FLECHA CAIDA FLOOD IMPROVEMENT STUDY -
PHASE I
100-YEAR PEAK DISCHARGE
MAGNITUDES AND FLOODPLAIN MAPPING

Prepared for:
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and Flood Control District
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Appendix C - Culvert Performance Curves
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I. STUDY AREA

The Flecha Caida study area encompasses approximately eight square miles of the foothill region of the Santa Catalina Mountains. The area is bounded by the Coronado National Forest on the north, River Road on the south, Alvernon Way on the west, and Craycroft Road on the east.

The three major washes studied include Finger Rock Wash, Valley View Wash, and Flecha Caida Wash. One tributary (Sky Club Wash) to the Valley View Wash and three tributaries to the Finger Rock Wash were also included in this study.
II. PEAK DISCHARGE DETERMINATION

One-hundred year peak discharge magnitudes were determined at all concentration points shown on the drainage basin map which is contained in Appendix A. The criteria used to establish the location of each concentration point were 1) drainage area (0.5 square miles or larger), and 2) the location of the associated watercourse with respect to section lines or major roadways.

The soil group identifications are also shown on the drainage basin map. It should be noted that the upper limits of the drainage basins associated with the Finger Rock Wash, Valley View Wash, and Sky Club Wash are located within the Coronado National Forest. The soil group classifications for this area are 40 percent Soil Group C and 60 percent Soil Group D. The vegetation type is mountain brush at a cover density of 30 percent. The associated Curve Numbers are 82 and 90, respectively. The soil group classification for the lower limits of the drainage basins located within the study area are 100 percent Soil Group B. The vegetation type is desert brush at a cover density of 20 percent. The associated Curve Number is 83.

The impervious cover percentages used in the hydrologic calculations were based on projected densities as shown on the Catalina Foothills Area Plan. The selected values are as follows:

<table>
<thead>
<tr>
<th>Type of Development</th>
<th>Percent Impervious Cover</th>
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</thead>
<tbody>
<tr>
<td>Natural</td>
<td>0</td>
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<tr>
<td>0.25 RAC</td>
<td>5</td>
</tr>
<tr>
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<td>Commercial</td>
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</tr>
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<td>Transitional</td>
<td>65</td>
</tr>
</tbody>
</table>

If the drainage basin contained a mixture of the above densities, a weighted value was computed. The weighted breakdown, where applicable, is shown on the back of the hydrologic data sheets which are contained in Appendix B.

In general, all basin factors were determined from aerial photographs and
field investigations of the areas which are currently developed. A basin factor for undeveloped areas was selected using the County's hydrology manual as a guide. If a particular watercourse traversed areas with different basin factors, a weighted value was computed. The weight breakdown where applicable is also shown on the back of each hydrologic data sheet.

Five one-hour precipitation depths (P₁-HR) were determined using the maps and procedure as presented in the County's hydrology manual. Those drainage basins extending into the Coronado National Forest are subject to a P₁-HR value approximately equal to 2.75 inches. Those drainage basins located in the southern-most region of the study area are subject to a P₁-HR value approximately equal to 2.60 inches. The P₁-HR value used in each hydrologic calculation was selected based on the location of the centroid of the respective drainage basin. The rainfall data sheet and depth versus return period curve used to determine the respective P₁-HR depths are also contained in Appendix B.

It should be noted that the 100-year peak discharge magnitudes for the Finger Rock Wash decrease in the downstream direction. This occurs primarily because the drainage area does not increase in proportion to the length of the watercourse. Therefore, the decrease in the effective rainfall intensity as computed using the County method has a more significant impact on the resultant peak discharge than does the increase in drainage area. Transmission losses is a natural process that can justify a slight reduction in the peak discharge, especially given the wide, sandy nature of the Finger Rock channel within the downstream reaches. However, the majority of the reduction is computational in nature.
III. FLOODPLAIN MAPPING.

The 100-year floodplains associated with all reaches of the respective washes and their tributaries were modeled using the U.S. Army Corps of Engineers HEC-2 computer program. Approximately 77,500 feet or 14.7 miles of floodplain mapping was performed. Both subcritical and supercritical runs were generated. In general, the flow characteristic for all washes was supercritical. Therefore, the subcritical runs generated critical water-surface elevations. The 100-year floodplain maps (submitted under a separate document) prepared as a result of this study are based on the critical water-surface elevations. The flow velocities associated with the supercritical runs are provided to assist in determining the erosion potential along various reaches of the wash. They can also be used to establish design parameters for bank protection if the need arises.

At various locations along the respective washes and their tributaries, culverts have been constructed to provide a dry crossing. The design capacity of these structures vary. Some are capable of accommodating the entire 100-year peak discharge while others are designed only to accommodate runoff from more frequent storm events. The two main culvert types are concrete box culverts (CBC) and corrugated metal pipes (CMP, both round and arch shapes). Since washes within the study area are known to carry a significant sediment load accompanied by debris, a clogging factor was considered when the capacity of the existing structures were determined. Culvert performance curves (Appendix C) for the CMP's were prepared which incorporated a 50 percent clogging factor. The resulting headwater elevation at each crossing was then incorporated in the HEC-2 analysis as a known water-surface elevation. The HEC-2's special bridge routine was used to compute water-surface elevations associated with the CBC's. The cross-sectional area associated with each CBC was reduced to account for a 25 percent clogging factor.

The input data used in our HEC-2 analysis (both subcritical and supercritical) were copied onto a floppy disk (Appendix D) The floodplain maps (24 sheets) are submitted under separate document. However, a copy of the index map to the floodplain maps is contained in Appendix E. This map shows the reaches of each wash studied and identifies cross-section locations relative to each map sheet.

R66-TC/R640-1
APPENDIX A

DRAINAGE BASIN MAP
APPENDIX B

HYDROLOGIC DATA SHEETS
### RAINFALL DATA SHEET

**LONG** 110° 53' 30"  **LAT** 32° 17' 42"

<table>
<thead>
<tr>
<th>Return Period (Years)</th>
<th>Precipitation Values (inches)*</th>
<th>6 Hour Duration</th>
<th>24 Hour Duration</th>
</tr>
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<tbody>
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<td>Map Value</td>
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<td>Map Value</td>
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</table>

\[
\gamma_2 = -0.011 + 0.947 \left( \frac{x_1^2}{x_2} \right) = 1.23''
\]

\[
\gamma_{100} = 0.494 + 0.755 \left( \frac{x_3^2}{x_4} \right) = 2.10''
\]
Return Period in Years, Partial-Duration Series

Precipitation Depth Versus Return Period for Partial-Duration Series
### RAINFALL DATA SHEET

**LONG 110° 53' 30" LAT 32° 18' 37"**

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\[
y_2 = -0.011 + 0.942 \left( \frac{x_1^2}{x_2} \right) = 1.24"\]

\[
y_{100} = 0.494 + 0.755 \left( \frac{x_3^2}{x_4} \right) = 2.44"\]
Precipitation Depth Versus Return Period for Partial-Duration Series
**RAINFALL DATA SHEET**

LONG 110° 53’ 30"  LAT 32° 19’ 54"

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<th>6 Hour Duration</th>
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<td>3.00</td>
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<td>100</td>
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<td>x₃ 3.67</td>
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\[ \gamma_2 = -0.011 + 0.942 \left( \frac{x_1}{x_2} \right) = 1.27'' \]

\[ \gamma_{100} = 0.494 + 0.755 \left( \frac{x_3}{x_4} \right) = 2.70'' \]
Return Period in Years, Partial-Duration Series

Precipitation Depth Versus Return Period for Partial-Duration Series
### RAINFALL DATA SHEET

**LONG** 110° 53' 30"  
**LAT** 32° 20' 22"

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\[
Y_2 = -0.011 + 0.942 \left( \frac{x_1^2}{x_2} \right) = 1.30 \\
Y_{100} = 0.494 + 0.755 \left( \frac{x_3^2}{x_4} \right) = 2.71
\]
Return Period in Years, Partial-Duration Series

Precipitation Depth Versus Return Period for Partial-Duration Series
### RAINFALL DATA SHEET

**Location:**
- Long: 110° 53' 30"
- Lat: 32° 21' 42"

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<th>Return Period (Years)</th>
<th>Precipitation Values (inches)</th>
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<th>24 Hour Duration</th>
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<td>10</td>
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<td>3.70</td>
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\[
y_2 = -0.011 + 0.942 \left( \frac{x_1^2}{x_2} \right) = 1.34''
\]

\[
y_{100} = 0.494 + 0.755 \left( \frac{x_3^2}{x_4} \right) = 2.75''
\]
Return Period in Years, Partial-Duration Series

Precipitation Depth Versus Return Period for Partial-Duration Series
# Chart for Adjusted Curve Numbers (CN*'s)

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<tr>
<th>CN</th>
<th>( K_1 )</th>
<th>( K_2 )</th>
</tr>
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<td>95</td>
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</table>

\[
CN^* = \frac{K_1(P_1 - .88) + K_2}{P_1}
\]

Where,

\( P_1 \) = 1 hour rainfall depth.

(Use areal depth, if applicable).

Notes:  
1. \( P_1 \) must always be greater than .88 inches.  
2. For impervious areas, \( CN^* = 99 \) (constant).

(108)
HYDROLOGIC DATA SHEET

Project Name and Location: **FLECHA CAIDA FLOOD IMPROVEMENT STUDY (E 1/2 R 14 E)**

Drainage Concentration Point: #1 (FINGER ROCK WASH @ FOREST SERVICE BOUNDARY)

Watershed Area (A): 10.33 acres

Length of Watercourse (Lc): 19,400 ft. Length to Center of Gravity (Lca): 13,000 ft.

Incremental Change in Length (Li) - ft.

4,300

1,000

5,000

Incremental Change in Elevation (Hi) - ft.

7,255 - 6,240 = 1,015

6,240 - 3,560 = 2,680

3,560 - 3,080 = 480

Mean Slope (Sc): 0.189 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED)

Basin Factor (nb): 0.060

Flood Frequency: 100 yrs.

P24 (24 hour): __________ in.

P6 (6 hour): __________ in.

P1 (1 hour): 2.75 in.

P2 (2 hour): __________ in.

P3 (3 hour): __________ in.

Areal Value: __________ in.

Areal Value: __________ in.

Areal Value: __________ in.

Areal Value: __________ in.

Areal Value: __________ in.

Soil Group(s): 30% C 70% D Cover Type(s): MOUNTAIN BRUSH

Cover Density (pervious areas): 30% (MB) 20% (DB) Impervious Cover: 0% (EB)

CN(s): 82 90 (pervious & impervious areas) CN* (s): 86.58 92.50 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.5426 0.7165 (pervious areas) 0.9545 (impervious areas)

Runoff Supply Rate (q): __________ in./hr. (function of i)

Time of Concentration (Tc): 55 i^-4 mins. (function of i)

Iterative Solution of Tc: 30 i^-4 mins.

