Drainage Reports

Abbreveated Water & Sewer Need Reports

Water Study

Wastewater Study

Stormwater Waiver Application

PRELIMINARY DRAINAGE REPORT

Reserve at Black Mountain
Scottsdale, Arizona

Case No. 536-PA-2016

Prepared For:

Pinnacle Land Development, LLC

Stormwater Review By:
Nerijus Baronas, P.E., CFM
Phone: 480-312-7072
Fax: 480-312-9187
e-mail: nbaronas@ScottsdaleAZ.gov
Review Cycle 1 Date 2-3-17

Registered Professional Engineer (Civil)
Certificate No. 51478
KEVIN W. PAYNE
Date Signed 01/03/17
ARIZONA, U.S.A.
EXPIRES 09/30/2019

291015001
December 2016

Kimley»Horn

City of Scottsdale
Stormwater Management Division

Memorandum

To: **KimleyHorn**
Attn: Kevin W. Payne, PE

From Nerijus Baronas, P.E., CFM
City of Scottsdale Sr. Stormwater Engineer
480-312-7072, nbaronas@scottsdaleaz.gov

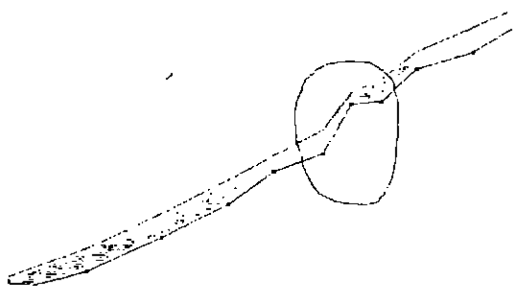
Re: Drainage review comments for Reserve at Black Mountain.
Case number: 26-ZN-2016
Review date: 11-30-2016

RESUBMITTAL INFORMATION: Please address the following review comments:

Policy and Design Related Issues:

1. The content and analysis requirements for case drainage reports in support of general plan amendments and zoning applications are not the same as those for case drainage reports in support of development review or preliminary plat applications. The City requires significantly less information and analysis for the former applications due to the preliminary nature of these applications. In general, case drainage reports submitted in support of zoning applications should include a 50% level of design and analysis.
2. Missing off-site watershed delineation exhibits
3. Provide HEC-1 schematic depicting all basins, storage, routing and concentration points consistent with the submitted model. Schematic shall be provided for existing and proposed conditions.
4. HEC-1 model LG Record – Green and Ampt Loss Rate, Field 5 RTIMP appears to be low for proposed condition when compared to existing condition. Provide Exhibit with analysis do show Percent of subbasin which is impervious for all proposed condition basins.
5. Provide rating tables for storage basin volume and outflow/overflow analysis.
6. Land use map is missing
7. Soils Map is missing
8. Proposed Condition HEC-RAS model is missing
9. Erosion setback limits analysis and discussion need to be expanded.
10. Identify proposed condition stormwater infrastructure sizes (catch basins, storm drains, culverts and erosion mitigation measures)
11. Revise bank station locations in HEC-RAS model

12 Submit DDMS and HEC-1 digital input / output files
13 Proposed condition drainage map add flow direction arrows which will conform to each lot grading upon development
14 Show and callout retaining walls if any
15 Discuss how each individual lot will be developed Do you plan to provide custom G&D for each lot?
16 Review / revise wash flow line of Ex HEC-RAS model



Resubmittal Checklist

- **Please briefly respond to the above comments (or check it with marker) and include the response in the re-submittal Please also see comments in preliminary drainage report**

- 1 Copies of Drainage Report
- 1 CD's with pdf files of drainage report and all supporting hydrologic and hydraulic digital files

- ADD LATERAL EROSION SETBACK ANALYSIS / DISCUSSION.

List of Appendices

MISSING HEC-RAS:
- DIGITAL FILES FOR EX. AND PROP. CONDITIONS
- HEC-RAS SECTION LOCATIONS.

List of Figures in Appendix D (Exhibits)

UPDATE FIGURE #'s

MISSING

1.0 Introduction

1.1 Project Description

Pinnacle Land Development, LLC is proposing to construct a single-family housing development consisting of 30 lots on the northwest corner of Black Mountain Road and 84th Street. The project is anticipated to consist of a single-family housing development and associated site infrastructure.

1.2 Site Location

The proposed development encompasses approximately 35.6± net acres in a portion of the Southwest Quarter of Section 1, Township 5 North, Range 4 East of the Gila and Salt River Meridian in Maricopa County, Arizona. The parcel is bounded by Black Mountain Road to the south, 84th Street to the east, Vista Viento Estates to the north, and the Sand Flower subdivision to the west. A site location map is included in Appendix A and a Context Aerial Map is provided as Figure 1 in Appendix D.

The site is currently undeveloped natural desert landscape that falls within the Environmentally Sensitive Lands Overlay (ESLO).

1.3 Purpose

This Preliminary Drainage Report is intended to satisfy City of Scottsdale requirements and demonstrate conformance to the overall drainage characteristics of the area. This report provides a description of the current storm water drainage patterns and systems and a description of the required and proposed drainage improvements.

1.4 Objectives

This report provides a drainage plan for the subject site that is intended to meet the drainage standards and guidelines of the City of Scottsdale and the Flood Control District of Maricopa County (FCDMC). In particular, this report will demonstrate the following:

1. Buildings and site amenities will be elevated such that regional storm water flows from un-named regulatory washes do not adversely impact the development.

2. Permanent drainage facilities will have a positive outfall, and any detained storm water will be disposed of within 36 hours.

3. Drainage facilities will be designed such that the 100-year post-development flows are collected and conveyed in such a manner so as to not cause damage to buildings and property.

4. Storm water detention and attenuation is provided with the intention of discharging at the same rate of pre-development at the property boundaries.

5. Building finished floor elevations are in compliance with City of Scottsdale requirements.

2.0 Description of Existing Drainage Conditions and Characteristics

2.1 Existing Off-Site Drainage Calculations

Offsite contributing drainage areas have been developed as part of the Andaluza and Sierra Highlands developments (Figures 2 and 3), currently under construction. The Andaluza and Sierra Highland HEC-1 Models were re-created within this study using updated NOAA-14 rainfall information. The offsite flow was quantified with three (3) concentration points at the upstream boundary of the site using the same nomenclature as the Andaluza and Sierra Highlands HEC-1 models. Table 1 summarizes the contributing flow from the upstream developments.

Table 1. Existing Offsite Flows

Concentration Point	2-Yr (cfs)	10-Yr (cfs)	100-Yr (cfs)
ARET20	3	7	18
SCP030	7	19	42
SCP025	42	94	184

2.2 Existing Site Drainage Conditions

The site currently consists of vacant land. The general topography of the site slopes from the northeast to the southwest at approximately 1-2% and could be described as hilly terrain with incised watercourses. One significant wash (> 50 cfs) transects the site and another wash exceeds the 50 cfs threshold onsite, downstream of CP060. Natural desert vegetation exists throughout the site. A soils map of the project area is provided as Figure 4 in Appendix D.

Site watersheds were delineated using topography flown for the project, supplemented with 2-foot contours provided by the FCDMC. The site is mostly comprised of seventeen (17) on-site sub-basins which drain to the southwest and exit the site at fifteen (15) locations along the western and southern property lines. Watershed, soil, land use, and time of concentration information was input into DDMSW in the form of GIS shapefiles. DDMSW was utilized to develop a HEC-1 model using the Green and Ampt loss-rate method.

Sub-basins and corresponding 100-year discharges are shown on the Existing Conditions Drainage Map, Figure 5 in Appendix D. A schematic of the Existing Conditions HEC-1 model is included as Figure 6 in Appendix D.

2.3 Context Relative to Adjacent Projects and Improvements

The improvements to 84th Street have been completed within the last year. See Figure 1 in Appendix D for the Context Aerial Map.

2.4 FEMA Flood Hazard Areas

The site is located in an unshaded Zone X according to the Flood Insurance Rate Map (FIRM) 04013C0895L, dated October 16, 2013. Unshaded Zone X areas are defined by FEMA as "areas determined to be outside the 0.2% annual chance floodplain." Refer to Appendix B for the FEMA FIRMette map for the site.

3.0 Proposed Drainage Plan

3.1 General Description

The following items are considered in the proposed drainage conditions analysis

- Area Types (pavement, building, and desert landscaping)
- Magnitude of Areas
- Slopes
- Cross Drainage
- Detention Basins/Attenuation from Culverts

3.2 Proposed Off-Site Drainage Conditions

Black Mountain Road, to the south of the site, will be improved to an urban roadway section, without adding additional lanes 84th Street, east of the site, is in its built-out condition, therefore no future improvements are anticipated The areas to the north and west are developed

3.3 Proposed Site Drainage Conditions

Site-generated storm water will be collected in natural channels and proposed residential streets and attenuated by three on-site detention basins The thirty (30) lots are graded to either drain into the street or to the back into natural channels Future land use is shown on Figure 7 in Appendix D Refer to Figure 8 for proposed sub-basins and attenuation locations and Figure 9 for a schematic of the Proposed Conditions HEC-1 model

The proposed site was modeled hydrologically using developed conditions loss-rate parameters generated using DDMSW A comparison of pre versus post discharges is provided in Table 2

UPDATE PER COMMENTS ON FIGURE 8.

Table 2: Peak Discharge Reduction from Proposed Improvements

Concentration Point	Pre			Post		
	2-Yr (cfs)	10-Yr (cfs)	100-Yr (cfs)	2-Yr (cfs)	10-Yr (cfs)	100-Yr (cfs)
OF-10	1	2	5	0	1	1
ON-10	1	2	3	1	1	3
ON-20	2	5	11	0	1	2
ON-30	0	1	2	0	1	1
ON-40	8	18	43	3	13	41
ON-50	1	1	3	0	0	1
ON-70	9	23	57	9	23	56
ON-80	1	3	7	1	3	6
ON-90	0	1	1	0	0	0
ON-100	0	0	1	0	0	1
ON-110	0	1	1	0	1	1
ON-120	2	4	9	1	2	5
ON-130	43	95	187	43	95	187
ON-140	0	0	1	0	0	1
ON-150	1	1	3	1	1	3

ADD RTMP VALUES FOR EX. & PROP. COND.

3.4 Storm Water Storage Requirements

Due to the location of the project in the ESLO overlay zone, the site is only required to ensure pre versus post runoff conditions are met. A stormwater storage waiver has been submitted to formalize the storage requirements for this project, see Appendix E.

3.5 Pre- and Post-Development Runoff Characteristics at Concentration Points

The existing site consists of approximately 35.6± acres of vacant land that drains from the northeast to the southwest. The existing drainage patterns create fifteen (15) concentration points along the downstream perimeter of the site, as shown on Figure 5. These concentration points are maintained in proposed conditions, as shown on Figure 8.

3.6 Proposed Drainage Structures or Special Drainage Facilities

Storm water quality will be maintained by elevating the outfall headwall, or orifice plate, 6 to 9 inches above the basin bottom. This will allow the basin to capture and dispose of the first flush of storm water via natural percolation. Orifice plates or pipe sizing will be used to meter the storm water outflow. Sizing recommendations will be included with the Final Drainage Report.

