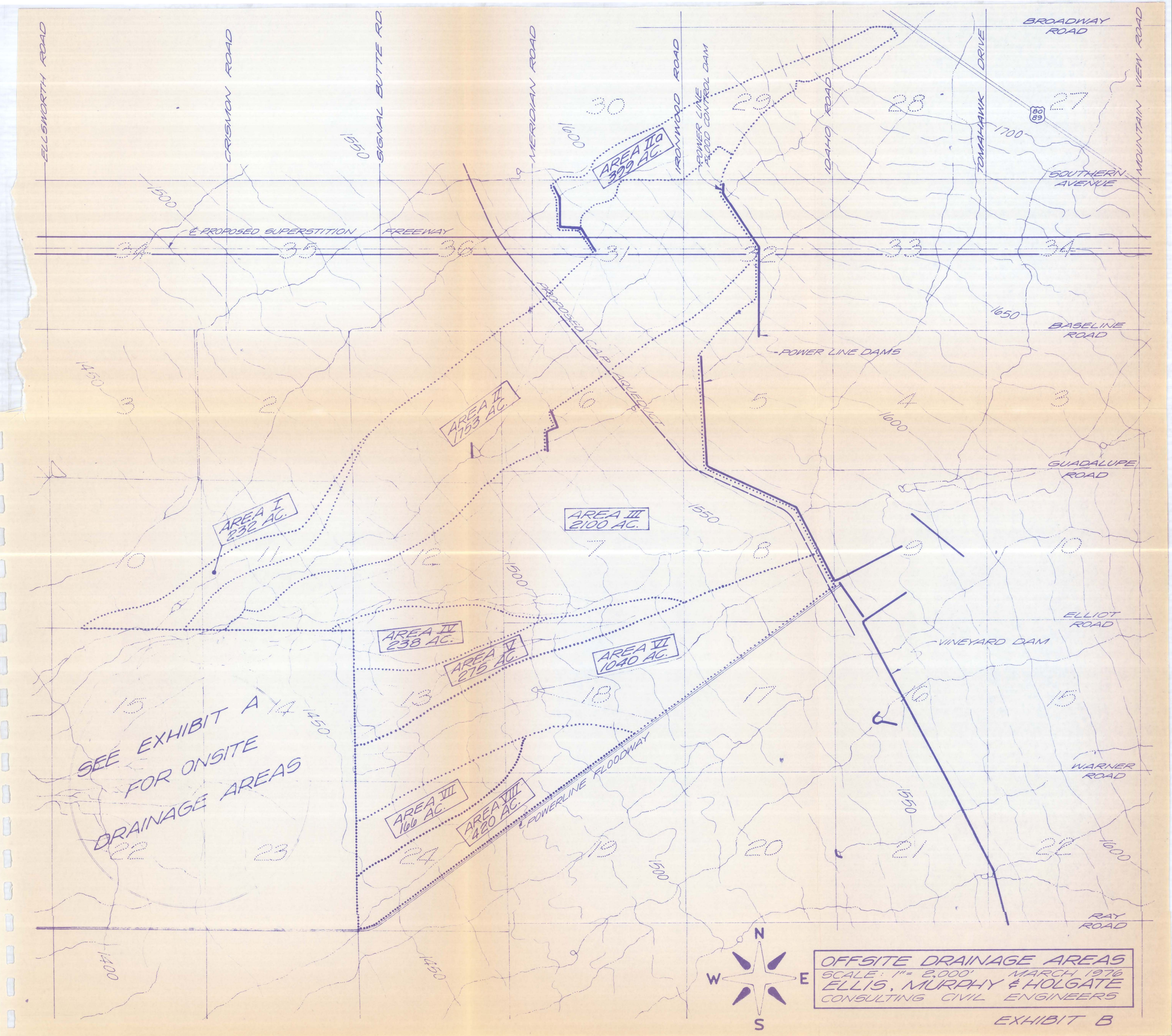

ELLSWORTH ROAD
CRISMON ROAD
SIGNAL BUTTE RD.
MERIDIAN ROAD
IRONWOOD ROAD
POWER LINE & FLOOD CONTROL DAM
IDAHO ROAD
TOMAHAWK DRIVE
BROADWAY ROAD
MOUNTAIN VIEW ROAD
SOUTHERN AVENUE
℄ PROPOSED SUPERSTITION FREEWAY
BASELINE ROAD
POWER LINE DAMS
PROPOSED CAP AQUEDUCT
GUADALUPE ROAD
ELLIOT ROAD
VINEYARD DAM
WARNER ROAD
RAY ROAD
℄ POWERLINE FLOODWAY
AREA IIa 309 AC.
AREA II 1753 AC.
AREA I 232 AC.
AREA III 2100 AC.
AREA IV 238 AC.
AREA V 275 AC.
AREA VI 1040 AC.
AREA VII 166 AC.
AREA VIII 420 AC.
SEE EXHIBIT A FOR ONSITE DRAINAGE AREAS
N
S
E
W
OFFSITE DRAINAGE AREAS
SCALE: 1" = 2,000'
MARCH 1976
ELLIS, MURPHY & HOLGATE
CONSULTING CIVIL ENGINEERS

EXHIBIT B

APPENDIX

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VII

DESIGN DATA:

Design Frequency		10	years
Drainage Area	A =	0.26	square miles
Drainage Length		7100	feet
Elevation			
Top of Drainage Area		1493	feet
At Structure (or Boundary)		1449	feet
Drainage Area Slope		0.62	%
Drainage Width		1018	feet
Width factor W_f		1.10	
Vegetative Cover Type		Herbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		1.92	inches
P = 24 hour =		2.30	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	1.48	inches
Curve Number		82	
Runoff	Q =	0.33	inches
Time of Concentration	Tc	0.83	hours
Time of Peak	$Tp = (Tc)(W_f)$	0.91	hours

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.26)(.33)}{.91}$

= 46 cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VII

DESIGN DATA:

Design Frequency		25	years
Drainage Area	A =	0.26	square miles
Drainage Length		7100	feet
Elevation			
Top of Drainage Area		1493	feet
At Structure (or Boundary)		1449	feet
Drainage Area Slope		0.62	%
Drainage Width		1018	feet
Width factor W_f		1.10	
Vegetative Cover Type		Herbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		2.41	inches
P = 24 hour =		2.78	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	1.80	inches
Curve Number		82	
Runoff	Q =	0.52	inches
Time of Concentration	Tc	0.83	hours
Time of Peak	$Tp = (Tc)(W_f)$	0.91	hours

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.26)(.52)}{.91}$

= 72 cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VII

DESIGN DATA:

Design Frequency		50	years
Drainage Area	A =	0.26	square miles
Drainage Length		7100	feet
Elevation			
Top of Drainage Area		1493	feet
At Structure (or Boundary)		1449	feet
Drainage Area Slope		0.62	%
Drainage Width		1018	feet
Width factor W_f		1.10	
Vegetative Cover Type		Herbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		2.69	inches
P = 24 hour =		3.20	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	2.10	inches
Curve Number		82	
Runoff	Q =	0.71	inches
Time of Concentration	Tc	0.83	hours
Time of Peak	$Tp = (Tc)(W_f)$	0.91	hours
Peak Discharge	$Qp = \frac{484\ AQ}{Tp} =$	$\frac{484(.26)(.71)}{.91}$	
	=	98	cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VII

DESIGN DATA:

Design Frequency		100	years
Drainage Area	A =	0.26	square miles
Drainage Length		7100	feet
Elevation			
Top of Drainage Area		1493	feet
At Structure (or Boundary)		1449	feet
Drainage Area Slope		0.62	%
Drainage Width		1018	feet
Width factor W_f		1.10	
Vegetative Cover Type		Herbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		3.04	inches
P = 24 hour =		3.72	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	2.37	inches
Curve Number		82	
Runoff	Q =	0.90	inches
Time of Concentration	Tc	0.83	hours
Time of Peak	$Tp = (Tc)(W_f)$	0.91	hours

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.26)(.90)}{.91}$

= 124 cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VIII

DESIGN DATA:

Design Frequency		10	years
Drainage Area	A =	0.66	square miles
Drainage Length		10,900	feet
Elevation			
Top of Drainage Area		1505	feet
At Structure (or Boundary)		1437	feet
Drainage Area Slope		0.62	%
Drainage Width		1678	feet
Width factor W_f		1.00	
Vegetative Cover Type		Herbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		1.92	inches
P = 24 hour =		2.30	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	1.48	inches
Curve Number		82	
Runoff	Q =	0.33	inches
Time of Concentration	Tc	1.15	hours
Time of Peak	$Tp = (Tc)(W_f)$	1.15	hours

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.66)(.33)}{1.15}$

= 92 cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VIII

DESIGN DATA:

Design Frequency		25	years
Drainage Area	A =	0.66	square miles
Drainage Length		10,900	feet
Elevation			
Top of Drainage Area		1505	feet
At Structure (or Boundary)		1437	feet
Drainage Area Slope		0.62	%
Drainage Width		1678	feet
Width factor W_f		1.00	
Vegetative Cover Type		Herbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		2.41	inches
P = 24 hour =		2.78	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	1.80	inches
Curve Number		82	
Runoff	Q =	0.52	inches
Time of Concentration	Tc	1.15	hours
Time of Peak	$Tp = (Tc)(W_f)$	1.15	hours

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.66)(.52)}{1.15}$

= 144 cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VIII

DESIGN DATA:

Design Frequency		50	years
Drainage Area	A =	0.66	square miles
Drainage Length		10,900	feet
Elevation			
Top of Drainage Area		1505	feet
At Structure (or Boundary)		1437	feet
Drainage Area Slope		0.62	%
Drainage Width		1678	feet
Width factor W_f		1.00	
Vegetative Cover Type		Herbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		2.69	inches
P = 24 hour =		3.20	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	2.10	inches
Curve Number		82	
Runoff	Q =	0.71	inches
Time of Concentration	Tc	1.15	hours
Time of Peak	$Tp = (Tc)(W_f)$	1.15	hours

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.66)(.71)}{1.15}$

= 197 cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VIII

DESIGN DATA:

Design Frequency		100	years
Drainage Area	A =	0.66	square miles
Drainage Length		10,900	feet
Elevation			
Top of Drainage Area		1505	feet
At Structure (or Boundary)		1437	feet
Drainage Area Slope		0.62	%
Drainage Width		1678	feet
Width factor W_f		1.00	
Vegetative Cover Type		H erbaceous	
Vegetative Cover Density		10	%
Soil Group		B	
Precipitation			
P = 6 hour =		3.04	inches
P = 24 hour =		3.72	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	2.37	inches
Curve Number		82	
Runoff	Q =	0.90	inches
Time of Concentration	Tc	1.15	hours
Time of Peak	$Tp = (Tc)(W_f)$	1.15	hours

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.66)(.90)}{1.15}$

= 250 cfs