Rainfall Intensity (i) at Tc: 4.4000 in./hr.

Runoff Supply Rate (q) at Tc: 2.9231 in./hr.

Peak Discharge:

1.008 QA (acres): 3044 cfs.

645.33qa (square miles): __________ cfs.

Equation for Tc:

\[ Tc = \frac{ab (Lc- Lca)}{50 (S_c)^4} q^{-4} \text{ hours.} \]

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAIDA FLOOD IMPROVEMENT STUDY

Drainage Concentration Point: #3A (CONFLUENCE WITH #27)

Watershed Area (A): 1,891 acres/square miles.

Length of Watercourse (Lc): 2,890 ft. Length to Center of Gravity (Lc0): 149.0 ft.

Incremental Change in Length (Li) - ft.

\[ \frac{4300}{10100} \]

\[ \frac{7700}{2760} \]

Incremental Change in Elevation (Hi) - ft.

\[ \frac{7250 - 6240}{6240 - 3560} = 1015 \]

\[ \frac{3560 - 2860}{2860 - 2160} = 70 \]

Mean Slope (Sc): 0.097 ft./ft. Watershed Type(s): MOUNTAIN UNDEVELOPED (future)

Basin Factor (nb): 0.053 (future)

Flood Frequency: 100 yrs.

Areal Value: ____________ in.

Areal Value: ____________ in.

Areal Value: ____________ in.

Areal Value: ____________ in.

Soil Group(s): 17%B 18%C 65%D Cover Type(s): MOUNTAIN BRUSH MIX

Cover Density (pervious areas): 30% (MB) 20% (DB) Impervious Cover: 30% (future)

CN(s): 63, 87, 90 (pervious & impervious areas) CN* (s): 87.19, 81.51, 97.04 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.655, 0.537, 0.726 (pervious areas) 0.956 (impervious areas)

Runoff Supply Rate (q): 0.6034 in./hr. (function of i)

Time of Concentration (Tc): 14 i^-0.4 hrs./mins. (function of i)

Iterative Solution of Tc: 410 hrs./mins.

Rainfall Intensity (i) at Tc: 3.297 in./hr.

Runoff Supply Rate (q) at Tc: 2.1872 in./hr.

Peak Discharge:

1.008 qa (acres): 635 cfs.

645.33qa (square miles): ____________ cfs.

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: **FLEXHAU (AIRD) FLOOD IMPROVEMENT STUDY (N Y 135)**

Drainage Concentration Point: #3 (@ SKYLING DRIVE, SEC LINE 3:10)

Watershed Area (A): 2,806 acres

Length of Watercourse (Lc): 2,6700 ft. Length to Center of Gravity (Lgc): 1,4000 ft.

Incremental Change in Length (Lt) - ft.

<table>
<thead>
<tr>
<th>Incremental Change in Elevation (Ht) - ft.</th>
</tr>
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<tbody>
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<td>4300</td>
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<td>5,000</td>
</tr>
<tr>
<td>1,800</td>
</tr>
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</table>

Mean Slope (S): 0.1190 (ft./ft.) Watershed Type(s): MOUNTAIN (UNDEVELOPED) (future)

Basin Factor (q): 0.05 (future)

Flood Frequency: 100 years

加盖 Value: __________________ in.

Flood Value: __________________ in.

Areal Value: __________________ in.

Areal Value: __________________ in.

Areal Value: __________________ in.

Areal Value: __________________ in.

Areal Value: __________________ in.

Areal Value: __________________ in.

Areal Value: __________________ in.

Soil Group(s): 14% B, 19% C, 67% D Cover Type(s): MOUNTAIN BRUSH (DESSERT BRUSH, MIX)

Cover Density (pervious areas): 30% (ME), 20% (DB) Impervious Cover: 29% (future)

N(s): 83 82 90 (pervious & impervious areas) CN*(s): 87.20 86.54 92.67 (adjust curve number)

Runoff to Rainfall Ratio(s), C: 0.6569, 0.5697, 0.7139 (pervious areas) 0.9552 (impervious areas)

Runoff Supply Rate (q): 0.6687 in./hr. (function of i)

Time of Concentration (Tc): 68 i^-4 mins. (function of i)

Iterative Solution of Tc: 4 i^-4 mins.

Rainfall Intensity (I) at Tc: 3.5803 in./hr.

Runoff Supply Rate (q) at Tc: 2.3798 in./hr.

Peak Discharge:

1.008 QA (acres): 1,673 cfs.

645.33QA (square miles): 1,673 cfs.

Equation for Tc:

\[ \text{Tc} = \frac{2h}{h_1} (Lc)^{1.3} q^{-0.4} \text{ hours.} \]

Note: For impervious areas, \( CN^* = 99 \) (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAIDA FLOOD IMPROVEMENT STUDY (2/2 14F)

Drainage Concentration Point: #4 (FINGER ROCK WASH @ SUNRISE DRIVE SEC LINE 10 1/15)

Watershed Area (A): 3716 acres

Length of Watercourse (L_c): 32200 ft. Length to Center of Gravity (L_c): 9000 ft.

Incremental Change in Length (L_i) - ft.

<table>
<thead>
<tr>
<th>i</th>
<th>L_i</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1000</td>
</tr>
<tr>
<td>2</td>
<td>5000</td>
</tr>
<tr>
<td>3</td>
<td>2000</td>
</tr>
<tr>
<td>4</td>
<td>6000</td>
</tr>
</tbody>
</table>

Incremental Change in Elevation (H_i) - ft.

<table>
<thead>
<tr>
<th>i</th>
<th>H_i</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7755-6740=1015</td>
</tr>
<tr>
<td>2</td>
<td>6240-3560=2680</td>
</tr>
<tr>
<td>3</td>
<td>3510-3060=450</td>
</tr>
<tr>
<td>4</td>
<td>3080-2760=320</td>
</tr>
<tr>
<td>5</td>
<td>2760-2630=130</td>
</tr>
</tbody>
</table>

Mean Slope (S_c): 0.0761 ft/ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED)

Basin Factor (q_b): 0.050 (future)

P24 (24 hour): in.

P6 (6 hour): in.

P1 (1 hour): 2.72 in.

P2 (2 hour): in.

P3 (3 hour): in.

Soil Group(s): 26% B 15% C 59% D. Cover Type(s): MOUNTAIN BRUSH

Cover Density (pervious areas): 30% (M2) 70% (CB) Impervious Cover: 50% (future)

CN(s): 83, 82, 90 (pervious & impervious areas) CN(s): 87, 81, 51, 92.4

(Curve number)

Runoff to Rainfall Ratio(s), (C): 0.555, 0.5376, 0.7126 (pervious areas) 0.9568 (impervious areas)

Runoff Supply Rate (q): 0.641 in./hr. (function of i)

Time of Concentration (T_c): 57 mins. (function of i)

Iterative Solution of T_c:

Rainfall Intensity (i) at T_c: 2.826 in./hr.

Runoff Supply Rate (q) at T_c: 1.8767 in./hr.

Peak Discharge:

1.008 QA (acres): 7030 cfs.

645.33 QA (square miles): cfs.

Flood Frequency: 100 yrs.

Areal Value: in.

Areal Value: in.

Areal Value: in.

Areal Value: in.

Areal Value: in.

Areal Value: in.

Areal Value: in.

MOUNTAIN BRUSH

DESSERT BRUSH MIX

CN(s): 87, 51, 51, 49

(adjusted curve number)

Equation for T_c:

T_c = 3h (l_c) S_c) ^ 0.4 hours.

Note: For impervious areas, CN(s) = 99 (constant).
**HYDROLOGIC DATA SHEET**

**Project Name and Location:** FLECHA CAIDA FLOOD IMPROVEMENT STUDY

**Drainage Concentration Point:** #4 (at SUNRISE DRIVE ROUTED)

**Watershed Area (A):** 3713 acres/square miles.

**Length of Watercourse (Lc):** 32000 ft. Length to Center of Gravity (Lca): 19000 ft.

**Incremental Change in Length (L1) - ft.**

<table>
<thead>
<tr>
<th>Incremental Change</th>
<th>Value (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>6000</td>
<td></td>
</tr>
<tr>
<td>2700</td>
<td></td>
</tr>
<tr>
<td>3100</td>
<td></td>
</tr>
</tbody>
</table>

**Incremental Change in Elevation (H1) - ft.**

<table>
<thead>
<tr>
<th>Incremental Change</th>
<th>Value (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7750 - 6240</td>
<td>1510</td>
</tr>
<tr>
<td>6240 - 3560</td>
<td>2680</td>
</tr>
<tr>
<td>3560 - 3000</td>
<td>560</td>
</tr>
<tr>
<td>3000 - 2700</td>
<td>300</td>
</tr>
<tr>
<td>2700 - 2630</td>
<td>70</td>
</tr>
</tbody>
</table>

**Mean Slope (S):** 0.0774 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED), FOOTHILLS (DEVELOPED) (future)

**Basin Factor (nb):** 0.049 (future)

**Flood Frequency:** 100 yrs.

**Runoff to Rainfall Ratio(s), (C):** 0.5557, 0.5375, 0.7124 (pervious areas), 0.9516 (impervious areas)

**Runoff Supply Rate (q):** 0.61672 in./hr. (function of 1)

**Time of Concentration (Tc):** 83 1^-4 hrs./mins. (function of 1)

**Iterative Solution of Tc:** 54 hrs./mins.

**Rainfall Intensity (I) at Tc:** 2.9405 in./hr.

**Runoff Supply Rate (q) at Tc:** 1.9619 in./hr.

**Peak Discharge:**

1.008 qa (acres): 7343 cfs.

645.33qa (square miles): __________ cfs.

**Soil Group(s):** 26%/51%/9%/ Cover Type(s): MOUNTAIN BRUSH, DEER BRUSH MIX

**Cover Density (pervious areas):** 30% (MB), 20% (DS) Impervious Cover: 7% (future)

**CN(s):** 63, 92, 99 (pervious & impervious areas) CN*(s): 87.15, 86.51, 92.46 (adjusted curve number)

**Equation for Tc:**

\[ Tc = \frac{nb \cdot Lc \cdot qa}{50 \cdot S} \]

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAIDA FLOOD IMPROVEMENT STUDY (E 1/2 R14E)

Drainage Concentration Point: #5 (FINGER ROCK WASH @ SEC LINE 15 & 22)

Watershed Area (A): 3913 acres

Length of Watercourse (L_c): 37800 ft. Length to Center of Gravity (L_cd): 19000 ft

Incremental Change in Length (L_i) - ft.

<p>| | | |</p>
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Incremental Change in Elevation (H_i) - ft.