Project roadways will have four drainage crossings, two of which originate in detention basins and will be used to meter outflow The crossing west of Lot 4 will consist of a single barrel 24-inch RCP and the crossing east of Lot 1 will consist of a double barrel 24-inch RCP

Normal depth calculations used to size roadside ditches and determine roadway drainage capacities will be included in the Final Drainage Report

Building finished floor elevations need to be at least one foot above the highest adjacent water surface elevation

3 7 ADEQ AZPDES requirements

An executed Notice of Intent (NOI) will be submitted to the Arizona Department of Environmental Quality (ADEQ) in conformance with the Arizona Pollution Discharge Elimination System Permit (AZPDES) permit The NOI and associated storm water management best management practices will remain active on the site until construction is complete and a Notice of Termination is filed with ADEQ in conformance with the AZPDES permit

3 8 Project Phasing

This project will be constructed in a single phase The lots will be graded individually (Figure 10) but will maintain the patterns set forth in this report and the preliminary plat

4.0 Special Conditions

4 1 404 Discussion

A Preliminary Jurisdictional Delineation is being prepared and will be submitted to the U S Army Corps of Engineers (Corps) for concurrence There are approximately 0 45 acres of potentially jurisdictional Waters of the U S (WOUS) onsite Based on preliminary impact calculations, it appears the the project will qualify for a Nationwide Permit (NWP) No 20-Residential Developments that requires Pre-Construction Notification (PCN) to the Corps

5.0 Data Analysis Methods

5.1 Hydrologic Procedures, Parameter Selection, and Assumptions

Hydrologic calculations for the site were performed using the Green & Ampt loss-rate method in HEC-1 maintaining the outfall locations developed within the existing conditions HEC-1 model. The DDMSW program was used to generate HEC-1 input files based on land-use, soils, and impervious cover.

For analysis of the proposed site, the site was sub-divided into 27 sub-basins consisting of paved areas, building areas, or landscaped areas. For each sub-basin, DDMSW generated loss-rate and unit hydrograph parameters for HEC-1. Future imperviousness was derived within DDMSW based on land use codes assigned according to lot density. Individual lot envelopes and associated right-of-way indicate a lot density of 1-2 homes/acre which corresponds to the large lot residential designation within DDMSW. HEC-1 output is located in Appendix C. Figure 8, which identifies the drainage sub-basin and concentration points, is located in Appendix D.

5.2 Hydraulic Procedures, Methods, Parameter Selection, and Assumptions

The site is divided into 27 sub-basins that drain into several natural and man-made channels. See Figure 8 in Appendix D for proposed drainage structures and concentration points associated with each drainage basin.

The hydraulic capacity of the proposed streets will be determined using normal depth calculations during final design.

Cross-drainage pipes will be modeled during final design. Roadway elevations should be designed to account for headwater generated by these culverts.

HEC-RAS was utilized to develop water surface profiles for washes >50 cfs. A steep drop in the channel bed elevation of Wash 70 occurs between XS 1122 and 1160 on Wash 70. This is due to an outcropping of bedrock that prevents the channel upstream from reaching its equilibrium slope. Floodplains were delineated in the natural channels using the 100-year discharges for existing conditions. In proposed conditions the flows are slightly lower as demonstrated in Table 2, so the existing conditions discharges are more conservative. Drainage Easements for the two washes > 50 cfs will be dedicated to the City. The easements will encompass the limits of the 100-year floodplain.

Erosion hazard setbacks (EHS) were developed using Arizona Department of Water Resources (ADWR) State Standards. EHS were delineated by setting back from the channel banks and modified by setting back from the floodplain limit when the floodplain limits were closer to the stream centerline.

Storm water quality will be maintained by elevating the surface basin outfall above the bottom of the basin, so that the first flush of storm water runoff will infiltrate within the basin.

6.0 Conclusion

Based on the results of this preliminary drainage report, the following can be concluded

- Off-site storm water flows from upstream development will be accommodated and passed through the site safely with adjacent residences elevated at least 1-ft above the 100-year water surface elevations

- This project is compatible with the overall natural drainage patterns and impacts to hydrology from development can be more than adequately attenuated and mitigated

- Flows leaving the developed site on the west and south will be less than or equal to existing conditions thus meeting ESLO pre versus post requirements

This drainage report is intended to provide a level of assurance that the proposed improvements will adhere to all appropriate reviewing agency guidelines with respect to drainage and flood protection

7.0 References

1 City of Scottsdale, *Design Standards and Policies Manual, Chapter 4 Grading and Drainage*, January 2010

2 Federal Emergency Management Agency (FEMA), *Flood Insurance Rate Map (FIRM) of Maricopa County, Arizona and Incorporated Areas, Panel 895 of 4425, Map Number 04013C0895L*, October 16, 2013

3 Flood Control District of Maricopa County (FCDMC), *Drainage Design Manual for Maricopa County, Hydrology Volume, February*, 2008

4 Flood Control District of Maricopa County (FCDMC), *Drainage Design Manual for Maricopa County, Hydraulics Volume*, January, 1996

5 Kimley-Horn, *Final Drainage Report for Andaluza*, August, 2014

6 Kimley-Horn, *Final Drainage Report for Sierra Highlands*, November, 2014

Appendix A

Site Location Map

Site Location Map

Document Path: K:\TUC_WaterResources\Shift\PHX291015001_BlackMountain\Design\GIS\Site Location Map.mxd

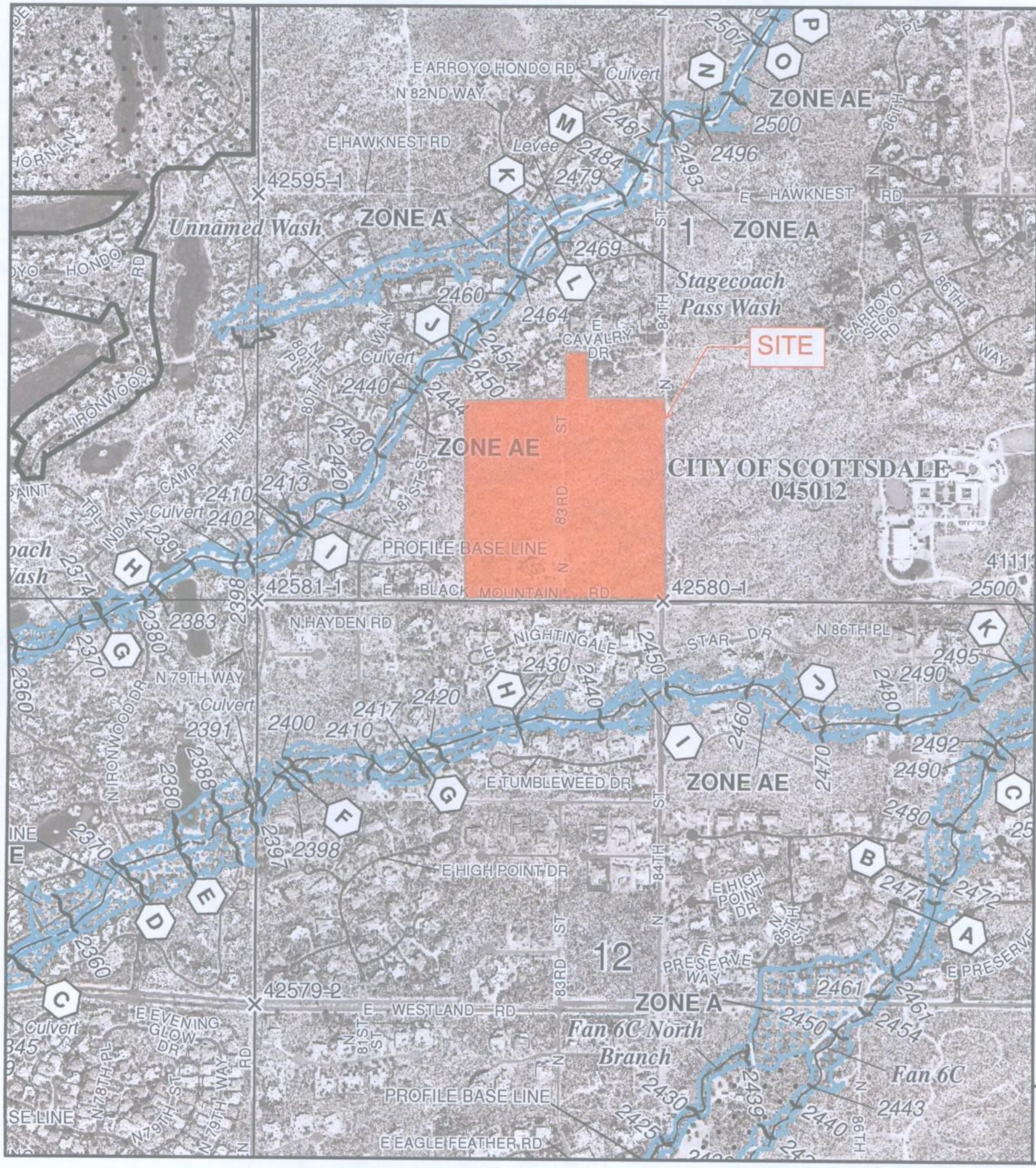
FIGURE 1

Kimley»Horn

RESERVE AT BLACK MOUNTAIN

Appendix B

FEMA Flood Insurance Rate Map (FIRM)



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METERS

NFIP

PANEL 0895L

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 895 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	0895	L
CAREFREE, TOWN OF	040126	0895	L
SCOTTSDALE, CITY OF	045012	0895	L

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C0895L

MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Kimley»Horn

Appendix C

Hydrologic/Hydraulic Calculations

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1*****************************************
****************************************                                        *
 *                                        *                                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                                                   *   U.S. ARMY CORPS OF ENGINEERS
 *              JUN   1998                *                                                   *   HYDROLOGIC ENGINEERING CENTER
 *           VERSION 4.1                  *                                                   *         609 SECOND STREET
 *                                        *                                                   *      DAVIS, CALIFORNIA 95616
 *  RUN DATE   19DEC16  TIME  15:01:37    *                                                   *          (916) 756-1104
 *                                        *                                                   *
 *****************************************
****************************************


                              X     X  XXXXXXX   XXXXX           X
                              X     X  X         X     X        XX
                              X     X  X         X               X
                              XXXXXXX  XXXX      X       XXXXX   X
                              X     X  X         X               X
                              X     X  X         X     X         X
                              X     X  XXXXXXX   XXXXX          XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL    LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                  HEC-1 INPUT                                                      PAGE  1

         LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           1           ID        Flood Control District of Maricopa County
           2           ID        BLACK MOUNTAIN - BLACK MOUNTAIN EXISTING CONDITIONS
           3           ID        2 YEAR
           4           ID        6 Hour  Storm
           5           ID        Unit Hydrograph: Clark
           6           ID        Storm: Multiple
           7           ID        08/23/2016
                       *DIAGRAM
           8           IT       5  1JAN99       0    2000
           9           IO       5
          10           IN      15
                       *

          11           KK   OF-10   BASIN
          12           BA  0.0018
          13           PB   1.394
          14           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
          15           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
          16           PC   0.962   0.972   0.983   0.991   1.000
          17           LG    0.12    0.25    5.05    0.42       6
          18           UC   0.165   0.182
          19           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
          20           UA     100
                       *

          21           KK   ON-10   BASIN
          22           BA  0.0016
          23           LG    0.10    0.25    5.05    0.44       5
          24           UC   0.198   0.282
          25           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
          26           UA     100
                       *

          27           KK   ON-20   BASIN
          28           BA  0.0058
          29           LG    0.10    0.25    5.05    0.44       5
          30           UC   0.281   0.386
          31           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
          32           UA     100
                       *

          33           KK   ON-30   BASIN
          34           BA  0.0009
```

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   35          LG    0.10    0.25    5.05    0.44       5
   36          UC   0.165   0.234
   37          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   38          UA     100
               *

   39          KK  ON-110   BASIN
   40          BA  0.0004
   41          LG    0.10    0.25    4.65    0.52       5
   42          UC   0.122   0.111
   43          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   44          UA     100
               *
1                                         HEC-1 INPUT                                              PAGE  2

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   45          KK  ON-120   BASIN
   46          BA  0.0055
   47          LG    0.10    0.25    5.05    0.44       5
   48          UC   0.320   0.468
   49          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   50          UA     100
               *

   51          KK  ON-140   BASIN
   52          BA  0.0002
   53          LG    0.10    0.25    5.46    0.35       5
   54          UC   0.098   0.063
   55          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   56          UA     100
               *

   57          KK  ON-150   BASIN
   58          BA   0.001
   59          LG    0.10    0.25    6.00    0.28       5
   60          UC   0.142   0.165
   61          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   62          UA     100
               *

   63          KK  CPBNDY COMBINE
   64          HC       8
               *

   65          KK  AON-20   BASIN
   66          BA   0.018
   67          LG    0.31    0.28    5.05    0.27      13
   68          UC   0.191   0.198
   69          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
   70          UA     100
               *

   71          KK  ARET20 STORAGE
   72          RS       1    STOR
   73          SV            0.30    0.46    0.64    0.76    0.84    0.96    1.04
   74          SQ            3.62    5.53    9.66   13.16   15.81   20.15   29.72
   75          SE  2482.0 2483.00 2483.50 2484.00 2484.30 2484.50 2484.80 2485.00
               *

   76          KK  RAON20   ROUTE
   77          RS       1    FLOW
   78          RC   0.035   0.035   0.035    2438  0.0193 2453.00
   79          RX    0.00    7.00   14.00   22.00   26.00   29.00   35.00   40.00
   80          RY  2453.0 2452.00 2451.00 2450.00 2450.00 2451.00 2452.00 2453.00
               *
1                                         HEC-1 INPUT                                              PAGE  3

  LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


   81          KK   ON-40   BASIN
   82          BA  0.0222
   83          LG    0.10    0.25    5.05    0.44       5
   84          UC   0.423   0.529
   85          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   86          UA     100
               *

   87          KK   CP040 COMBINE
   88          HC       2
               *

   89          KK   ON-50   BASIN
   90          BA  0.0014
   91          LG    0.10    0.25    5.05    0.44       5
   92          UC   0.173   0.285
   93          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   94          UA     100
```

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                *

   95           KK  SOF-30   BASIN
   96           BA   0.007
   97           LG    0.35    0.36    5.05    0.27       0
   98           UC   0.166   0.146
   99           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  100           UA     100
                *

  101           KK  SROF30   ROUTE
  102           RS       1    FLOW
  103           RC   0.035   0.035   0.035     386  0.0214 2484.00
  104           RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
  105           RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
                *

  106           KK  SON-26   BASIN
  107           BA   0.001
  108           LG    0.35    0.36    5.05    0.27       0
  109           UC   0.138   0.279
  110           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  111           UA     100
                *

  112           KK  SCP026 COMBINE
  113           HC       2
                *

  114           KK  SR2628   ROUTE
  115           RS       1    FLOW
  116           RC   0.035   0.035   0.035     740  0.0214 2484.00
  117           RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
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                *
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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  119           KK  SON-28   BASIN
  120           BA   0.010
  121           LG    0.31    0.26    5.05    0.26      15
  122           UC   0.133   0.106
  123           UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  124           UA     100
                *

  125           KK  SCP028 COMBINE
  126           HC       2
                *

  127           KK  SRET28 STORAGE
  128           RS       1    STOR
  129           SV            0.11    0.26    0.30    0.35    0.40    0.46
  130           SQ            3.94    6.13   11.27   20.23   31.64   45.04
  131           SE  2475.0 2476.00 2477.00 2477.30 2477.50 2477.80 2478.00
                *

  132           KK  SON-27   BASIN
  133           BA   0.009
  134           LG    0.30    0.25    5.58    0.20      17
  135           UC   0.139   0.168
  136           UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  137           UA     100
                *

  138           KK  SRET27 STORAGE
  139           RS       1    STOR
  140           SV            0.18    0.39    0.64    0.78
  141           SQ            2.00    3.30    4.22    4.61
  142           SE  2472.0 2473.00 2474.00 2475.00 2475.50
                *

  143           KK  SON-30   BASIN
  144           BA   0.001
  145           LG    0.35    0.36    5.05    0.27       0
  146           UC   0.112   0.177
  147           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  148           UA     100
                *

  149           KK  SCP030 COMBINE
  150           HC       3
                *

  151           KK  RSON30   ROUTE
  152           RS       1    FLOW
  153           RC   0.035   0.035   0.035     530  0.0226 2464.00
  154           RX    0.00    4.00    6.00    8.00   10.00   13.00   33.00   43.00
```

```
 155            RY  2464.0 2463.00 2462.00 2461.00 2461.00 2462.00 2463.00 2464.00
                *
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 156            KK   ON-60   BASIN
 157            BA   0.005
 158            LG    0.10    0.25    5.05    0.44       5
 159            UC   0.292   0.425
 160            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 161            UA     100
                *

 162            KK   CP060 COMBINE
 163            HC       2
                *

 164            KK   RON60   ROUTE
 165            RS       1    FLOW
 166            RC   0.035   0.035   0.035    2435  0.0111 2454.00
 167            RX    0.00    3.00    5.00    8.00   13.00   17.00   21.00   27.00
 168            RY  2454.0 2453.00 2452.00 2451.00 2451.00 2452.00 2453.00 2454.00
                *

 169            KK   ON-70   BASIN
 170            BA  0.0123
 171            LG    0.12    0.25    4.96    0.44       6
 172            UC   0.374   0.494
 173            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 174            UA     100
                *

 175            KK   CP070 COMBINE
 176            HC       2
                *

 177            KK   ON-80   BASIN
 178            BA  0.0043
 179            LG    0.11    0.25    5.05    0.43       6
 180            UC   0.308   0.564
 181            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 182            UA     100
                *

 183            KK   ON-90   BASIN
 184            BA  0.0005
 185            LG    0.10    0.25    4.33    0.62       5
 186            UC   0.147   0.171
 187            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 188            UA     100
                *

 189            KK  ON-100   BASIN
 190            BA  0.0003
 191            LG    0.10    0.25    4.33    0.62       5
 192            UC   0.146   0.171
 193            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 194            UA     100
                *
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 195            KK  CPBND2 COMBINE
 196            HC       3
                *

 197            KK  SOF-25   BASIN
 198            BA   0.112
 199            LG    0.32    0.33    5.71    0.22      12
 200            UC   0.376   0.375
 201            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 202            UA     100
                *

 203            KK  SROF25   ROUTE
 204            RS       1    FLOW
 205            RC   0.035   0.035   0.035    1880  0.0164 2486.00
 206            RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
 207            RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
                *

 208            KK  SON-22   BASIN
 209            BA   0.015
 210            LG    0.34    0.36    6.00    0.17       5
 211            UC   0.288   0.479
 212            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
```

```
          213           UA     100
                        *

          214           KK   SCP022 COMBINE
          215           HC        2
                        *

          216           KK   SR2225   ROUTE
          217           RS        1    FLOW
          218           RC    0.035   0.035   0.035     398  0.0164 2486.00
          219           RX     0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
          220           RY   2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
                        *

          221           KK   SON-25   BASIN
          222           BA    0.002
          223           LG     0.34    0.37    6.00    0.17       4
          224           UC    0.130   0.210
          225           UA        0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
          226           UA      100
                        *

          227           KK   SON-24   BASIN
          228           BA    0.003
          229           LG     0.32    0.31    6.00    0.17      11
          230           UC    0.154   0.144
          231           UA        0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
          232           UA      100
                        *
1                                                      HEC-1 INPUT                                              PAGE  7

         LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


          233           KK   SRET24 STORAGE
          234           RS        1    STOR
          235           SV             0.12    0.26    0.44
          236           SQ             0.82    1.25    1.57
          237           SE   2467.0 2468.00 2469.00 2470.00
                        *

          238           KK   SCP025 COMBINE
          239           HC        3
                        *

          240           KK   RSON25   ROUTE
          241           RS        1    FLOW
          242           RC    0.035   0.035   0.035     643  0.0249 2456.00
          243           RX     0.00   13.00   16.00   19.00   31.00   33.00   36.00   39.00
          244           RY   2456.0 2455.00 2454.00 2453.00 2453.00 2454.00 2455.00 2456.00
                        *

          245           KK   ON-130   BASIN
          246           BA   0.0037
          247           LG     0.10    0.25    5.24    0.40       5
          248           UC    0.337   0.682
          249           UA        0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
          250           UA      100
                        *

          251           KK    CP130 COMBINE
          252           HC        2
                        *
          253           ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE        (V) ROUTING           (--->) DIVERSION OR PUMP FLOW