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<thead>
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<tbody>
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</tbody>
</table>

Mean Slope (S_c): 0.0568 ft./ft. Watershed Type(s): MOUNTAINS (UNDEVELOPED) (future)

Basin Factor (a_b): 0.047 (future)

Flood Frequency: 100 yrs

Areal Value: in.

P_24 (24 hour): in.

P_6 (6 hour): in.

P_1 (1 hour): in.

P_2 (2 hour): in.

P_3 (3 hour): in.

Areal Value: in.

Areal Value: in.

Areal Value: in.

Areal Value: in.

Areal Value: in.

Soil Group(s): 30% B 14% C 56% D Cover Type(s): MOUNTAIN BRUSH DESERT BRUSH MIX

Cover Density (perious areas): 30% (MB) 20% (DB) Impervious Cover: 7% (future)

CN(s): 93, 92, 90 (perious & impervious areas) CN^*(s): 87.116, 86.49, 92.44 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.535, 0.535, 0.711 (perious areas) 0.956 (impervious areas)

Runoff Supply Rate (q): in./hr. (function of i)

Time of Concentration (T_c): 95 t^-0.6 hrs./mins. (function of i)

Iterative Solution of T_c: 660 hrs.

Rainfall Intensity (I) at T_c: 2.5209 in./hr.

Runoff Supply Rate (q) at T_c: in./hr.

Peak Discharge:

1.008 qa (acres): 6578 cfs.

645.33 qa (square miles): cfs.

Equation for T_c:

T_c = \frac{a}{(S_c)^{0.4}} \text{ hours.}

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLEXA LAIDA FLOOD IMPROVEMENT STUDY (4½ RIHE) N 7° 3' 13" W Drainage Concentration Point: 46 (FING FORK WASH & SEC CORNER 21, 22, 21, 28) Watershed Area (A): 4124 acres/ft. Length of Watercourse (Lc): 44200 ft. Length to Center of Gravity (Lca): 23000 ft. Incremental Change in Length (L): - ft. 4300 1000 8000 4300 6000 12000 Incremental Change in Elevation (H): - ft. 7250 - 6240 = 1015 6240 - 3560 = 2680 3560 - 3070 = 490 3080 - 2700 = 380 2710 - 2680 = 30 Mean Slope (S): 0.0454 ft./ft. Watershed Type(s): MOUNTAINS (undeveloped) Foothills (developed) (future) Basin Factor (q): 0.045 (future) Flood Frequency: 100 yrs. Areal Value: in. Areal Value: in. Areal Value: in. Areal Value: in. Areal Value: in. Soil Group(s): 34% A, 12% B, 53% C Cover Type(s): DESERT BRUSH Cover Density (perVIOUS areas): 30% (MB), 20% (DE) Impervious Cover: 10% (future) CN(s): 68, 82, 90 (perVIOUS & IMPERVIOUS areas) CN* (s): 87.14, 86.49, 92.44 (adjusted curve number) Runoff to Rainfall Ratio(s), (C): 0.535, 0.538, 0.713 (perVIOUS areas) 0.960 (impervious areas) Runoff Supply Rate (q): 0.541 in/hr. (function of t) Time of Concentration (Tc): 111 minutes (function of t) Iterative Solution of Tc: 82 minutes Rainfall Intensity (I) at Tc: 2.1255 in/hr. Runoff Supply Rate (q) at Tc: 1.3903 in/hr. Peak Discharge: 1.008 QA (acres): 5779 cfs. 645.33QA (square miles): cfs. Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLEXHA CAIDA FLOOD IMPROVEMENT STUDY (EV 2 R 145)

Drainage Concentration Point: # 1 (@ SWAN RD SEC LINE 2 & 3)

Watershed Area (A): 312 (340 sq) acres/square miles.

Length of Watercourse (Lc): 102.00 ft. Length to Center of Gravity (Lcg): 16000 ft.

Incremental Change in Length (Li) - ft.

<table>
<thead>
<tr>
<th>Li</th>
<th>Incremental Change in Elevation (Hi) - ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>5280 - 4000 = 1280</td>
</tr>
<tr>
<td>2000</td>
<td>4000 - 3400 = 600</td>
</tr>
<tr>
<td>1800</td>
<td>3400 - 3080 = 320</td>
</tr>
<tr>
<td>4200</td>
<td>3080 - 2850 = 230</td>
</tr>
</tbody>
</table>

Mean Slope (S0): 0.1743 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED) (future)

Basin Factor (nB): 0.054 (future)

P24 (24 hour): ______________ in.
P6 (6 hour): ______________ in.
P1 (1 hour): ______________ in.
P2 (2 hour): ______________ in.
P3 (3 hour): ______________ in.

Areal Value: ______________ in.

Soil Group(s): 25% B 75% D Cover Type(s): MOUNTAIN BRUSH

Cover Density (pervious areas): 30% (MB) 70% (OB) Impervious Cover: 8% (future)

CN(s): 83 90 (pervious & impervious areas) CN* (s): 87.112 92.44 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.5535, 0.7113 (pervious areas) 0.9516 (impervious areas)

Runoff Supply Rate (q): 0.494g in./hr. (function of i)

Time of Concentration (Tc): 37 1/4 hrs./mins. (function of i)

Iterative Solution of Tc: 19 hrs./mins.

Rainfall Intensity (i) at Tc: 5.5590 in./hr.

Runoff Supply Rate (q) at Tc: 3.81613 in./hr.

Peak Discharge:

1.008 qA (acres): 124 (1323 3/4) cfs.

645.336q (square miles): ______________ cfs.

3 2 SKYLINE DRIVE (SEC LINE 3 & 10)

Flood Frequency: 100 yrs.

Areal Value: ______________ in.

Equation for Tc:

Tc = nh (Lc/Lcg) 3 q - 4 hours.

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: **Flecha Caida Flood Improvement Study**

Drainage Concentration Point: **#7A (UPSTREAM OF CONFLUENCE WITH 8A)**

Watershed Area (A): **348** acres/square miles.

Length of Watercourse (Lc): **2100** ft. Length to Center of Gravity (Lca): **7200** ft.

Incremental Change in Length (Li) - ft.

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>L3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2100</td>
<td>4200</td>
<td>-1200</td>
</tr>
<tr>
<td>4200</td>
<td>2400</td>
<td></td>
</tr>
</tbody>
</table>

Incremental Change in Elevation (Hi) - ft.

<table>
<thead>
<tr>
<th>H1</th>
<th>H2</th>
<th>H3</th>
</tr>
</thead>
<tbody>
<tr>
<td>5280</td>
<td>4000</td>
<td>1280</td>
</tr>
<tr>
<td>4000</td>
<td>3400</td>
<td>600</td>
</tr>
<tr>
<td>3400</td>
<td>3080</td>
<td>320</td>
</tr>
<tr>
<td>3080</td>
<td>7850</td>
<td>230</td>
</tr>
<tr>
<td>2850</td>
<td>2165</td>
<td>85</td>
</tr>
</tbody>
</table>

Mean Slope (S0): **0.0914** ft./ft. Watershed Type(s): **FOOTHILLS UNDEVELOPED (future)**

Flood Frequency: **100** yrs.

Basin Factor (nB): **0.050** (future)

Areal Value: _in._

P24 (24 hour): _in._

P6 (6 hour): _in._

P1 (1 hour): **2.71** _in._

P2 (2 hour): _in._

P3 (3 hour): _in._

Soil Group(s): **35BD L67JD** Cover Type(s): **MOUNTAIN BRUSH, DESERT BRUSH MIX**

Cover Density (pervious areas): **30%/(mg) & 10%** Impervious Cover: **11%** (future)

CN(s): **83** 90 (pervious & impervious areas) CN*(s): **87.116** 92.44 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): **0.5535** 0.7113 (pervious areas) 0.9566 (impervious areas)

Runoff Supply Rate (q): **0.6919** _in./hr. (function of i)

Time of Concentration (Tc): **44** _hrs./mins. (function of i)

Iterative Solution of Tc: **23** _hrs./mins.

Rainfall Intensity (i) at Tc: **5.0419** _in./hr.

Runoff Supply Rate (q) at Tc: **3.4885** _in./hr.

Peak Discharge:

1.008 QA (acres): **12.24** _cfs._

645.33qa (square miles): **_cfs._

Equation for Tc:

\[ Tc = \frac{90}{50} \left( \frac{S0}{Lc} \right)^{0.4} \]

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLEXHA GAIDA FLOOD IMPROVEMENT STUDY (E 1/2 R44'E)

Drainage Concentration Point: #8 (C SWAN ROAD SEC LINE 10 & 11)

Watershed Area (A): 285 acres

Length of Watercourse (Lc): 8600 ft. Length to Center of Gravity (Lcd): 4400 ft.

Incremental Change in Length (L1) - ft.

| 4000 | 3400 | 600 |
| 3400 | 3200 | 200 |
| 3200 | 3000 | 200 |
| 3000 | 2820 | 180 |

Incremental Change in Elevation (H1) - ft.

Mean Slope (Sc): 0.0713 ft./ft. Watershed Type(s): FOOT HILLS (DEVELOPED) (future)

Basin Factor (aB): 0.043 (future)

Flood Frequency: 100 yrs.

P24 (24 hour): 0.043 in.

P6 (6 hour): 0.043 in.

P1 (1 hour): 2.69 in.

P2 (2 hour): 2.69 in.

P3 (3 hour): 2.69 in.

Soil Group(s): 75% B 25% D

Cover Type(s): MOUNTAIN BRUSH

Cover Density ( pervious areas): 30% (MB) 20% (OB) Impervious Cover: 22% (future)

CN(s): 50

(pervious & impervious areas) CN*(s): 87.1

(adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.708 (pervious areas) 0.9763 (impervious areas)

Runoff Supply Rate (q): 0.6763 1 in./hr. (function of i)

Time of Concentration (Tc): 83 1.4 mins. (function of i)

Iterative Solution of Tc: 160 1.4 mins.

Rainfall Intensity (i) at Tc: 5.977 1 in./hr.

Runoff Supply Rate (q) at Tc: 4.6771 1 in./hr.

Peak Discharge:

1.008 qa (acres): 515 cfs.

645.33 qa (square miles): 663 cfs.

Equation for Tc:

\[ Tc = \frac{nh}{50} \left( \frac{Lc}{Sc} \right)^{3/4} q^{-1/4} \text{ hours.} \]

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CANOA FLOOD IMPROVEMENT STUDY

Drainage Concentration Point: #8A (UPSTREAM OF CONFLUENCE WITH 7A)

Watershed Area (A): 315 acres/square miles.

Length of Watercourse (Lc): 10200 ft. Length to Center of Gravity (Lcg): 5200 ft.

Incremental Change in Length (L1) - ft.

<table>
<thead>
<tr>
<th>1100</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
</tr>
<tr>
<td>7500</td>
</tr>
<tr>
<td>4700</td>
</tr>
<tr>
<td>1600</td>
</tr>
</tbody>
</table>

Incremental Change in Elevation (H1) - ft.