  NO.         (.) CONNECTOR         (<---) RETURN OF DIVERTED OR PUMPED FLOW

   11          OF-10
                 .
                 .
   21            .      ON-10
                 .          .
                 .          .
   27            .          .      ON-20
                 .          .          .
                 .          .          .
   33            .          .          .      ON-30
                 .          .          .          .
                 .          .          .          .
   39            .          .          .          .      ON-110
                 .          .          .          .          .
                 .          .          .          .          .
   45            .          .          .          .          .      ON-120
                 .          .          .          .          .          .
                 .          .          .          .          .          .
   51            .          .          .          .          .          .      ON-140
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               .           .           .           .           .           .           .
  57           .           .           .           .           .           .           .      ON-150
               .           .           .           .           .           .           .           .
  63      CPBNDY....................................................................................
               .
  65           .      AON-20
               .           V
               .           V
  71           .      ARET20
               .           V
               .           V
  76           .      RAON20
               .           .
  81           .           .      ON-40
               .           .           .
  87           .       CP040............
               .           .
  89           .           .      ON-50
               .           .           .
  95           .           .           .      SOF-30
               .           .           .           V
               .           .           .           V
 101           .           .           .      SROF30
               .           .           .           .
 106           .           .           .           .      SON-26
               .           .           .           .           .
 112           .           .           .      SCP026............
               .           .           .           V
               .           .           .           V
 114           .           .           .      SR2628
               .           .           .           .
 119           .           .           .           .      SON-28
               .           .           .           .           .
 125           .           .           .      SCP028............
               .           .           .           V
               .           .           .           V
 127           .           .           .      SRET28
               .           .           .           .
 132           .           .           .           .      SON-27
               .           .           .           .           V
               .           .           .           .           V
 138           .           .           .           .      SRET27
               .           .           .           .           .
 143           .           .           .           .           .      SON-30
               .           .           .           .           .           .
 149           .           .           .      SCP030........................
               .           .           .           V
               .           .           .           V
 151           .           .           .      RSON30
               .           .           .           .
 156           .           .           .           .       ON-60
               .           .           .           .           .
 162           .           .           .       CP060............
               .           .           .           V
               .           .           .           V
 164           .           .           .       RON60
               .           .           .           .
 169           .           .           .           .       ON-70
               .           .           .           .           .
 175           .           .           .       CP070............
               .           .           .           .
 177           .           .           .           .       ON-80
               .           .           .           .           .
 183           .           .           .           .           .       ON-90
               .           .           .           .           .           .
 189           .           .           .           .           .           .      ON-100
               .           .           .           .           .           .           .
 195           .           .           .           .      CPBND2........................
```

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                .           .           .           .           .
                .           .           .           .           .
  197           .           .           .           .           .     SOF-25
                .           .           .           .           .          V
                .           .           .           .           .          V
  203           .           .           .           .           .     SROF25
                .           .           .           .           .          .
                .           .           .           .           .          .
  208           .           .           .           .           .          .     SON-22
                .           .           .           .           .          .          .
                .           .           .           .           .          .          .
  214           .           .           .           .           .     SCP022............
                .           .           .           .           .          V
                .           .           .           .           .          V
  216           .           .           .           .           .     SR2225
                .           .           .           .           .          .
                .           .           .           .           .          .
  221           .           .           .           .           .          .     SON-25
                .           .           .           .           .          .          .
                .           .           .           .           .          .          .
  227           .           .           .           .           .          .          .     SON-24
                .           .           .           .           .          .          .          V
                .           .           .           .           .          .          .          V
  233           .           .           .           .           .          .          .     SRET24
                .           .           .           .           .          .          .          .
                .           .           .           .           .          .          .          .
  238           .           .           .           .           .     SCP025.......................
                .           .           .           .           .          V
                .           .           .           .           .          V
  240           .           .           .           .           .     RSON25
                .           .           .           .           .          .
                .           .           .           .           .          .
  245           .           .           .           .           .          .     ON-130
                .           .           .           .           .          .          .
                .           .           .           .           .          .          .
  251           .           .           .           .           .      CP130............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
****************************************
 *                                       *                                                *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                *   U.S. ARMY CORPS OF ENGINEERS
*
 *             JUN   1998                *                                                *   HYDROLOGIC ENGINEERING CENTER
*
 *           VERSION 4.1                 *                                                *         609 SECOND STREET
*
 *                                       *                                                *      DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   19DEC16  TIME  15:01:37   *                                                *          (916) 756-1104
*
 *                                       *                                                *
*
 *****************************************
****************************************



                              Flood Control District of Maricopa County
                              BLACK MOUNTAIN - BLACK MOUNTAIN EXISTING CONDITIONS
                              2 YEAR
                              6 Hour  Storm
                              Unit Hydrograph: Clark
                              Storm: Multiple
                              08/23/2016

   9 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1JAN99  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     7JAN99  ENDING DATE
                     NDTIME       2235  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
```

FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	OF-10	1.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-10	1.	4.17	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-20	2.	4.17	0.	0.	0.	.01		
+	HYDROGRAPH AT	ON-30	0.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-110	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-120	2.	4.25	0.	0.	0.	.01		
+	HYDROGRAPH AT	ON-140	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-150	1.	4.08	0.	0.	0.	.00		
+	8 COMBINED AT	CPBNDY	6.	4.17	1.	0.	0.	.02		
+	HYDROGRAPH AT	AON-20	11.	4.08	1.	0.	0.	.02		
+	ROUTED TO	ARET20	3.	4.42	1.	0.	0.	.02		
+									2482.86	4.42
+	ROUTED TO	RAON20	3.	4.75	1.	0.	0.	.02		
+									2450.24	4.75
+	HYDROGRAPH AT	ON-40	6.	4.33	1.	0.	0.	.02		
+	2 COMBINED AT	CP040	8.	4.33	2.	0.	0.	.04		
+	HYDROGRAPH AT	ON-50	1.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	SOF-30	3.	4.08	0.	0.	0.	.01		
+	ROUTED TO	SROF30	3.	4.17	0.	0.	0.	.01		
+									2476.06	4.17
+	HYDROGRAPH AT	SON-26	0.	4.08	0.	0.	0.	.00		
+	2 COMBINED AT	SCP026	4.	4.17	0.	0.	0.	.01		
+	ROUTED TO	SR2628	3.	4.17	0.	0.	0.	.01		
+									2476.06	4.17
+	HYDROGRAPH AT	SON-28	8.	4.00	1.	0.	0.	.01		
+	2 COMBINED AT	SCP028	9.	4.08	1.	0.	0.	.02		
+	ROUTED TO	SRET28	5.	4.25	1.	0.	0.	.02		
+									2476.32	4.25
+	HYDROGRAPH AT	SON-27	7.	4.00	1.	0.	0.	.01		

ROUTED TO	SRET27	2.	4.33	1.	0.	0.	.01	2472.93	4.33
HYDROGRAPH AT	SON-30	0.	4.08	0.	0.	0.	.00		
3 COMBINED AT	SCP030	7.	4.25	1.	0.	0.	.03		
ROUTED TO	RSON30	7.	4.33	1.	0.	0.	.03	2461.56	4.33
HYDROGRAPH AT	ON-60	2.	4.25	0.	0.	0.	.00		
2 COMBINED AT	CP060	8.	4.25	1.	0.	0.	.03		
ROUTED TO	RON60	7.	4.58	1.	0.	0.	.03	2451.44	4.58
HYDROGRAPH AT	ON-70	4.	4.25	0.	0.	0.	.01		
2 COMBINED AT	CP070	9.	4.42	2.	0.	0.	.05		
HYDROGRAPH AT	ON-80	1.	4.25	0.	0.	0.	.00		
HYDROGRAPH AT	ON-90	0.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	ON-100	0.	4.08	0.	0.	0.	.00		
3 COMBINED AT	CPBND2	1.	4.17	0.	0.	0.	.01		
HYDROGRAPH AT	SOF-25	44.	4.25	5.	1.	0.	.11		
ROUTED TO	SROF25	38.	4.33	5.	1.	0.	.11	2477.08	4.33
HYDROGRAPH AT	SON-22	5.	4.25	1.	0.	0.	.01		
2 COMBINED AT	SCP022	42.	4.33	6.	1.	0.	.13		
ROUTED TO	SR2225	42.	4.33	6.	1.	0.	.13	2477.12	4.33
HYDROGRAPH AT	SON-25	1.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	SON-24	2.	4.08	0.	0.	0.	.00		
ROUTED TO	SRET24	0.	4.42	0.	0.	0.	.00	2467.47	4.42
3 COMBINED AT	SCP025	42.	4.33	6.	2.	1.	.13		
ROUTED TO	RSON25	43.	4.42	6.	2.	1.	.13	2453.66	4.42
HYDROGRAPH AT	ON-130	1.	4.25	0.	0.	0.	.00		
2 COMBINED AT	CP130	43.	4.42	6.	2.	1.	.14		

*** NORMAL END OF HEC-1 ***

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1***************************************
**************************************
 *                                      *                                               *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                               *   U.S. ARMY CORPS OF ENGINEERS
*
 *             JUN   1998               *                                               *   HYDROLOGIC ENGINEERING CENTER
*
 *           VERSION 4.1                *                                               *         609 SECOND STREET
*
 *                                      *                                               *      DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   19DEC16  TIME  14:59:32  *                                               *          (916) 756-1104
*
 *                                      *                                               *
*
 ***************************************
**************************************


                                    X     X  XXXXXXX   XXXXX          X
                                    X     X  X        X     X        XX
                                    X     X  X        X               X
                                    XXXXXXX  XXXX     X       XXXXX   X
                                    X     X  X        X               X
                                    X     X  X        X     X         X
                                    X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL    LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                           HEC-1 INPUT                                            PAGE  1

         LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           1           ID        Flood Control District of Maricopa County
           2           ID        BLACK MOUNTAIN - BLACK MOUNTAIN EXISTING CONDITIONS
           3           ID        10 YEAR
           4           ID        6 Hour  Storm
           5           ID        Unit Hydrograph: Clark
           6           ID        Storm: Multiple
           7           ID        08/23/2016
                       *DIAGRAM
           8           IT       5  1JAN99       0    2000
           9           IO       5
          10           IN      15
                       *

          11           KK   OF-10   BASIN
          12           BA  0.0018
          13           PB   2.068
          14           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
          15           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
          16           PC   0.962   0.972   0.983   0.991   1.000
          17           LG    0.12    0.25    5.05    0.42       6
          18           UC   0.141   0.153
          19           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
          20           UA     100
                       *

          21           KK   ON-10   BASIN
          22           BA  0.0016
          23           LG    0.10    0.25    5.05    0.44       5
          24           UC   0.170   0.237
          25           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
          26           UA     100
                       *

          27           KK   ON-20   BASIN
          28           BA  0.0058
          29           LG    0.10    0.25    5.05    0.44       5
          30           UC   0.241   0.325
          31           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
          32           UA     100
                       *

          33           KK   ON-30   BASIN
          34           BA  0.0009
```

```
   35          LG    0.10    0.25    5.05    0.44       5
   36          UC   0.141   0.197
   37          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   38          UA     100
               *

   39          KK  ON-110   BASIN
   40          BA  0.0004
   41          LG    0.10    0.25    4.65    0.52       5
   42          UC   0.104   0.093
   43          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   44          UA     100
               *
1                                              HEC-1 INPUT                                        PAGE  2

  LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


   45          KK  ON-120   BASIN
   46          BA  0.0055
   47          LG    0.10    0.25    5.05    0.44       5
   48          UC   0.274   0.394
   49          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   50          UA     100
               *

   51          KK  ON-140   BASIN
   52          BA  0.0002
   53          LG    0.10    0.25    5.46    0.35       5
   54          UC   0.084   0.053
   55          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   56          UA     100
               *

   57          KK  ON-150   BASIN
   58          BA   0.001
   59          LG    0.10    0.25    6.00    0.28       5
   60          UC   0.122   0.140
   61          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   62          UA     100
               *

   63          KK  CPBNDY COMBINE
   64          HC       8
               *

   65          KK  AON-20   BASIN
   66          BA   0.018
   67          LG    0.31    0.28    5.05    0.27      13
   68          UC   0.191   0.198
   69          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
   70          UA     100
               *

   71          KK  ARET20 STORAGE
   72          RS       1    STOR
   73          SV            0.30    0.46    0.64    0.76    0.84    0.96    1.04
   74          SQ            3.62    5.53    9.66   13.16   15.81   20.15   29.72
   75          SE  2482.0 2483.00 2483.50 2484.00 2484.30 2484.50 2484.80 2485.00
               *

   76          KK  RAON20   ROUTE
   77          RS       1    FLOW
   78          RC   0.035   0.035   0.035    2438  0.0193 2453.00
   79          RX    0.00    7.00   14.00   22.00   26.00   29.00   35.00   40.00
   80          RY  2453.0 2452.00 2451.00 2450.00 2450.00 2451.00 2452.00 2453.00
               *
1                                              HEC-1 INPUT                                        PAGE  3

  LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


   81          KK   ON-40   BASIN
   82          BA  0.0222
   83          LG    0.10    0.25    5.05    0.44       5
   84          UC   0.362   0.445
   85          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   86          UA     100
               *

   87          KK   CP040 COMBINE
   88          HC       2
               *

   89          KK   ON-50   BASIN
   90          BA  0.0014
   91          LG    0.10    0.25    5.05    0.44       5
   92          UC   0.148   0.240
   93          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   94          UA     100
```

```
                *

   95           KK  SOF-30   BASIN
   96           BA   0.007
   97           LG    0.35    0.36    5.05    0.27       0
   98           UC   0.166   0.146
   99           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  100           UA     100
                *

  101           KK  SROF30   ROUTE
  102           RS       1    FLOW
  103           RC   0.035   0.035   0.035     386  0.0214 2484.00
  104           RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
  105           RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
                *

  106           KK  SON-26   BASIN
  107           BA   0.001
  108           LG    0.35    0.36    5.05    0.27       0
  109           UC   0.138   0.279
  110           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  111           UA     100
                *

  112           KK  SCP026 COMBINE
  113           HC       2
                *

  114           KK  SR2628   ROUTE
  115           RS       1    FLOW
  116           RC   0.035   0.035   0.035     740  0.0214 2484.00
  117           RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
  118           RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
                *
1                                             HEC-1 INPUT                                          PAGE  4

 LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  119           KK  SON-28   BASIN
  120           BA   0.010
  121           LG    0.31    0.26    5.05    0.26      15
  122           UC   0.133   0.106
  123           UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  124           UA     100
                *

  125           KK  SCP028 COMBINE
  126           HC       2
                *

  127           KK  SRET28 STORAGE
  128           RS       1    STOR
  129           SV            0.11    0.26    0.30    0.35    0.40    0.46
  130           SQ            3.94    6.13   11.27   20.23   31.64   45.04
  131           SE  2475.0 2476.00 2477.00 2477.30 2477.50 2477.80 2478.00
                *

  132           KK  SON-27   BASIN
  133           BA   0.009
  134           LG    0.30    0.25    5.58    0.20      17
  135           UC   0.139   0.168
  136           UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  137           UA     100
                *

  138           KK  SRET27 STORAGE
  139           RS       1    STOR
  140           SV            0.18    0.39    0.64    0.78
  141           SQ            2.00    3.30    4.22    4.61
  142           SE  2472.0 2473.00 2474.00 2475.00 2475.50
                *

  143           KK  SON-30   BASIN
  144           BA   0.001
  145           LG    0.35    0.36    5.05    0.27       0
  146           UC   0.112   0.177
  147           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  148           UA     100
                *

  149           KK  SCP030 COMBINE
  150           HC       3
                *

  151           KK  RSON30   ROUTE
  152           RS       1    FLOW
  153           RC   0.035   0.035   0.035     530  0.0226 2464.00
  154           RX    0.00    4.00    6.00    8.00   10.00   13.00   33.00   43.00
```

```
   155          RY  2464.0 2463.00 2462.00 2461.00 2461.00 2462.00 2463.00 2464.00
                *
1                                         HEC-1 INPUT                                           PAGE  5

  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   156          KK   ON-60   BASIN
   157          BA   0.005
   158          LG    0.10    0.25    5.05    0.44       5
   159          UC   0.250   0.357
   160          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   161          UA     100
                *

   162          KK   CP060 COMBINE
   163          HC       2
                *

   164          KK   RON60   ROUTE
   165          RS       1    FLOW
   166          RC   0.035   0.035   0.035    2435  0.0111 2454.00
   167          RX    0.00    3.00    5.00    8.00   13.00   17.00   21.00  27.00
   168          RY  2454.0 2453.00 2452.00 2451.00 2451.00 2452.00 2453.00 2454.00
                *

   169          KK   ON-70   BASIN
   170          BA  0.0123
   171          LG    0.12    0.25    4.96    0.44       6
   172          UC   0.321   0.416
   173          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   174          UA     100
                *

   175          KK   CP070 COMBINE
   176          HC       2
                *

   177          KK   ON-80   BASIN
   178          BA  0.0043
   179          LG    0.11    0.25    5.05    0.43       6
   180          UC   0.264   0.475
   181          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   182          UA     100
                *

   183          KK   ON-90   BASIN
   184          BA  0.0005
   185          LG    0.10    0.25    4.33    0.62       5
   186          UC   0.123   0.141
   187          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   188          UA     100
                *

   189          KK  ON-100   BASIN
   190          BA  0.0003
   191          LG    0.10    0.25    4.33    0.62       5
   192          UC   0.123   0.141
   193          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   194          UA     100
                *
1                                         HEC-1 INPUT                                           PAGE  6

  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   195          KK  CPBND2 COMBINE
   196          HC       3
                *

   197          KK  SOF-25   BASIN
   198          BA   0.112
   199          LG    0.32    0.33    5.71    0.22      12
   200          UC   0.376   0.375
   201          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   202          UA     100
                *

   203          KK  SROF25   ROUTE
   204          RS       1    FLOW
   205          RC   0.035   0.035   0.035    1880  0.0164 2486.00
   206          RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
   207          RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
                *

   208          KK  SON-22   BASIN
   209          BA   0.015
   210          LG    0.34    0.36    6.00    0.17       5
   211          UC   0.288   0.479
   212          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
```

```
 213            UA     100
                *

 214            KK  SCP022 COMBINE
 215            HC       2
                *

 216            KK  SR2225   ROUTE
 217            RS       1    FLOW
 218            RC   0.035   0.035   0.035     398  0.0164 2486.00
 219            RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
 220            RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
                *

 221            KK  SON-25   BASIN
 222            BA   0.002
 223            LG    0.34    0.37    6.00    0.17       4
 224            UC   0.130   0.210
 225            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 226            UA     100
                *

 227            KK  SON-24   BASIN
 228            BA   0.003
 229            LG    0.32    0.31    6.00    0.17      11
 230            UC   0.154   0.144
 231            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 232            UA     100
                *
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 233            KK  SRET24 STORAGE
 234            RS       1    STOR
 235            SV            0.12    0.26    0.44
 236            SQ            0.82    1.25    1.57
 237            SE  2467.0 2468.00 2469.00 2470.00
                *

 238            KK  SCP025 COMBINE
 239            HC       3
                *

 240            KK  RSON25   ROUTE
 241            RS       1    FLOW
 242            RC   0.035   0.035   0.035     643  0.0249 2456.00
 243            RX    0.00   13.00   16.00   19.00   31.00   33.00   36.00   39.00
 244            RY  2456.0 2455.00 2454.00 2453.00 2453.00 2454.00 2455.00 2456.00
                *

 245            KK  ON-130   BASIN
 246            BA  0.0037
 247            LG    0.10    0.25    5.24    0.40       5
 248            UC   0.289   0.575
 249            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 250            UA     100
                *

 251            KK   CP130 COMBINE
 252            HC       2
                *
 253            ZZ
```

```
1
           SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  11      OF-10
              .
              .
  21          .      ON-10
              .          .
              .          .
  27          .          .      ON-20
              .          .          .
              .          .          .
  33          .          .          .      ON-30
              .          .          .          .
              .          .          .          .
  39          .          .          .          .      ON-110
              .          .          .          .          .
              .          .          .          .          .
  45          .          .          .          .          .      ON-120
              .          .          .          .          .          .
              .          .          .          .          .          .
  51          .          .          .          .          .          .      ON-140
```

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                          .           .          .           .          .           .           .
                          .           .          .           .          .           .           .
   57                     .           .          .           .          .           .           .     ON-150
                          .           .          .           .          .           .           .          .
                          .           .          .           .          .           .           .          .
   63               CPBNDY.................................................................................
                          .
                          .
   65                     .     AON-20
                          .          V
                          .          V
   71                     .     ARET20
                          .          V
                          .          V
   76                     .     RAON20
                          .           .
                          .           .
   81                     .           .     ON-40
                          .           .          .
                          .           .          .
   87                     .      CP040...........
                          .           .
                          .           .
   89                     .           .     ON-50
                          .           .          .
                          .           .          .
   95                     .           .          .     SOF-30
                          .           .          .          V
                          .           .          .          V
  101                     .           .          .     SROF30
                          .           .          .           .
                          .           .          .           .
  106                     .           .          .           .     SON-26
                          .           .          .           .          .
                          .           .          .           .          .
  112                     .           .          .     SCP026...........
                          .           .          .          V
                          .           .          .          V
  114                     .           .          .     SR2628
                          .           .          .           .
                          .           .          .           .
  119                     .           .          .           .     SON-28
                          .           .          .           .          .
                          .           .          .           .          .
  125                     .           .          .     SCP028...........
                          .           .          .          V
                          .           .          .          V
  127                     .           .          .     SRET28
                          .           .          .           .
                          .           .          .           .
  132                     .           .          .           .     SON-27
                          .           .          .           .          V
                          .           .          .           .          V
  138                     .           .          .           .     SRET27
                          .           .          .           .          .
                          .           .          .           .          .
  143                     .           .          .           .          .     SON-30
                          .           .          .           .          .           .
                          .           .          .           .          .           .
  149                     .           .          .     SCP030.......................
                          .           .          .          V
                          .           .          .          V
  151                     .           .          .     RSON30
                          .           .          .           .
                          .           .          .           .
  156                     .           .          .           .      ON-60
                          .           .          .           .          .
                          .           .          .           .          .
  162                     .           .          .      CP060...........
                          .           .          .          V
                          .           .          .          V
  164                     .           .          .      RON60
                          .           .          .           .
                          .           .          .           .
  169                     .           .          .           .      ON-70
                          .           .          .           .          .
                          .           .          .           .          .
  175                     .           .          .      CP070...........
                          .           .          .           .
                          .           .          .           .
  177                     .           .          .           .      ON-80
                          .           .          .           .          .
                          .           .          .           .          .
  183                     .           .          .           .          .      ON-90
                          .           .          .           .          .           .
                          .           .          .           .          .           .
  189                     .           .          .           .          .           .     ON-100
                          .           .          .           .          .           .           .
                          .           .          .           .          .           .           .
  195                     .           .          .           .     CPBND2........................
```

```
                 .             .             .             .             .
                 .             .             .             .             .
  197            .             .             .             .             .     SOF-25
                 .             .             .             .             .          V
                 .             .             .             .             .          V
  203            .             .             .             .             .     SROF25
                 .             .             .             .             .          .
                 .             .             .             .             .          .
  208            .             .             .             .             .          .     SON-22
                 .             .             .             .             .          .          .
                 .             .             .             .             .          .          .
  214            .             .             .             .             .     SCP022............
                 .             .             .             .             .          V
                 .             .             .             .             .          V
  216            .             .             .             .             .     SR2225
                 .             .             .             .             .          .
                 .             .             .             .             .          .
  221            .             .             .             .             .          .     SON-25
                 .             .             .             .             .          .          .
                 .             .             .             .             .          .          .
  227            .             .             .             .             .          .          .     SON-24
                 .             .             .             .             .          .          .          V
                 .             .             .             .             .          .          .          V
  233            .             .             .             .             .          .          .     SRET24
                 .             .             .             .             .          .          .          .
                 .             .             .             .             .          .          .          .
  238            .             .             .             .             .     SCP025.......................
                 .             .             .             .             .          V
                 .             .             .             .             .          V
  240            .             .             .             .             .     RSON25
                 .             .             .             .             .          .
                 .             .             .             .             .          .
  245            .             .             .             .             .          .     ON-130
                 .             .             .             .             .          .          .
                 .             .             .             .             .          .          .
  251            .             .             .             .             .      CP130............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
****************************************
 *                                        *                                                  *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                                                  *   U.S. ARMY CORPS OF ENGINEERS
*
 *              JUN   1998                *                                                  *   HYDROLOGIC ENGINEERING CENTER
*
 *           VERSION 4.1                  *                                                  *         609 SECOND STREET
*
 *                                        *                                                  *      DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   19DEC16  TIME  14:59:32    *                                                  *          (916) 756-1104
*
 *                                        *                                                  *
*
 *****************************************
****************************************



                                    Flood Control District of Maricopa County
                                    BLACK MOUNTAIN - BLACK MOUNTAIN EXISTING CONDITIONS
                                    10 YEAR
                                    6 Hour  Storm
                                    Unit Hydrograph: Clark
                                    Storm: Multiple
                                    08/23/2016

    9 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN          5  MINUTES IN COMPUTATION INTERVAL
                        IDATE     1JAN99  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     7JAN99  ENDING DATE
                       NDTIME       2235  ENDING TIME
                        ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE  166.58 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
```

FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	OF-10	2.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	ON-10	2.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	ON-20	5.	4.17	0.	0.	0.	.01		
HYDROGRAPH AT	ON-30	1.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	ON-110	1.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	ON-120	4.	4.17	0.	0.	0.	.01		
HYDROGRAPH AT	ON-140	0.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	ON-150	1.	4.00	0.	0.	0.	.00		
8 COMBINED AT	CPBNDY	15.	4.08	1.	0.	0.	.02		
HYDROGRAPH AT	AON-20	22.	4.08	2.	0.	0.	.02		
ROUTED TO	ARET20	7.	4.33	2.	0.	0.	.02	2483.66	4.33
ROUTED TO	RAON20	6.	4.58	2.	0.	0.	.02	2450.37	4.58
HYDROGRAPH AT	ON-40	15.	4.25	2.	0.	0.	.02		
2 COMBINED AT	CP040	18.	4.25	3.	1.	0.	.04		
HYDROGRAPH AT	ON-50	1.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	SOF-30	9.	4.08	0.	0.	0.	.01		
ROUTED TO	SROF30	8.	4.08	0.	0.	0.	.01	2476.16	4.08
HYDROGRAPH AT	SON-26	1.	4.08	0.	0.	0.	.00		
2 COMBINED AT	SCP026	9.	4.08	1.	0.	0.	.01		
ROUTED TO	SR2628	8.	4.17	1.	0.	0.	.01	2476.16	4.17
HYDROGRAPH AT	SON-28	17.	4.00	1.	0.	0.	.01		
2 COMBINED AT	SCP028	21.	4.08	2.	0.	0.	.02		
ROUTED TO	SRET28	15.	4.17	2.	0.	0.	.02	2477.39	4.17
HYDROGRAPH AT	SON-27	13.	4.00	1.	0.	0.	.01		

ROUTED TO	SRET27	3.	4.33	1.	0.	0.	.01	2473.70	4.33
HYDROGRAPH AT	SON-30	1.	4.00	0.	0.	0.	.00		
3 COMBINED AT	SCP030	19.	4.17	3.	1.	0.	.03		
ROUTED TO	RSON30	18.	4.25	3.	1.	0.	.03	2461.94	4.25
HYDROGRAPH AT	ON-60	4.	4.17	0.	0.	0.	.00		
2 COMBINED AT	CP060	22.	4.25	3.	1.	0.	.03		
ROUTED TO	RON60	16.	4.33	3.	1.	0.	.03	2451.72	4.33
HYDROGRAPH AT	ON-70	9.	4.25	1.	0.	0.	.01		
2 COMBINED AT	CP070	23.	4.33	4.	1.	0.	.05		
HYDROGRAPH AT	ON-80	3.	4.17	0.	0.	0.	.00		
HYDROGRAPH AT	ON-90	1.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	ON-100	0.	4.00	0.	0.	0.	.00		
3 COMBINED AT	CPBND2	3.	4.17	0.	0.	0.	.01		
HYDROGRAPH AT	SOF-25	92.	4.25	10.	3.	1.	.11		
ROUTED TO	SROF25	83.	4.33	10.	3.	1.	.11	2477.54	4.33
HYDROGRAPH AT	SON-22	10.	4.17	1.	0.	0.	.01		
2 COMBINED AT	SCP022	92.	4.33	12.	3.	1.	.13		
ROUTED TO	SR2225	92.	4.33	12.	3.	1.	.13	2477.61	4.33
HYDROGRAPH AT	SON-25	2.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	SON-24	4.	4.08	0.	0.	0.	.00		
ROUTED TO	SRET24	1.	4.42	0.	0.	0.	.00	2467.93	4.42
3 COMBINED AT	SCP025	94.	4.33	12.	3.	1.	.13		
ROUTED TO	RSON25	93.	4.33	12.	3.	1.	.13	2454.03	4.33
HYDROGRAPH AT	ON-130	2.	4.25	0.	0.	0.	.00		
2 COMBINED AT	CP130	95.	4.33	12.	3.	1.	.14		

*** NORMAL END OF HEC-1 ***

```
1*****************************************                                                         
****************************************
 *                                       *                                                  *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *   U.S. ARMY CORPS OF ENGINEERS
*
 *             JUN   1998                *                                                  *   HYDROLOGIC ENGINEERING CENTER
*
 *           VERSION 4.1                 *                                                  *         609 SECOND STREET
*
 *                                       *                                                  *      DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   19DEC16  TIME  14:54:43   *                                                  *          (916) 756-1104
*
 *                                       *                                                  *
*
 *****************************************
****************************************

                                                   X     X  XXXXXXX   XXXXX           X
                                                   X     X  X        X     X         XX
                                                   X     X  X        X                X
                                                   XXXXXXX  XXXX     X        XXXXX   X
                                                   X     X  X        X                X
                                                   X     X  X        X     X          X
                                                   X     X  XXXXXXX   XXXXX          XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL    LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                      HEC-1 INPUT                                              PAGE  1

         LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID        Flood Control District of Maricopa County
            2           ID        BLACK MOUNTAIN - BLACK MOUNTAIN EXISTING CONDITIONS
            3           ID        100 YEAR
            4           ID        6 Hour  Storm
            5           ID        Unit Hydrograph: Clark
            6           ID        Storm: Multiple
            7           ID        08/23/2016
                        *DIAGRAM
            8           IT       5  1JAN99       0    2000
            9           IO       5
           10           IN      15
                        *

           11           KK   OF-10   BASIN
           12           BA  0.0018
           13           PB   3.143
           14           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
           15           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
           16           PC   0.962   0.972   0.983   0.991   1.000
           17           LG    0.12    0.25    5.05    0.42       6
           18           UC   0.108   0.114
           19           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
           20           UA     100
                        *

           21           KK   ON-10   BASIN
           22           BA  0.0016
           23           LG    0.10    0.25    5.05    0.44       5
           24           UC   0.130   0.176
           25           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
           26           UA     100
                        *

           27           KK   ON-20   BASIN
           28           BA  0.0058
           29           LG    0.10    0.25    5.05    0.44       5
           30           UC   0.184   0.241
           31           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
           32           UA     100
                        *

           33           KK   ON-30   BASIN
           34           BA  0.0009
```

```
 35             LG    0.10    0.25    5.05    0.44       5
 36             UC   0.108   0.146
 37             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 38             UA     100
                *

 39             KK  ON-110   BASIN
 40             BA  0.0004
 41             LG    0.10    0.25    4.65    0.52       5
 42             UC   0.079   0.069
 43             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 44             UA     100
                *
1                                        HEC-1 INPUT                                               PAGE  2

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 45             KK  ON-120   BASIN
 46             BA  0.0055
 47             LG    0.10    0.25    5.05    0.44       5
 48             UC   0.210   0.293
 49             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 50             UA     100
                *

 51             KK  ON-140   BASIN
 52             BA  0.0002
 53             LG    0.10    0.25    5.46    0.35       5
 54             UC   0.065   0.040
 55             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 56             UA     100
                *

 57             KK  ON-150   BASIN
 58             BA   0.001
 59             LG    0.10    0.25    6.00    0.28       5
 60             UC   0.094   0.104
 61             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 62             UA     100
                *

 63             KK  CPBNDY COMBINE
 64             HC       8
                *

 65             KK  AON-20   BASIN
 66             BA   0.018
 67             LG    0.31    0.28    5.05    0.27      13
 68             UC   0.191   0.198
 69             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 70             UA     100
                *

 71             KK  ARET20 STORAGE
 72             RS       1    STOR
 73             SV            0.30    0.46    0.64    0.76    0.84    0.96    1.04
 74             SQ            3.62    5.53    9.66   13.16   15.81   20.15   29.72
 75             SE  2482.0 2483.00 2483.50 2484.00 2484.30 2484.50 2484.80 2485.00
                *

 76             KK  RAON20   ROUTE
 77             RS       1    FLOW
 78             RC   0.035   0.035   0.035    2438  0.0193 2453.00
 79             RX    0.00    7.00   14.00   22.00   26.00   29.00   35.00   40.00
 80             RY  2453.0 2452.00 2451.00 2450.00 2450.00 2451.00 2452.00 2453.00
                *
1                                        HEC-1 INPUT                                               PAGE  3

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 81             KK   ON-40   BASIN
 82             BA  0.0222
 83             LG    0.10    0.25    5.05    0.44       5
 84             UC   0.277   0.330
 85             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 86             UA     100
                *

 87             KK   CP040 COMBINE
 88             HC       2
                *

 89             KK   ON-50   BASIN
 90             BA  0.0014
 91             LG    0.10    0.25    5.05    0.44       5
 92             UC   0.113   0.178
 93             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 94             UA     100
```

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                 *

  95             KK  SOF-30   BASIN
  96             BA   0.007
  97             LG    0.35    0.36    5.05    0.27       0
  98             UC   0.166   0.146
  99             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 100             UA     100
                 *

 101             KK  SROF30   ROUTE
 102             RS       1    FLOW
 103             RC   0.035   0.035   0.035     386  0.0214 2484.00
 104             RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
 105             RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
                 *

 106             KK  SON-26   BASIN
 107             BA   0.001
 108             LG    0.35    0.36    5.05    0.27       0
 109             UC   0.138   0.279
 110             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 111             UA     100
                 *

 112             KK  SCP026 COMBINE
 113             HC       2
                 *

 114             KK  SR2628   ROUTE
 115             RS       1    FLOW
 116             RC   0.035   0.035   0.035     740  0.0214 2484.00
 117             RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
 118             RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
                 *
1                                         HEC-1 INPUT                                            PAGE  4

LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 119             KK  SON-28   BASIN
 120             BA   0.010
 121             LG    0.31    0.26    5.05    0.26      15
 122             UC   0.133   0.106
 123             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 124             UA     100
                 *

 125             KK  SCP028 COMBINE
 126             HC       2
                 *

 127             KK  SRET28 STORAGE
 128             RS       1    STOR
 129             SV            0.11    0.26    0.30    0.35    0.40    0.46
 130             SQ            3.94    6.13   11.27   20.23   31.64   45.04
 131             SE  2475.0 2476.00 2477.00 2477.30 2477.50 2477.80 2478.00
                 *

 132             KK  SON-27   BASIN
 133             BA   0.009
 134             LG    0.30    0.25    5.58    0.20      17
 135             UC   0.139   0.168
 136             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 137             UA     100
                 *

 138             KK  SRET27 STORAGE
 139             RS       1    STOR
 140             SV            0.18    0.39    0.64    0.78
 141             SQ            2.00    3.30    4.22    4.61
 142             SE  2472.0 2473.00 2474.00 2475.00 2475.50
                 *

 143             KK  SON-30   BASIN
 144             BA   0.001
 145             LG    0.35    0.36    5.05    0.27       0
 146             UC   0.112   0.177
 147             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 148             UA     100
                 *