<table>
<thead>
<tr>
<th>4000</th>
<th>3400</th>
<th>600</th>
</tr>
</thead>
<tbody>
<tr>
<td>3400</td>
<td>3200</td>
<td>800</td>
</tr>
<tr>
<td>3200</td>
<td>3000</td>
<td>200</td>
</tr>
<tr>
<td>3000</td>
<td>2820</td>
<td>180</td>
</tr>
<tr>
<td>2820</td>
<td>2765</td>
<td>55</td>
</tr>
</tbody>
</table>

Mean Slope (S0): 0.0024 ft./ft. Watershed Type(s): MOUNTAIN UNDEVELOPED (futur)E.

Basin Factor (pA): 0.047 (future)

Flood Frequency: 100 yrs.

P24 (24 hour): n in.

P6 (6 hour): n in.

P1 (1 hour): 2.69 in.

P2 (2 hour): n in.

P3 (3 hour): n in.

Areal Value: n in.

Areal Value: n in.

Areal Value: n in.

Areal Value: n in.

Soil Group(s): 77% B 23% D

Cover Type(s): MOUNTAIN BRUSH DESERT BRUSH MIX

Cover Density (pervious areas): 30% (MB) 20% (DS) Impervious Cover: 21% (future)

CN(s): 83 90 (pervious & impervious areas) CN*(s): 87.11 92.41

(curve number)

(adj usted curve number)

Runoff to Rainfall Ratio (s, C): 0.5501, 0.7086 (pervious areas) 0.9563 (impervious areas)

Runoff Supply Rate (q): 0.0827 1 in./hr. (function of i)

Time of Concentration (Tc): 31 1^-4 hrs./mins. (function of i)

Iterative Solution of Tc:

Rainfall Intensity (I) at Tc: 5.5179 in./hr.

Runoff Supply Rate (q) at Tc: 3.7669 in./hr.

Peak Discharge:

1.008 qa (acres): 1196 cfs.

645.33qa (square miles): 1196 cfs.

Equation for Tc:

\[ Tc = \frac{nh (Lc - Lcg)}{S0^{1.4} q^{0.4}} \text{ hours.} \]

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLEXHA CAIDA FLOOD IMPROVEMENT STUDY (E 1/2 R14E)

Drainage Concentration Point: #9 (@ SWAN ROAD SEC LINE 10 & 11)

Watershed Area (A): 367 acres

Length of Watercourse (Lc): 15200 ft. Length to Center of Gravity (Lca): 7600 ft.

Incremental Change in Length (Lt) - ft.

<table>
<thead>
<tr>
<th>Incremental Change</th>
<th>5900</th>
<th>1300</th>
<th>4000</th>
<th>4000</th>
</tr>
</thead>
</table>

Incremental Change in Elevation (Ht) - ft.

<table>
<thead>
<tr>
<th>Incremental Change</th>
<th>5780 - 3400 = 2380</th>
<th>3400 - 3200 = 200</th>
<th>3200 - 2950 = 250</th>
<th>2950 - 2820 = 130</th>
</tr>
</thead>
</table>

Mean Slope (Sc): 0.0896 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED) Foothills (DEVELOPED) (future)

Basin Factor (nb): 0.048 (future)

Flood Frequency: 100 yrs.

Areal Value: __________ in.

Areal Value: __________ in.

Areal Value: __________ in.

Areal Value: __________ in.

Areal Value: __________ in.

Soil Group(s): 48% B, 16% C, 46% D

Cover Type(s): MOUNTAIN BRUSH DESERT BRUSH MIX

Cover Density ( pervious areas): 30% (nb), 10% (nb) Impervious Cover: 70% (future)

CN(s): 83, 82, 90 (pervious & impervious areas) CN*(s): 87.7, 86.47, 92.46 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.65, 0.58, 0.70 (pervious areas) 0.95 (impervious areas)

Runoff Supply Rate (q): 0.16468 1 in./hr. (function of i)

Time of Concentration (Tc): 47 i^-6 mins. (function of i)

Iterative Solution of Tc: 25 i^-6 mins.

Rainfall Intensity (I) at Tc: 4.800 in./hr.

Runoff Supply Rate (q) at Tc: 3.1045 in./hr.

Equation for Tc:

\[ T_c = \frac{nb}{50} \left( \frac{Lc}{Sc} \right) \cdot \frac{1}{q} \cdot 4 \, \text{hours} \cdot \left( \frac{Sc}{S_c} \right)^{1.4} \]

Note: For impervious areas,
CN* = 99 (constant).

Peak Discharge:

1.008 QA (acres): 1148 cfs.

645.33QA (square miles): __________ cfs.
**HYDROLOGIC DATA SHEET**

**Project Name and Location:** FLEXHA AIDA FLOOD IMPROVEMENT STUDY W. 41/2 R.I.

**Drainage Concentration Point:** #10 (SUNRISE DRIVE)

**Watershed Area (A):** 537 acres/sq. miles.

**Length of Watercourse (Lc):** 19000 ft. Length to Center of Gravity (Lcg): 9500 ft.

**Incremental Change in Length (Li) - ft.**

<table>
<thead>
<tr>
<th>Incremental Change</th>
<th>5700</th>
<th>1300</th>
<th>4000</th>
<th>500</th>
</tr>
</thead>
</table>

**Mean Slope (S):** 0.0159 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED), POTHILLS (DEVELOPED) (future)

**Basin Factor (nh):** 0.644 (future)

**Flood Frequency:** 100 yrs.

**Areal Value:**

<table>
<thead>
<tr>
<th>24 (24 hour):</th>
<th>in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₆ (6 hour):</td>
<td>in.</td>
</tr>
<tr>
<td>r₁ (1 hour):</td>
<td>2.68 in.</td>
</tr>
<tr>
<td>r₂ (2 hour):</td>
<td>in.</td>
</tr>
<tr>
<td>P₃ (3 hour):</td>
<td>in.</td>
</tr>
</tbody>
</table>

**Soil Group(s):** 55% B, 40% C, 5% D

**Cover Type(s):** MOUNTAIN BUSH MIX

**Cover Density (perious areas):** 30% (MB), 20% (DB)

**Impervious Cover:** 10% (future)

**N(s):** 83, 31, 90 (perious & impervious areas) CN*(s): 87.09, 82.48, 92.40 (adjusted curve number)

**Runoff to Rainfall Ratio(s), (C):** 0.4453, 0.5316, 0.7072 (perious areas) 0.9562 (impervious areas)

**Runoff Supply Rate (q):** 0.4328 in/hr. (function of i)

**Time of Concentration (Tc):** 560 in. 4/3 mins. (function of i)

**Iterative Solution of Tc:** 32 in. 3 mins.

**Rainfall Intensity (i) at Tc:** 4.123 in/hr.

**Runoff Supply Rate (q) at Tc:** 2.609 in/hr.

**Peak Discharge:**

- 1.008 qa (acres): 147 cfs.
- 645.33qa (square miles): cfs.

**Equation for Tc:**

\[ T_c = \frac{nh(Lc - Lcg)}{50 \cdot (S)^{0.4}} \text{ hours.} \]

**Note:** For impervious areas, \( CN^* = 99 \) (constant).
## Hydrologic Data Sheet

**Project Name and Location:** FLECHA CAIDA FLOOD IMPROVEMENT STUDY (E/1 R1/4 E)

**Drainage Concentration Point:** #11 (@ SWAN ROAD SEC LINE 10 & 11)

**Watershed Area (A):** 908 (927\*1 acres/square miles.

**Length of Watercourse (Lc):** 21700 ft. Length to Center of Gravity (Lcg): 10900 ft.

<table>
<thead>
<tr>
<th>Incremental Change in Length (Lc) - ft.</th>
<th>Incremental Change in Elevation (Hc) - ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100</td>
<td>6080 - 5600 = 480</td>
</tr>
<tr>
<td>4000</td>
<td>5600 - 3800 = 1800</td>
</tr>
<tr>
<td>2200</td>
<td>3800 - 3400 = 400</td>
</tr>
<tr>
<td>1900</td>
<td>3400 - 3200 = 200</td>
</tr>
<tr>
<td>12500</td>
<td>3200 - 2740 = 460</td>
</tr>
</tbody>
</table>

**Mean Slope (S):** 0.0670 ft./ft. Watershed Type(s): Mountain (undeveloped) Foothills (developed) (future)

**Flood Frequency:** 100 yrs.

**Basin Factor (q):** 0.047 (future)

**P6 (6 hour):** in.

**P1 (1 hour):** 2.69 in.

**P2 (2 hour):** in.

**P3 (3 hour):** in.

**Soil Group(s):** 38% B 13% C 49% D  Cover Type(s): Mountain Brush Desert Brush Mix

**Cover Density (pervious areas):** 30% (MB) 70% (DB) Impervious Cover: 8% (future)

**IN(s):** 83.82.90  (pervious & impervious areas) CN*(s): 87.11 64.45.92.41 (adjusted curve number)

**Runoff to Rainfall Ratio(s), (C):** 0.550, 0.5323, 0.76  (pervious areas) 0.9563  (impervious areas)

**Runoff Supply Rate (q):** 0.6519 i in./hr. (function of C)

**Time of Concentration (Tc):** 164 1.4 mins. (function of C)

**Iterative Solution of Tc:** 38 .

**Rainfall Intensity (I) at Tc:** 3.7103 in./hr.

**Runoff Supply Rate (q) at Tc:** 2.4187 in./hr.

**Peak Discharge:**

- 1.008 qa (acres): 2214 (2760*) cfs.
- 645.33ha (square miles): cfs.

**Note:** For impervious areas, CN* = 99 (constant).
<table>
<thead>
<tr>
<th>Percentage</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>65%</td>
</tr>
<tr>
<td>2%</td>
<td>30%</td>
</tr>
<tr>
<td>8%</td>
<td>5%</td>
</tr>
<tr>
<td>47%</td>
<td>0%</td>
</tr>
<tr>
<td>38%</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Layer Factor</th>
<th>Breakdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>8400</td>
<td>0.035</td>
</tr>
<tr>
<td>3400</td>
<td>0.040</td>
</tr>
<tr>
<td>9900</td>
<td>0.060</td>
</tr>
<tr>
<td></td>
<td>21700</td>
</tr>
<tr>
<td></td>
<td>0.047</td>
</tr>
</tbody>
</table>
Project Name and Location: FLECHA GAIDA FLOOD IMPROVEMENT STUDY  (E+R14E)

Drainage Concentration Point: #12 (SEC LINE 15-22)

Creshed Area (A): 794 acres

Length of Watercourse (Lc): 24500 ft. Length to Center of Gravity (Lca): 12250 ft.