 149             KK  SCP030 COMBINE
 150             HC       3
                 *

 151             KK  RSON30   ROUTE
 152             RS       1    FLOW
 153             RC   0.035   0.035   0.035     530  0.0226 2464.00
 154             RX    0.00    4.00    6.00    8.00   10.00   13.00   33.00   43.00
```

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 155          RY  2464.0 2463.00 2462.00 2461.00 2461.00 2462.00 2463.00 2464.00
              *
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 156          KK   ON-60   BASIN
 157          BA   0.005
 158          LG    0.10    0.25    5.05    0.44       5
 159          UC   0.191   0.265
 160          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 161          UA     100
              *

 162          KK   CP060 COMBINE
 163          HC       2
              *

 164          KK   RON60   ROUTE
 165          RS       1    FLOW
 166          RC   0.035   0.035   0.035    2435  0.0111 2454.00
 167          RX    0.00    3.00    5.00    8.00   13.00   17.00   21.00   27.00
 168          RY  2454.0 2453.00 2452.00 2451.00 2451.00 2452.00 2453.00 2454.00
              *

 169          KK   ON-70   BASIN
 170          BA  0.0123
 171          LG    0.12    0.25    4.96    0.44       6
 172          UC   0.246   0.309
 173          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 174          UA     100
              *

 175          KK   CP070 COMBINE
 176          HC       2
              *

 177          KK   ON-80   BASIN
 178          BA  0.0043
 179          LG    0.11    0.25    5.05    0.43       6
 180          UC   0.202   0.354
 181          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 182          UA     100
              *

 183          KK   ON-90   BASIN
 184          BA  0.0005
 185          LG    0.10    0.25    4.33    0.62       5
 186          UC   0.094   0.104
 187          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 188          UA     100
              *

 189          KK  ON-100   BASIN
 190          BA  0.0003
 191          LG    0.10    0.25    4.33    0.62       5
 192          UC   0.093   0.104
 193          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 194          UA     100
              *
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 195          KK  CPBND2 COMBINE
 196          HC       3
              *

 197          KK  SOF-25   BASIN
 198          BA   0.112
 199          LG    0.32    0.33    5.71    0.22      12
 200          UC   0.376   0.375
 201          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 202          UA     100
              *

 203          KK  SROF25   ROUTE
 204          RS       1    FLOW
 205          RC   0.035   0.035   0.035    1880  0.0164 2486.00
 206          RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
 207          RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
              *

 208          KK  SON-22   BASIN
 209          BA   0.015
 210          LG    0.34    0.36    6.00    0.17       5
 211          UC   0.288   0.479
 212          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
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 213           UA     100
               *

 214           KK  SCP022 COMBINE
 215           HC       2
               *

 216           KK  SR2225   ROUTE
 217           RS       1    FLOW
 218           RC   0.035   0.035   0.035     398  0.0164 2486.00
 219           RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
 220           RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
               *

 221           KK  SON-25   BASIN
 222           BA   0.002
 223           LG    0.34    0.37    6.00    0.17       4
 224           UC   0.130   0.210
 225           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 226           UA     100
               *

 227           KK  SON-24   BASIN
 228           BA   0.003
 229           LG    0.32    0.31    6.00    0.17      11
 230           UC   0.154   0.144
 231           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 232           UA     100
               *
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1                                          HEC-1 INPUT                                          PAGE  7

      LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 233           KK  SRET24 STORAGE
 234           RS       1    STOR
 235           SV            0.12    0.26    0.44
 236           SQ            0.82    1.25    1.57
 237           SE  2467.0 2468.00 2469.00 2470.00
               *

 238           KK  SCP025 COMBINE
 239           HC       3
               *

 240           KK  RSON25   ROUTE
 241           RS       1    FLOW
 242           RC   0.035   0.035   0.035     643  0.0249 2456.00
 243           RX    0.00   13.00   16.00   19.00   31.00   33.00   36.00   39.00
 244           RY  2456.0 2455.00 2454.00 2453.00 2453.00 2454.00 2455.00 2456.00
               *

 245           KK  ON-130   BASIN
 246           BA  0.0037
 247           LG    0.10    0.25    5.24    0.40       5
 248           UC   0.221   0.427
 249           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 250           UA     100
               *

 251           KK   CP130 COMBINE
 252           HC       2
               *
 253           ZZ
```

```
1
           SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE       (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.        (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   11      OF-10
              .
              .
   21         .      ON-10
              .          .
              .          .
   27         .          .      ON-20
              .          .          .
              .          .          .
   33         .          .          .      ON-30
              .          .          .          .
              .          .          .          .
   39         .          .          .          .     ON-110
              .          .          .          .          .
              .          .          .          .          .
   45         .          .          .          .          .     ON-120
              .          .          .          .          .          .
              .          .          .          .          .          .
   51         .          .          .          .          .          .     ON-140
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               .           .           .           .           .           .           .
 57            .           .           .           .           .           .           .      ON-150
               .           .           .           .           .           .           .           .
               .           .           .           .           .           .           .           .
 63      CPBNDY.....................................................................................
               .
               .
 65            .      AON-20
               .           V
               .           V
 71            .      ARET20
               .           V
               .           V
 76            .      RAON20
               .           .
               .           .
 81            .           .       ON-40
               .           .           .
               .           .           .
 87            .       CP040............
               .           .
               .           .
 89            .           .       ON-50
               .           .           .
               .           .           .
 95            .           .           .      SOF-30
               .           .           .           V
               .           .           .           V
101            .           .           .      SROF30
               .           .           .           .
               .           .           .           .
106            .           .           .           .      SON-26
               .           .           .           .           .
               .           .           .           .           .
112            .           .           .      SCP026............
               .           .           .           V
               .           .           .           V
114            .           .           .      SR2628
               .           .           .           .
               .           .           .           .
119            .           .           .           .      SON-28
               .           .           .           .           .
               .           .           .           .           .
125            .           .           .      SCP028............
               .           .           .           V
               .           .           .           V
127            .           .           .      SRET28
               .           .           .           .
               .           .           .           .
132            .           .           .           .      SON-27
               .           .           .           .           V
               .           .           .           .           V
138            .           .           .           .      SRET27
               .           .           .           .           .
               .           .           .           .           .
143            .           .           .           .           .      SON-30
               .           .           .           .           .           .
               .           .           .           .           .           .
149            .           .           .      SCP030........................
               .           .           .           V
               .           .           .           V
151            .           .           .      RSON30
               .           .           .           .
               .           .           .           .
156            .           .           .           .       ON-60
               .           .           .           .           .
               .           .           .           .           .
162            .           .           .       CP060............
               .           .           .           V
               .           .           .           V
164            .           .           .       RON60
               .           .           .           .
               .           .           .           .
169            .           .           .           .       ON-70
               .           .           .           .           .
               .           .           .           .           .
175            .           .           .       CP070............
               .           .           .           .
               .           .           .           .
177            .           .           .           .       ON-80
               .           .           .           .           .
               .           .           .           .           .
183            .           .           .           .           .       ON-90
               .           .           .           .           .           .
               .           .           .           .           .           .
189            .           .           .           .           .           .      ON-100
               .           .           .           .           .           .           .
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195            .           .           .           .      CPBND2........................
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                 .           .           .           .           .
  197            .           .           .           .           .     SOF-25
                 .           .           .           .           .          V
                 .           .           .           .           .          V
  203            .           .           .           .           .     SROF25
                 .           .           .           .           .          .
                 .           .           .           .           .          .
  208            .           .           .           .           .          .     SON-22
                 .           .           .           .           .          .          .
                 .           .           .           .           .          .          .
  214            .           .           .           .           .     SCP022............
                 .           .           .           .           .          V
                 .           .           .           .           .          V
  216            .           .           .           .           .     SR2225
                 .           .           .           .           .          .
                 .           .           .           .           .          .
  221            .           .           .           .           .          .     SON-25
                 .           .           .           .           .          .          .
                 .           .           .           .           .          .          .
  227            .           .           .           .           .          .          .     SON-24
                 .           .           .           .           .          .          .          V
                 .           .           .           .           .          .          .          V
  233            .           .           .           .           .          .          .     SRET24
                 .           .           .           .           .          .          .          .
                 .           .           .           .           .          .          .          .
  238            .           .           .           .           .     SCP025.......................
                 .           .           .           .           .          V
                 .           .           .           .           .          V
  240            .           .           .           .           .     RSON25
                 .           .           .           .           .          .
                 .           .           .           .           .          .
  245            .           .           .           .           .          .     ON-130
                 .           .           .           .           .          .          .
                 .           .           .           .           .          .          .
  251            .           .           .           .           .      CP130...........

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
****************************************
 *                                       *                                              *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                              *   U.S. ARMY CORPS OF ENGINEERS
*
 *             JUN   1998                *                                              *   HYDROLOGIC ENGINEERING CENTER
*
 *           VERSION 4.1                 *                                              *         609 SECOND STREET
*
 *                                       *                                              *      DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   19DEC16  TIME  14:54:43   *                                              *          (916) 756-1104
*
 *                                       *                                              *
*
 *****************************************
****************************************



                                   Flood Control District of Maricopa County
                                   BLACK MOUNTAIN - BLACK MOUNTAIN EXISTING CONDITIONS
                                   100 YEAR
                                   6 Hour  Storm
                                   Unit Hydrograph: Clark
                                   Storm: Multiple
                                   08/23/2016

   9 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1JAN99  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      7JAN99  ENDING DATE
                      NDTIME        2235  ENDING TIME
                       ICENT          19  CENTURY MARK

                   COMPUTATION INTERVAL     .08 HOURS
                        TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
```

FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	OF-10	5.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	ON-10	3.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	ON-20	11.	4.08	1.	0.	0.	.01		
HYDROGRAPH AT	ON-30	2.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	ON-110	1.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	ON-120	9.	4.08	1.	0.	0.	.01		
HYDROGRAPH AT	ON-140	1.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	ON-150	3.	4.00	0.	0.	0.	.00		
8 COMBINED AT	CPBNDY	33.	4.08	3.	1.	0.	.02		
HYDROGRAPH AT	AON-20	39.	4.08	3.	1.	0.	.02		
ROUTED TO	ARET20	18.	4.33	3.	1.	0.	.02	2484.65	4.33
ROUTED TO	RAON20	16.	4.50	3.	1.	0.	.02	2450.63	4.50
HYDROGRAPH AT	ON-40	35.	4.17	4.	1.	0.	.02		
2 COMBINED AT	CP040	43.	4.25	7.	2.	1.	.04		
HYDROGRAPH AT	ON-50	3.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	SOF-30	17.	4.08	1.	0.	0.	.01		
ROUTED TO	SROF30	16.	4.08	1.	0.	0.	.01	2476.31	4.08
HYDROGRAPH AT	SON-26	2.	4.08	0.	0.	0.	.00		
2 COMBINED AT	SCP026	18.	4.08	1.	0.	0.	.01		
ROUTED TO	SR2628	17.	4.17	1.	0.	0.	.01	2476.32	4.17
HYDROGRAPH AT	SON-28	29.	4.00	2.	0.	0.	.01		
2 COMBINED AT	SCP028	38.	4.08	3.	1.	0.	.02		
ROUTED TO	SRET28	36.	4.08	3.	1.	0.	.02	2477.87	4.08
HYDROGRAPH AT	SON-27	23.	4.00	2.	0.	0.	.01		