Incremental Change in Length (Lr) - ft.
- 5900 ft.
- 1300 ft.
- 4000 ft.
- 1300 ft.

Incremental Change in Elevation (Hr) - ft.
- 5780 - 3400 = 2380 ft.
- 3400 - 3200 = 200 ft.
- 3200 - 2950 = 250 ft.
- 2950 - 2580 = 370 ft.

Slope (Sc): 0.0511 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED) Forthills (DEVELOPED) (future)

Basin Factor (ab): 0.042 (future)

Flood Frequency: 100 yrs.

Areal Value: ________________ in.

R3 (6 hour): ________________ in.

R1 (1 hour): ________________ in.

R2 (2 hour): ________________ in.

R3 (3 hour): ________________ in.

Flood Group(s): 74% 3% C 21% D Cover Type(s): DESERT BRUSH MIX

Cover Density (pervious areas): 30% (MB) 70% (DB) Impervious Cover: 11% (future)

N(s): 23 87 90 (pervious & impervious areas) CN* (s): 87.67 66.40 97.35 (adjusted curve number)

Runoff Supply Rate (q): 0.6709 in./hr. (function of I)

Time of Concentration (Tc): 70 hrs./mins. (function of I)

Iterative Solution of Tc: 4 1 3 hrs./mins.

Rainfall Intensity (I) at Tc: 3.3905 in./hr.

Runoff Supply Race (q) at Tc: 2.1052 in./hr.

Peak Discharge:
1.008 QA (acres): 1485 cfs.
645.33QA (square miles): ____________ cfs.

Equation for Tc:

\[ Tc = \frac{Ab}{1} \cdot \left( \frac{Lc}{Lca} \right)^{3/4} \cdot q^{-4/5} \text{ hours.} \]

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAISA FLOOD IMPROVEMENT STUDY (51/2 RILE)
Drainage Concentration Point: #13 (VALLEY VIEW WASH @ SE. line 15 & 22)
Watershed Area (A): 1239 acres
Length of Watercourse (Lc): 27300 ft. Length to Center of Gravity (Lcg): 13700 ft.
Incremental Change in Length (Li) - ft.

<table>
<thead>
<tr>
<th>Li</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1100</td>
<td></td>
</tr>
<tr>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td></td>
</tr>
<tr>
<td>12600</td>
<td></td>
</tr>
<tr>
<td>5600</td>
<td></td>
</tr>
</tbody>
</table>

Incremental Change in Elevation (Hi) - ft.

<table>
<thead>
<tr>
<th>Hi</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5600 - 5100 = 500</td>
<td></td>
</tr>
<tr>
<td>3600 - 3800 = 200</td>
<td></td>
</tr>
<tr>
<td>3400 - 3200 = 200</td>
<td></td>
</tr>
<tr>
<td>3200 - 2740 = 460</td>
<td></td>
</tr>
<tr>
<td>2740 - 7350 = 460</td>
<td></td>
</tr>
</tbody>
</table>

Mean Slope (S): 0.0545 ft./ft. Watershed Type(s): (future)
Basin Factor (q): 0.045 (future)
Flood Frequency: ______________ yts.

<table>
<thead>
<tr>
<th>24 (24 hour):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P6 (6 hour):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6</td>
<td>in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1 (1 hour):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.68</td>
<td>in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T2 (2 hour):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T3 (3 hour):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in.</td>
</tr>
</tbody>
</table>

Oil Group(s): 53% B, 10% C, 37% D
Cover Type(s): MOUNTAIN BRUSH, DESERT BRUSH MIX
Cover Density (pervious areas): 30% (MB), 20% (BS)
Impervious Cover: 10% (future)
N(s): 23, 42, 90 (pervious & impervious areas)
CN*(s): 87.09, 86.43, 92.40

Runoff Supply Rate (q): 0.6474 in./hr. (function of i)

<table>
<thead>
<tr>
<th>Rate of Concentration (Tc):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>77 1^-4 hrs./mins. (function of i)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Iterative Solution of Tc:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>49 hrs./mins.</td>
<td></td>
</tr>
</tbody>
</table>

Rainfall Intensity (i) at Tc: 3.1072 in./hr.

<table>
<thead>
<tr>
<th>unoff Supply Rate (q) at Tc:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0117 in./hr.</td>
<td></td>
</tr>
</tbody>
</table>

Peak Discharge:

<table>
<thead>
<tr>
<th>1.008 qa (acres):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2517 cfs.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>645.33qa (square miles):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>______________________ cfs.</td>
<td></td>
</tr>
</tbody>
</table>

Equation for Tc:

\[ Tc = \frac{nh}{LC_LCG} \cdot \frac{3}{q} \cdot \frac{a}{50} \cdot \frac{1}{(Sc)^4} \]

Note: For Impervious areas,
CN* = 99 (constant).
unreliables cover breakdown

9% @ 65%
3% @ 30%
6% @ 5%
35% @ 0%
416% @ 10%
1% @ 50%

12%

33

Warm factor breakdown

14000 @ 0.035
3400 @ 0.040
9900 @ 0.060

27300
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAIDA FLOOD IMPROVEMENT STUDY (E.B. RUUS)

Drainage Concentration Point: #14 (SEC. LINE 14 & 23)

Acreage Area (A): 2.39 acres/square mile

Length of Watercourse (Lc): 10,800 ft. Length to Center of Gravity (Lca): 5000 ft.

Incremental Change in Length (Li) - ft.

4200
6600

Incremental Change in Elevation (Hi) - ft.

3000 - 2800 = 200
2800 - 2610 = 190

Mean Slope (Sc): 0.0345 ft./ft. Watershed Type(s): foothills (developed) (future)

Basin Factor (mB): 0.035 (future)

24 (24 hour): __________________ in.

96 (6 hour): __________________ in.

24 (1 hour): 2.63 in.

2 (2 hour): __________________ in.

P (3 hour): __________________ in.

Oil Group(s): 100% B

Cover Type(s): DECO BRUSH

Cover Density (perious areas): 70% Impervious Cover: 15% (future)

CN(s): 86.98 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.5395 (perious areas) 0.9553 (impervious areas)

Runoff Supply Rate (q): 0.0019 in./hr. (function of i)

Time of Concentration (Tc): 4.4 hr. (function of Tc)

Iterative Solution of Tc: 22 hours/minutes

Rainfall Intensity (i) at Tc: 5.0095 in./hr.

Runoff Supply Rate (q) at Tc: 3.0152 in./hr.

Peak Discharge:

1.008 QA (acres): 72.6 cfs.

645.33 QA (square miles): __________ cfs.

Flood Frequency: __________ yrs.

Areal Value: __________________ in.

Areal Value: __________________ in.

Areal Value: __________________ in.

Areal Value: __________________ in.

Areal Value: __________________ in.

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAYDA FLOOD IMPROVEMENT STUDY (E/4 RIVE N32°31'33")
Drainage Concentration Point: 15 VALLEY VIEW WASH @ SEC LINE 2277 RIVER ED
Watershed Area (A): 2510 acres/square miles.
Length of Watercourse (Lc): 32900 ft. Length to Center of Gravity (Lcg): 11500 ft.
Incremental Change in Length (L1) - ft.

<table>
<thead>
<tr>
<th>Incremental Change in Length (L1) - ft.</th>
<th>Incremental Change in Elevation (H1) - ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100</td>
<td>100 80 - 5600 = 460</td>
</tr>
<tr>
<td>5200</td>
<td>5600 - 3800 = 1800</td>
</tr>
<tr>
<td>1900</td>
<td>3800 - 2400 = 1400</td>
</tr>
<tr>
<td>1700</td>
<td>2400 - 3200 = 2000</td>
</tr>
<tr>
<td></td>
<td>11500</td>
</tr>
</tbody>
</table>

Mean Slope (S): 0.0177 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED) foot hills (DEVELOPED) (future)
Basin Factor (nb): 0.47 (future)
Flood Frequency: 100 yrs.
P24 (24 hour): ___________ in.
P6 (6 hour): ___________ in.
P1 (1 hour): 2.16 in.
P2 (2 hour): ___________ in.
P3 (3 hour): ___________ in.
Areal Value: ___________ in.

Soil Group(s): 70% B 16% C 24% D Cover Type(s): MOUNTAIN BRUSH DESERT BRUSH MIX
Cover Density (pervious areas): 30% (MB) 70% (DB) Impervious Cover: 12% (future)
CN(s): 83 82 90 (pervious & impervious areas) CN*: 87.05, 86.38, 92.24 (adjusted curve number)
Runoff to Rainfall Ratio(s), (C): 0.5448, 0.5770, 0.7044 (pervious areas) 0.9558 (impervious areas)
Runoff Supply Rate (q): 0.6269 in./hr. (function of i)
Time of Concentration (Tc): 106 1/4 mins. (function of L)
Iterative Solution of Tc: 78 hrs./mins.
Rainfall Intensity (I) at Ti: 2.1714 in./hr.
Runoff Supply Rate (q) at Tc: 1.320 3 in./hr.
Peak Discharge:

1.008 QA (acres): 3514 cfs.
645.33 QA (square miles): ___________ cfs.

Equation for Tc:

\[ Tc = ab \left( \frac{Lc \cdot Tc}{S_c} \right)^{2/4} \text{ hours}. \]

Note: For Impervious areas, CN*: 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLEXHA CAIDA FLOOD IMPROVEMENT STUDY (E 1/2 R 14E)

Drainage Concentration Point: #16 (@ FOREST SERVICE BOUNDARY)

Watershed Area (A): 390 acres/square miles.

Length of Watercourse (Lc): 7,300 ft. Length to Center of Gravity (Lca): 3,700 ft.

Incremental Change in Length (Li) - ft.

<table>
<thead>
<tr>
<th>Li</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

Incremental Change in Elevation (Hi) - ft.

<table>
<thead>
<tr>
<th>Hi</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6080 5600 = 480</td>
<td></td>
</tr>
<tr>
<td>5600 3800 = 1800</td>
<td></td>
</tr>
<tr>
<td>3800 3400 = 400</td>
<td></td>
</tr>
</tbody>
</table>

Mean Slope (Sc): 0.0259 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED) Existent

Basin Factor (ab): 0.060 (Existent)

Flood Frequency: 100 yrs.

Areal Value: 

P6 (6 hour): 

P1 (1 hour): 2.72 in.

P2 (2 hour): 

P3 (3 hour): 

Soil Group(s): 29% C 71% D Cover Type(s): MOUNTAIN BRUSH

Cover Density (perforous areas): 30% (MB) 20% (DS) Impervious Cover: 0% (Existent)

CN(s): 82.90 (perforous & impervious areas) CN*(s): 81.51 92.40 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.5375 0.7120 (perforous areas) 0.9508 (impervious areas)

Runoff Supply Rate (q): 0.1618 in./hr. (function of i)

Time of Concentration (Tc): 23 i^-4 hrs./mins. (function of i)

Iterative Solution of Tc: 10 hrs./mins.

Rainfall Intensity (I) at Tc: 7.3440 in./hr.

Runoff Supply Rate (q) at Tc: 4.81603 in./hr.

Peak Discharge:

1.008 QA (acres): 1911 cfs.

645.33QA (square miles): __________ cfs.

Equation for Tc:

Tc = \frac{nh(LcLca)^{0.4}}{50 (Sc)^{0.4}} hours.

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: ELECHA CAIDA FLOOD IMPROVEMENT STUDY (E 1/2, R 14E)

Drainage Concentration Point: #17 (SEC. LINE 2 & 11 ALONG SKYLINE DRIVE ALIGNMENT)

Watershed Area (A): 257 acres/

Length of Watercourse (Lc): 11200 ft. Length to Center of Gravity (Lca): 5600 ft.

Incremental Change in Length (L1) - ft.

5900

1300

Incremental Change in Elevation (H1) - ft.

5780 - 3400 = 2380

3400 - 3200 = 200

3200 - 2950 = 250

Mean Slope (Sc): 0.1533 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED)

Flood Frequency: 100 yrs.

Watershed Type(s): PEOPLIUS (DEVELOPED) (future)

Basin Factor (qD): 0.053 (future)

Areal Value: 

Area (24 hour): 

Area (6 hour): 

Area (1 hour): 2.71 in.

Area (2 hour): 

Area (3 hour): 

Soil Group(s): 25% B, 9% C, 66% D Cover Type(s): MOUNTAIN BRUSH

Cover Density (pervious areas): 30% (MA), 20% (DB) Cover Type(s): DESERT BRUSH MIX

Impervious Cover: 0% (future)

CN(s): 83, 82, 90 (pervious & impervious areas) CN*(s): 87.4, 86.49, 92.14 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.5535, 0.5558, 0.7112 (pervious areas) 0.9560 (impervious areas)

Runoff Supply Rate (q): 0.6065 in./hr. (function of i)

Time of Concentration (Tc): 35 i^-4 hrs./mins. (function of i)

Iterative Solution of Tc: 17 hrs./mins.

Rainfall Intensity (I) at Tc: 5.8595 in./hr.

Runoff Supply Rate (q) at Tc: 3.9055 in./hr.

Peak Discharge: 1.008 QA (acres): 1012 cfs.

645.33QA (square miles): 6 cfs.

Equation for Tc:

Tc = nh (Lca - Sc) q^-4 hours.

Note: For impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: **Flecha Caida Flood Improvement Study (Evie River)**

Drainage Concentration Point: **#18 (Selkirk 7 & 11 Skyline Drive Alignment)**

Watershed Area (A): **610 acres/miles**

Length of Watercourse (L_c): **13,300 ft.** Length to Center of Gravity (L_c, g): **7,000 ft.**

Incremental Change in Length (L_i) - ft.

| Incremental Change |-ft. | 1,000 | 4,000 | 2,000 | 1,900 | 4,100 |

Mean Slope (S_c): **0.1339 ft./ft.** Watershed Type(s): MOUNTAIN (UNDEVELOPED), FOOTHILLS (DEVELOPED) (future)

Basin Factor (m_b): **0.055** (future)

24 (24 hour): **-** in.

P6 (6 hour): **-** in.

-1 (1 hour): **2.72** in.

T2 (2 hour): **-** in.

P3 (3 hour): **-** in.

Soil Group(s): **8%B, 19%C, 73%D** Cover Type(s): MOUNTAIN BRUSH, DESERT BRUSH MIX

Cover Density (pervious areas): **30% (MB), 20% (DB)** Impervious Cover: **3.0%** (future)

CN(s): **83, 82, 90** (pervious & impervious areas) **CN(a)**: **67.16, 84, 91.9** (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): **0.6552, 0.5375, 0.7126** (pervious areas) **0.9568** (impervious areas)

Runoff Supply Rate (q): **0.6754** in./hr. (function of L)

Time of Concentration (T_c): **42** in./hr. (function of L)

Iterative Solution of T_c: **27** in./hr.

Rainfall Intensity (i) at T_c: **5.1810** in./hr.

Runoff Supply Rate (q) at T_c: **3.4994** in./hr.

Peak Discharge:

1.008 qa (acres): **2152** cfs.

645.33qa (square miles): **-** cfs.

Incremental Change in Elevation (H_i) - ft.

<table>
<thead>
<tr>
<th>Incremental Change</th>
<th>ft.</th>
<th>6,000 - 5,600 = 400</th>
<th>5,600 - 3,800 = 1,800</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3,800 - 3,400 = 400</td>
<td>3,400 - 3,200 = 200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,200 - 2,980 = 220</td>
<td></td>
</tr>
</tbody>
</table>

Flood Frequency: **100** yrs.

Areal Value: **-** in.

Areal Value: **-** in.

Areal Value: **-** in.

Areal Value: **-** in.

Areal Value: **-** in.

Note: For impervious areas, CN^a = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: **FLECHA CHIDA FLOOD IMPROVEMENT STUDY (E 1/2 RILE)**

Drainage Concentration Point: **#19 (FLECHA CHIDA WASH @ SUNRISE DRIVE EXIT LINE 1161)**

Watershed Area (A): **101 acres/square miles.**

Length of Watercourse (Lc): **7000 ft.** Length to Center of Gravity (Lca): **3500 ft.**

Incremental Change in Length (Li) - ft.

<table>
<thead>
<tr>
<th>i</th>
<th>2000</th>
<th>5000</th>
</tr>
</thead>
</table>

Incremental Change in Elevation (Hi) - ft.

<table>
<thead>
<tr>
<th>i</th>
<th>3080</th>
<th>2960</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>2960</td>
<td>2830</td>
<td>130</td>
</tr>
</tbody>
</table>

Mean Slope (Sc): **0.0319 ft./ft.** Watershed Type(s): **FOOTHILLS (DEVELOPED) (future)**

Basin Factor (Qb): **0.039** (future)

Flood Frequency: **100 yrs.**

Areal Value: **— in.**

Areal Value: **— in.**

Areal Value: **— in.**

Areal Value: **— in.**

Areal Value: **— in.**

Areal Value: **— in.**

Soil Group(s): **100 9/CB**

Cover Type(s): **DESERT GRASS**

Cover Density (pervious areas): **20%** Impervious Cover: **10% (future)**

N(s): **68** (pervious & impervious areas) CN*(s): **87.05** (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): **0.5448** (pervious areas) **0.9558** (impervious areas)

Runoff Supply Rate (q): **0.5859** in./hr. (function of i)

Time of Concentration (Tc): **38 1-4/6 mins.** (function of i)

Iterative Solution of Tc: **19 55 mins.**

Rainfall Intensity (i) at Tc: **5.4564** in./hr.

Runoff Supply Rate (q) at Tc: **3.1971** in./hr.

Peak Discharge:

1.008 qA (acres): **519** cfs.

645.33qa (square miles): **— cfs.**

---

Equation for Tc:

$$ Tc = \frac{Rh (Lc-Lca)^{0.3} q^{0.4}}{50 (Sc)^{0.4}} $$

Note: For impervious areas, CN* = 99 (constant).
**HYDROLOGIC DATA SHEET**

**Project Name and Location:** FLECHA CAIDA FLOOD IMPROVEMENT STUDY (2\1/2 FyIUE)

**Drainage Concentration Point:** 720 (FLECHA CAIDA WASH @ SEY LINE 14 \& 23)

**Watershed Area (A):** 321 acres/square mile

**Length of Watercourse (Lc):** 13600 ft. **Length to Center of Gravity (Lcg):** 6800 ft.

**Incremental Change in Length (L):** ft.

<table>
<thead>
<tr>
<th>Incremental Change</th>
<th>ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>6000</td>
<td></td>
</tr>
<tr>
<td>6000</td>
<td></td>
</tr>
</tbody>
</table>

**Incremental Change in Elevation (H):** ft.

<table>
<thead>
<tr>
<th>Incremental Change</th>
<th>ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3080 - 2910 = 170</td>
<td></td>
</tr>
<tr>
<td>2910 - 2830 = 130</td>
<td></td>
</tr>
<tr>
<td>2830 - 2610 = 120</td>
<td></td>
</tr>
</tbody>
</table>

**Mean Slope (S):** 0.8287 ft/ft. **Watershed Type(s):** BOOTHILLS DEVELOPED (future)

**Basin Factor (n):** 0.837 (future)

**P24 (24 hour):** in.

**P6 (6 hour):** in.

**P1 (1 hour):** 2.14 in.

**P2 (2 hour):** in.

**P3 (3 hour):** in.

**Soil Group(s):** 100% B **Cover Type(s):** DECKET BRUSH

**Cover Density (pervious areas):** 70% **Impervious Cover:** 10% (future)

**CN(s):** 88 (pervious & impervious areas) **CN*(s):** 87.00 (adjusted curve number)

**Runoff to Rainfall Ratio(s):** 0.54 (pervious areas) 0.9555 (impervious areas)

**Runoff Supply Rate (q):** 0.5827 in./hr. (function of i)

**Time of Concentration (Tc):** 56 in. 1/4 hrs./mins. (function of i)

**Iterative Solution of Tc:** 32 hrs./mins.

**Rainfall Intensity (i) at Tc:** 4.0615 in./hr.

**Runoff Supply Rate (q) at Tc:** 2.3648 in./hr.

**Peak Discharge:**

1.008 QA (acres): 7660 cfs.

645.33qa (square miles): __________ cfs.

**Flood Frequency:** 100 yrs.

Areal Value:

Areal Value:

Areal Value:

Areal Value:

Areal Value:

**Equation for Tc:**

\[
T_c = \frac{8h (LcLcg)}{50 (S_c)^{0.4}} q^{0.4} \text{ hours.}
\]

**Note:** For Impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

- Project Name and Location: FLECHA CAIDA FLOOD IMPROVEMENT STUDY (EL RIO)
- Drainage Concentration Point: #21 (FLECHA CAIDA WASH & CREEK LINE 23 7/8 RIVER ROAD)
- Watershed Area (A): 521 acres/2.08 miles
- Length of Watercourse (Lc): 19400 ft. Length to Center of Gravity (Lcg): 9500 ft.
- Incremental Change in Length (Lt) - ft.
  - 2000
  - 5000
  - 8000
  - 5800
- Mean Slope (S_c): 0.0294 ft./ft. Watershed Type(s): FT-4 (DRAINAGE) (future)
- Basin Factor (nB): 0.036 (future)
- P_24 (24 hour): __________ in.
- P_6 (6 hour): __________ in.
- P_1 (1 hour): 2.162 in.
- P_2 (2 hour): __________ in.
- P_3 (3 hour): __________ in.
- Soil Group(s): 100% B
- Cover Type(s): DEEP BUSH

Cover Density (pervious areas): 20% Impervious Cover: 10% (future)

N(s): 8.3 (pervious & impervious areas) CN*(s): 86.95 (adjusted curve number)

unoff to Rainfall Ratio(s), (C): 0.5377 (pervious areas) 0.9552 (impervious areas)

Runoff Supply (q): 0.5795 in./hr. (function of i)

Line of Concentration (T_c): 1.67 1.67/hr. (function of i)

Iterative Solution of T_c: 41 hrs./min.

Rainfall Intensity (i) at T_c: 3.4360 in./hr.

unoff Supply Rate (q) at T_c: 1.9911 in./hr.

Peak Discharge:
1.008 QA (acres): 104.0 cfs.
645.33qa (square miles): __________ cfs.

Flood Frequency: __________ yrs.

Areal Value: __________ in.
Areal Value: __________ in.
Areal Value: __________ in.
Areal Value: __________ in.
Areal Value: __________ in.

Equation for T_c:
\[ T_c = \frac{a n_b}{(S_c)^{0.4}} \text{ hours.} \]

Note: For impervious areas,
CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLEX HA CAIDA FLOOD IMPROVEMENT STUDY (E 1/2 R14E
N34T35S)

Drainage Concentration Point: #12 (SEC 13 1-2 26)

Watershed Area (A): 253 acres/square miles.

Length of Watercourse (Lc): 1,070.00 ft. Length to Center of Gravity (Lcg): 510.00 ft.

Incremental Change in Length (Li) - ft.

<table>
<thead>
<tr>
<th>Li</th>
<th>3800</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6400</td>
</tr>
</tbody>
</table>

Incremental Change in Elevation (Hi) - ft.

<table>
<thead>
<tr>
<th>Hi</th>
<th>2850 - 2640 = 210</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2640 - 2480 = 160</td>
</tr>
</tbody>
</table>

Mean Slope (Sc): 0.0324 ft./ft. Watershed Type(s): TRADEFLICTS (developed) (future)

Basin Factor (q): 0.035 (future)

Flood Frequency: 100 yrs.

P1 (6 hour): 2.59 in.

P2 (2 hour): 1.65 in.

P3 (3 hour): 1.00 in.

Soil Group(s): 10 B 16 Cover Type(s): DEER BEAK

Cover Density (pervious areas): 20 1/2 % Impervious Cover: 10 5/6 (future)

CN(s): 33 (pervious & impervious areas) CN* (s): 86.88 (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.5323 (pervious areas) 0.9547 (impervious areas)

Runoff Supply Rate (q): 0.5745 1 in./hr. (function of t)

Time of Concentration (Tc): 43 ¹/₄ hrs./mins. (function of I)

Iterative Solution of Tc: 23 hrs./mins.

Rainfall Intensity (I) at Tc: 4.7186 in./hr.

Runoff Supply Rate (q) at Tc: 2.1683 in./hr.

Peak Discharge:

1.008 qa (acres): 706 cfs.

645.33qa (square miles): 4,900 cfs.

Equation for Tc:

Tc = \frac{\ln (Lc/Lcg)}{\frac{3}{50} \left(\frac{1}{S_c}\right)^{0.4}} hours.

Note: For Impervious areas, CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAIDA FLOOD IMPROVEMENT STUDY (E 1/2 R 14E)
Drainage Concentration Point: #23 (WITHIN SE 1/4 SEC 3) @ FINGER ROCK WASH
Watershed Area (A): 390 acres
Length of Watercourse (Lc): 8900 ft. Length to Center of Gravity (Lca): 4400 ft.
Incremental Change in Length (Li) - ft.

2000
2100
1400
3400

Incremental Change in Elevation (Hi) - ft.

5040 - 3680 = 1360
3680 - 3200 = 480
3200 - 3000 = 200
3000 - 2800 = 200

Mean Slope (Sc): 0.1315 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED)
Basin Factor (qb): 0.050 (future) FOOTBALL (DEVELOPED) (future)
Flood Frequency: __________ yrs.

P24 (24 hour): __________ in.
P6 (6 hour): __________ in.
P1 (1 hour): 2.71 in.
P2 (2 hour): __________ in.
P3 (3 hour): __________ in.

Areal Value: __________ in.

Soil Group(s): 33% B, 67% D Cover Type(s): MOUNTAIN BRUSH

Cover Density (pervious areas): 30% (MB) 20% (DB) Impervious Cover: 8% (future)

CN(s): 83 90 (pervious & impervious areas) CN* (s): 87.11, 92.44

CN (curve number)

(adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.5535, 0.7113 (pervious areas) 0.9560 (impervious areas)
Runoff Supply Rate (q): 0.4630 in./hr. (function of i)
Time of Concentration (Tc): 30 i^-4 hrs./mins. (function of i)
Iterative Solution of Tc: 14 hrs./mins.

Rainfall Intensity (i) at Tc: 0.3745 in./hr.
Runoff Supply Rate (q) at Tc: 4.3550 in./hr.

Peak Discharge:

1.008 qa (acres): 1717 cfs.
645.33qa (square miles): __________ cfs.

Equation for Tc:

Tc = Nh (Le/Lca) 3 q^-0.4 hours.

50

Note: For impervious areas,

CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAIDA FLOOD IMPROVEMENT STUDY (N47T13S)
Drainage Concentration Point: ± 2.4 (FLECHA CAIDA WASH @ SEC LINE 26127 SWAN ROAD)

Crest Area (A): 850 acres/ha

Length of Watercourse (Lc): 20,600 ft. Length to Center of Gravity (Lcg): 10,300 ft.

Incremental Change in Length (Li) - ft.

- 2,000
- 5,000
- 6,000
- 7,000

Mean Slope (S): 0.0291 ft./ft. Watershed Type(s): Foothills (Developed) (future)

Basin Factor (n): 0.0360 (future)

24 (24 hour): 0.023 in.

P6 (6 hour): 0.020 in.

1 (1 hour): 0.019 in.

- 2 (2 hour): 0.018 in.

P3 (3 hour): 0.017 in.

100% Cover Type(s): Desert Brush

Cover Density (pervious areas): 20% Impervious Cover: 10% (future)

CN(s): 85.91 (pervious & impervious areas) (adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.5341 (pervious areas) 0.9548 (impervious areas)

Runoff Supply Rate (q): 0.5762 in./hr. (function of i)

Time of Concentration (Tc): 7.0 in. (function of L)

Iterative Solution of Tc: 44 hrs./mins.

Rainfall Intensity (i) at Tc: 32.500 in./hr.

Runoff Supply Rate (q) at Tc: 1.8726 in./hr.

Peak Discharge:

1.008 QA (acres): 1504 cfs.

645.33QA (square miles): cfs.

Incremental Change in Elevation (H): - ft.

- 3080 - 2950 = 130
- 2950 - 2830 = 120
- 2830 - 2760 = 70
- 2760 - 2450 = 210

Flood Frequency: 100 yrs.
Areal Value: in.
Areal Value: in.
Areal Value: in.
Areal Value: in.
Areal Value: in.

Equation for Tc:

Tc = 8h (LcLc)a.4 q-.4

Note: For Impervious areas, CN = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAIDA FLOOD IMPROVEMENT STUDY (E/2 RIVER)

Drainage Concentration Point: #7.5 FINGER ROCK WASH SOUTH OF FOREST SERVICE BOUNDARY

Watershed Area (A): 2167 acres/square miles

Length of Watercourse (Lc): 20400 ft. Length to Center of Gravity (Lca): 9500 ft.

Incremental Change in Length (L1) - ft.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>10100</td>
<td></td>
</tr>
<tr>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td></td>
</tr>
</tbody>
</table>

Mean Slope (Sd): 0.1791 ft./ft. Watershed Type(s): MOUNTAIN (undeveloped) (future)

Basin Factor (nB): 0.060 (future)

24 (24 hour): in.

6 (6 hour): in.

1 (1 hour): 2.74 in.

2 (2 hour): in.

3 (3 hour): in.

soil Group(s): 98.8 25% 74% D  Cover Type(s): MOUNTAIN BRUSH / DESERT BRUSH

Cover Density (pervious areas): 30% (MB) 10% (DB) Impervious Cover: 0% (future)

N(s): 83 82.90 (pervious & impervious areas) CN*(s): 27.27 86.56 92.6 (adjusted curve number)

Runoff to Rainfall Ratio(s), C: 0.5685, 0.5409, 0.7157 (pervious areas) 0.9571 (impervious areas)

Runoff Supply Rate (q): 0.6791 i in/hr. (function of i)

Time of Concentration (Tc): 51.4 hrs/mins. (function of i)

Iterative Solution of Tc: 2.8 hrs/mins.

Rainfall Intensity (i) at Tc: 4.5667 in/hr.

Runoff Supply Rate (q) at Tc: 3.0600 in/hr.

Peak Discharge:

1.008 QA (acres): 60684 cfs

645.33QA (square miles): cfs.

Incremental Change in Elevation (H1) - ft.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>72500</td>
<td>6240</td>
</tr>
<tr>
<td>62400</td>
<td>3560</td>
</tr>
<tr>
<td>35600</td>
<td>3050</td>
</tr>
</tbody>
</table>

Flood Frequency: 100 yrs.

Areal Value: in.

Note: For impervious areas,

CN* = 99 (constant).
HYDROLOGIC DATA SHEET

Project Name and Location: FLECHA CAIDA FLOOD IMPROVEMENT STUDY
Drainage Concentration Point: (CONFLUENCE 7 & 8) (FINGER ROCK TRIBUTARY)
Watershed Area (A): 66.93 acres/square miles.
Length of Watercourse (Lc): 12,400 ft. Length to Center of Gravity (Lca): 6,000 ft.
Incremental Change in Length (Li) - ft.
2,000
2,200
1,800
4,200
2,400
Incremental Change in Elevation (Hi) - ft.
5,280 - 4,000 = 1,280
3,400 - 2,400 = 1,000
2,400 - 2,080 = 320
300 - 2,850 = 230
2,850 - 2,715 = 85
Mean Slope (Sc): 0.0914 ft./ft. Watershed Type(s): MOUNTAIN (UNDEVELOPED) (future)
Basin Factor (nb): 0.046 (future)
Flood Frequency: 100 yrs.
P24 (24 hour): ________________ in.
P6 (6 hour): ________________ in.
P1 (1 hour): 2.70 in.
P2 (2 hour): ________________ in.
P3 (3 hour): ________________ in.
Areal Value: ________________ in.
Areal Value: ________________ in.
Areal Value: ________________ in.
Areal Value: ________________ in.
Areal Value: ________________ in.
Soil Group(s): 54% B 46% D Cover Type(s): MOUNTAIN BRUSH DESERT BRUSH MIX
Cover Density (pervious areas): 30% (MB) 20% (DB) Impervious Cover: 20% (future)
CN(s): 83, 90 (pervious & impervious areas) CN*(s): 87.13, 86.47, 92.45 (adjusted curve number)
Runoff to Rainfall Ratio(s), (C): 0.515, 0.534, 0.709 (pervious areas) 0.9505 (impervious areas)
Runoff Supply Rate (q): 0.6875 in./hr. (function of i)
Time of Concentration (Tc): 38 i^-1 hrs./mins. (function of i)
Iterative Solution of Tc: 20 hrs./mins.
Rainfall Intensity (i) at Tc: 5.4000 in./hr.
Runoff Supply Rate (q) at Tc: 3.7125 in/hr.
Peak Discharge:
1,008 qa (acres): 2,481 cfs.
645.33qa (square miles): ______________ cfs.

Note: For impervious areas, CN* = 99 (constant).

Equation for Tc:

\[ T_c = \frac{m_0 (L_c - L_a)}{n_b} \times \left( \frac{S_c}{100} \right)^{0.4} \text{ hours.} \]

048
HYDROLOGIC DATA SHEET

Project Name and Location: FECOHA CAIDA FLOOD IMPROVEMENT STUDY

Drainage Concentration Point: # 27 (CONFLUENCE WITH FINGER ROCK WASH)

Watershed Area (A): 16.98 acres/square miles.

Length of Watercourse (Lc): 14,900 ft. Length to Center of Gravity (Lg): 7,200 ft.

Incremental Change in Length (Li) - ft.

<table>
<thead>
<tr>
<th>Li</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2,600</td>
<td></td>
</tr>
<tr>
<td>2,200</td>
<td></td>
</tr>
<tr>
<td>1,800</td>
<td></td>
</tr>
<tr>
<td>4,200</td>
<td></td>
</tr>
<tr>
<td>2,400</td>
<td></td>
</tr>
<tr>
<td>2,300</td>
<td></td>
</tr>
</tbody>
</table>

Incremental Change in Elevation (Hi) - ft.

<table>
<thead>
<tr>
<th>Hi</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5,780 - 4,000 = 1,780</td>
<td></td>
</tr>
<tr>
<td>4,000 - 3,400 = 600</td>
<td></td>
</tr>
<tr>
<td>3,400 - 3,060 = 340</td>
<td></td>
</tr>
<tr>
<td>3,060 - 2,850 = 210</td>
<td></td>
</tr>
<tr>
<td>2,850 - 2,765 = 85</td>
<td></td>
</tr>
<tr>
<td>2,765 - 2,690 = 75</td>
<td></td>
</tr>
</tbody>
</table>

Mean Slope (S): 0.0750 ft./ft. Watershed Type(s): MOUNTAIN UNDEVELOPED

Flood Frequency: ______________________ years.

Basin Factor (qB): 0.044 (future)

Areal Value: ______________________ in.

P24 (24 hour): ______________________ in.

Areal Value: ______________________ in.

P6 (6 hour): ______________________ in.

Areal Value: ______________________ in.

P1 (1 hour): 2.69 in.

Areal Value: ______________________ in.

P2 (2 hour): ______________________ in.

Areal Value: ______________________ in.

P3 (3 hour): ______________________ in.

Areal Value: ______________________ in.

Soil Group(s): 56% B 44% D Cover Type(s): MOUNTAIN BRUSH & DESERT BRUSH

Cover Density (pervious areas): 30% (B) 20% (D) Impervious Cover: 70% (future)

CN(s): 83.96 (pervious & impervious areas) CN*(s): 87.11 97.41

(curve number)

(adjusted curve number)

Runoff to Rainfall Ratio(s), (C): 0.550 0.7086 (pervious areas) 0.9563 (impervious areas)

Runoff Supply Rate (q): 0.1271 in./hr. (function of i)

Time of Concentration (Tc): 44 i^-1.4 hrs./mins. (function of i)

Iterative Solution of Tc: 24 hrs./mins.

Rainfall Intensity (I) at Tc: 4.8909 in./hr.

Runoff Supply Rate (q) at Tc: 3.3605 in./hr.

Equation for Tc:

\[
T_c = \frac{nn \left( \frac{L_c}{S_c} \right)^{0.3}}{50} q^{-0.4} \text{ hours.}
\]

Note: For impervious areas, \( \text{CN}^* = 99 \) (constant).

Peak Discharge:

1.008 QA (acres): 2364 cfs.

645.33qa (square miles): 1264 cfs.
APPENDIX C

CULVERT PERFORMANCE CURVES
FINGER ROCK WASH

DISCHARGE RATING CURVE FOR 7-84" CIP & DIP
SECTION AT PONTADO CANYON DRIVE Q/100 ± 7100 ft
CURT = 2.7

DIP SECTION

9/21 18/20 46/18 103/17 103/16 195/15.4 275/16 305/17
330/18 353/19 362/20 383/22

DISTANCE (FT)

ELEV.

0 120 180 240 300 350

0 5 10 15

RATING CURVE FOR DISCHARGE THROUGH DIP

COMPOSITE STAGE/DISCHARGE CURVE

PERFORMANCE CURVE FOR 7-84" CMP ASSUMING 50% CLOGGING
@ INLET, E ASSUMED AT 7.0
FINGER ROCK WASH

DISCHARGE RATING CURVE FOR 1-48" CMP & DIP SECTION AT SKYLINE DRIVE Q@100 ft = 6100 cfs Curv e= 2.7

DIP SECTION

0’/80 33/85 78/84 124/83 193/82 233/81.4 343/82
415/82.6 443/83 500/84 529/85 565/86

ELEV 86

ELEV 83

LOW PT. @ 81.4

DISTANCE (FT)

ELEV 82

ELEV 80

ELEV 78

ELEV 74

ELEV 72

ELEV 68

RATING CURVE FOR DISCHARGE THROUGH DIP SECTION

COMPOSITE STAGE/DISCHARGE CURVE

PERFORMANCE CURVE FOR 1-48" CMP ASSUMING 50% CLOGGING @ INLET; IT ASSUMED @ 15%
VALLEY VIEW WASH
HEC-2 SECTION NO 36
DISCHARGE RATING CURVE FOR 1-72° CMP & DIP
SECTION AT SWAN RD Q100 = 2250 Cweir = 1270

DIP SECTION

15/51 30/51 45/60 55/60 72/51 105/52

135/53 150/54 175/55

ELEV 55

DISTANCE (FT)

ELEV 52

ELEV 55

ELEV 53

ELEV 43

ELEV 49

0 30 60 90 120 150 180

0 400 800 1200 1600 2000 2400

DISCHARGE (cfs)

RATING CURVE FOR DISCHARGE THROUGH DIP

COMPOSITE STAGE/DISCHARGE CURVE

PERFORMANCE CURVE FOR 1-72° CMP ASSUMING 50% CLOSING @ INLET. P ASSUMED AT 372

APPENDIX C
SHEET 3 OF 12
VALLEY VIEW WASH
HEC-2 SECTION NO. 51
DISCHARGE RATING CURVE FOR 1-48" CMP & DIP
SECTION AT CMO. ARCO Q100 = 2250 Cu./ft² = 2.7

DIP SECTION

\[
\frac{9}{42} \quad \frac{5}{31.5} \quad \frac{19}{37} \quad \frac{103}{36.5} \quad \frac{88}{37} \quad \frac{108/38}{123/39} \quad \frac{138/40}{163/42}
\]

ELEV. 39

DISTANCE (FT)

\[
\begin{align*}
0 & \quad 10 & \quad 20 & \quad 30 & \quad 40 & \quad 50 & \quad 60 & \quad 70 & \quad 80 & \quad 90 & \quad 100 & \quad 110 & \quad 120 & \quad 130 & \quad 140 & \quad 150 & \quad 160 & \quad 170 & \quad 180
\end{align*}
\]

\[
\text{LOW PT @ 36.5}
\]

\[
\text{COMPOSITE STAGE / DISCHARGE CURVE}
\]

\[
\text{PERFORMANCE CURVE FOR 1-48" CMP ASSUMING 50% CLOGGING AT INLET; IT ASSUMED AT 312}
\]

\[
\text{DISCHARGE (CF/S)}
\]

APPENDIX C:
SHEET 1 OF 8
VALLEY VIEW WASH TRIBUTARY
(SKY CLUB WASH)

DISCHARGE RATING CURVE FOR 1 - 48" CMP & DIP
SECTION AT SWAN ROAD C100 = 1150 Cwet = 2.7
DIP SECTION

0/20 5/19 15/18 25/17 90/18 175/19 230/20

ELEV

DISTANCE (FT)

DISCHARGE (cfs)
FLECHA CAIDA WASH

DISCHARGE RATING CURVE FOR 4-36" CMP & DIP SECTION AT CALLE DE LAS CHARAS Qₚₐ = 950 cfs.
C_WEIR = 2.70

DIP SECTION
0/81 30/100 58/79 118/78 159/78 153/78 190/79 220/80 240/81

ELEV 79

ELEV 70

ELEV 74

RATING CURVE FOR DISCHARGE THROUGH DIP SECTION

COMPOSITE STAGE/DISCHARGE CURVE

PERFORMANCE CURVE FOR 4-36" CMP ASSUMING 50% CLOGGING @ INLET, k₂ ASSUMED @ 7428

DISCHARGE (cfs)
FLECHA CAIDA WASH

Discharge Rating Curve for 2 - 58" x 36" CMP Arch & Dip Crossing at Paseo Del Bac
Q100 = 750 cfs  Cw = 2.70

Dip Section

9'/4 30'/13 65'/12 80'/11 140'/11 150'/12 163'/14

ELEV 12

Low Pt. Assumed at 11 5'

Distance (ft)

0 40 80 120 160 200

Rating Curve for Discharge Through Dip Section

Composite Stage / Discharge Curve

Performance Curve for 2 - 58" x 36" CMP Arch Assuming 80% Clogging @ Inlet & @ 112'

Discharge (cfs)
FLECHA CAIDA WASH

Discharge Rating Curve for 4 - 43" x 21" LMPA & Dip Crossing of Como Cardenal Q_{100} = 890 cfs  q_{weir} = 2.70

Dip Section:

0'/91  40/90  92/89  112/88  158/89  165/90  295/90  175/90

ELEV 90

DISTANCE (FT)

ELEV 89

Rating Curve for Discharge through Dip Section

Composite Stage/Discharge Curve

Performance Curve for 4 - 43" x 21" LMPA Assuming 50% Clogging @ inlet % assumed @ 85°

Discharge (cfs)

Appendix C
Sheet B c = 8
APPENDIX D

DISKETTE CONTAINING INPUT DATA FOR SUBCRITICAL AND SUPERCRITICAL RUNS
APPENDIX E

INDEX MAP TO THE FLOODPLAIN MAPS
(SEPARATE DOCUMENT)