ROUTED TO	SRET27	4.	4.42	2.	0.	0.	.01	2475.04	4.42
HYDROGRAPH AT	SON-30	2.	4.00	0.	0.	0.	.00		
3 COMBINED AT	SCP030	42.	4.08	5.	1.	0.	.03		
ROUTED TO	RSON30	41.	4.17	5.	1.	0.	.03	2462.30	4.17
HYDROGRAPH AT	ON-60	9.	4.08	1.	0.	0.	.00		
2 COMBINED AT	CP060	50.	4.17	6.	2.	1.	.03		
ROUTED TO	RON60	40.	4.25	6.	2.	1.	.03	2452.14	4.25
HYDROGRAPH AT	ON-70	20.	4.17	2.	0.	0.	.01		
2 COMBINED AT	CP070	57.	4.25	8.	2.	1.	.05		
HYDROGRAPH AT	ON-80	7.	4.17	1.	0.	0.	.00		
HYDROGRAPH AT	ON-90	1.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	ON-100	1.	4.00	0.	0.	0.	.00		
3 COMBINED AT	CPBND2	8.	4.08	1.	0.	0.	.01		
HYDROGRAPH AT	SOF-25	172.	4.25	21.	5.	2.	.11		
ROUTED TO	SROF25	162.	4.33	21.	5.	2.	.11	2478.02	4.33
HYDROGRAPH AT	SON-22	20.	4.17	3.	1.	0.	.01		
2 COMBINED AT	SCP022	180.	4.33	24.	6.	2.	.13		
ROUTED TO	SR2225	181.	4.33	24.	6.	2.	.13	2478.12	4.33
HYDROGRAPH AT	SON-25	4.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	SON-24	8.	4.08	1.	0.	0.	.00		
ROUTED TO	SRET24	1.	4.42	1.	0.	0.	.00	2468.75	4.50
3 COMBINED AT	SCP025	184.	4.33	24.	6.	2.	.13		
ROUTED TO	RSON25	184.	4.33	24.	6.	2.	.13	2454.48	4.33
HYDROGRAPH AT	ON-130	5.	4.17	1.	0.	0.	.00		
2 COMBINED AT	CP130	187.	4.33	25.	6.	2.	.14		

*** NORMAL END OF HEC-1 ***

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1***************************************
***************************************
 *                                     *                                                   *
 *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                   *   U.S. ARMY CORPS OF ENGINEERS
 *
 *              JUN   1998              *                                                   *   HYDROLOGIC ENGINEERING CENTER
 *
 *             VERSION 4.1              *                                                   *        609 SECOND STREET
 *
 *                                      *                                                   *     DAVIS, CALIFORNIA 95616
 *
 *  RUN DATE   22DEC16  TIME  15:45:15  *                                                   *         (916) 756-1104
 *
 *                                      *                                                   *
 *
 ***************************************
***************************************


                         X     X  XXXXXXX   XXXXX          X
                         X     X  X        X     X        XX
                         X     X  X        X               X
                         XXXXXXX  XXXX     X       XXXXX   X
                         X     X  X        X               X
                         X     X  X        X     X         X
                         X     X  XXXXXXX   XXXXX         XXX


           THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

           THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
           THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
           NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
           DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
           KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                              HEC-1 INPUT                                                   PAGE  1

          LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1         ID          Flood Control District of Maricopa County
            2         ID          BLACK MOUNTAIN_PROP - BLACK MOUNTAIN PROPOSED CONDITIONS
            3         ID          2 YEAR
            4         ID          6 Hour  Storm
            5         ID          Unit Hydrograph: Clark
            6         ID          Storm: Multiple
            7         ID          12/22/2016
                      *DIAGRAM
            8         IT       5  1JAN99       0    2000
            9         IO       5
           10         IN      15
                      *

           11         KK   OF-10   BASIN
           12         BA  0.0005
           13         PB   1.394
           14         PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
           15         PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
           16         PC   0.962   0.972   0.983   0.991   1.000
           17         LG    0.10    0.25    5.05    0.44       5
           18         UC   0.149   0.175
           19         UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
           20         UA     100
                      *

           21         KK   ON-10   BASIN
           22         BA  0.0018
           23         LG    0.10    0.25    5.05    0.44       5
           24         UC   0.224   0.385
           25         UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
           26         UA     100
                      *

           27         KK   ON-20   BASIN
           28         BA  0.0009
           29         LG    0.12    0.25    5.05    0.42       6
           30         UC   0.186   0.349
           31         UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
           32         UA     100
                      *

           33         KK   ON-30   BASIN
           34         BA  0.0004
```

```
      35             LG    0.10    0.25    5.05    0.44       5
      36             UC   0.096   0.062
      37             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
      38             UA     100
                     *

      39             KK   ON-50   BASIN
      40             BA  0.0002
      41             LG    0.10    0.25    5.05    0.44       5
      42             UC   0.065   0.023
      43             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
      44             UA     100
                     *
1                                        HEC-1 INPUT                                              PAGE  2

    LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


      45             KK   ON-80   BASIN
      46             BA  0.0031
      47             LG    0.12    0.25    5.05    0.43       6
      48             UC   0.241   0.358
      49             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
      50             UA     100
                     *

      51             KK   ON-90   BASIN
      52             BA  0.0001
      53             LG    0.10    0.25    4.33    0.62       5
      54             UC   0.092   0.034
      55             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
      56             UA     100
                     *

      57             KK  ON-100   BASIN
      58             BA  0.0003
      59             LG    0.10    0.25    4.33    0.62       5
      60             UC   0.126   0.116
      61             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
      62             UA     100
                     *

      63             KK  ON-110   BASIN
      64             BA  0.0004
      65             LG    0.10    0.25    4.58    0.55       5
      66             UC   0.100   0.064
      67             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
      68             UA     100
                     *

      69             KK  CP BDY COMBINE
      70             HC       9
                     *

      71             KK  ON-120   BASIN
      72             BA  0.0019
      73             LG    0.19    0.25    5.05    0.39      10
      74             UC   0.177   0.223
      75             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
      76             UA     100
                     *

      77             KK  ON-140   BASIN
      78             BA  0.0002
      79             LG    0.10    0.25    5.46    0.35       5
      80             UC   0.107   0.069
      81             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
      82             UA     100
                     *
1                                        HEC-1 INPUT                                              PAGE  3

    LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


      83             KK  ON-150   BASIN
      84             BA   0.001
      85             LG    0.10    0.25    6.00    0.28       5
      86             UC   0.142   0.165
      87             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
      88             UA     100
                     *

      89             KK  CPBDY2 COMBINE
      90             HC       3
                     *

      91             KK  AON-20   BASIN
      92             BA   0.018
      93             LG    0.31    0.28    5.05    0.27      13
      94             UC   0.191   0.198
```

```
  95          UA      0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  96          UA    100
              *

  97          KK  ARET20 STORAGE
  98          RS      1    STOR
  99          SV           0.30    0.46    0.64    0.76    0.84    0.96    1.04
 100          SQ           3.62    5.53    9.66   13.16   15.81   20.15   29.72
 101          SE  2482.0 2483.00 2483.50 2484.00 2484.30 2484.50 2484.80 2485.00
              *

 102          KK  RAON20   ROUTE
 103          RS      1    FLOW
 104          RC   0.035   0.035   0.035     141  0.0071 2478.00
 105          RX    0.00    5.00   14.00   23.00   37.00   42.00   46.00   51.00
 106          RY  2478.0 2477.00 2476.00 2475.00 2475.00 2476.00 2477.00 2478.00
              *

 107          KK   PON20   BASIN
 108          BA  0.0012
 109          LG    0.10    0.25    5.05    0.44       5
 110          UC   0.156   0.220
 111          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 112          UA     100
              *

 113          KK   CP020 COMBINE
 114          HC       2
              *

 115          KK  RCP020   ROUTE
 116          RS       1    FLOW
 117          RC   0.035   0.035   0.035     454  0.0330 2469.00
 118          RX    0.00    2.00    3.00    4.00    4.01    5.00    6.00    8.00
 119          RY  2469.0 2468.50 2468.25 2468.00 2468.00 2468.25 2468.50 2469.00
              *
1                                                      HEC-1 INPUT                                                     PAGE  4

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 120          KK   PON10   BASIN
 121          BA  0.0019
 122          LG    0.13    0.25    5.05    0.42       7
 123          UC   0.164   0.181
 124          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 125          UA     100
              *

 126          KK  RPON10   ROUTE
 127          RS       1    FLOW
 128          RC   0.035   0.035   0.035     348  0.0402 2469.00
 129          RX    0.00    2.00    3.00    4.00    4.01    5.00    6.00    8.00
 130          RY  2469.0 2468.50 2468.25 2468.00 2468.00 2468.25 2468.50 2469.00
              *

 131          KK   PON40   BASIN
 132          BA  0.0013
 133          LG    0.13    0.25    5.05    0.42       7
 134          UC   0.208   0.395
 135          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 136          UA     100
              *

 137          KK   CPP40 COMBINE
 138          HC       3
              *

 139          KK    DETA
 140          KM   DETENTION BASIN A
 141          RS       1    STOR       0
 142          SA   0.098    .126    .161
 143          SE       0     1.0     2.0
 144          SS     1.4      24     2.3     1.5
 145          SL    0.75  0.1963     0.6     0.5
              *

 146          KK   RDETA   ROUTE
 147          RS       1    FLOW
 148          RC   0.035   0.035   0.035     529  0.0246 2456.00
 149          RX    0.00    4.00    6.00    8.00    8.01   10.00   12.00   16.00
 150          RY  2456.0 2455.00 2454.50 2454.00 2454.00 2454.50 2455.00 2456.00
              *

 151          KK   PON30   BASIN
 152          BA  0.0004
 153          LG    0.10    0.25    5.05    0.44       5
 154          UC   0.232   0.227
 155          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 156          UA     100
```

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                    *
1                                            HEC-1 INPUT                                              PAGE  5

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


       157          KK  RPON30   ROUTE
       158          RS       1    FLOW
       159          RC   0.035   0.035   0.035     623  0.0241 2458.00
       160          RX    0.00    2.00    3.00    4.00    4.01    5.00    6.00    8.00
       161          RY  2458.0 2457.50 2457.25 2457.00 2457.00 2457.25 2457.50 2458.00
                    *

       162          KK   PON50   BASIN
       163          BA  0.0018
       164          LG    0.16    0.25    5.05    0.41       8
       165          UC   0.209   0.356
       166          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
       167          UA     100
                    *

       168          KK   PON60   BASIN
       169          BA  0.0187
       170          LG    0.28    0.25    5.05    0.34      14
       171          UC   0.267   0.287
       172          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
       173          UA     100
                    *

       174          KK   CP060 COMBINE
       175          HC       4
                    *

       176          KK    DETB
       177          KM   DETENTION BASIN B
       178          RS       1    STOR       0
       179          SA    .135    .166    .200    .235
       180          SE       0     1.0     2.0     3.0
       181          SS     2.0      24     2.3     1.5
       182          SL    0.83  0.3526     0.6     0.5
                    *

       183          KK   RDETB   ROUTE
       184          RS       1    FLOW
       185          RC   0.035   0.035  0.035     350  0.0229 2449.00
       186          RX    0.00    4.00   8.00   12.00   32.01   36.00   40.00   44.00
       187          RY  2449.0 2447.00 2446.0 2445.00 2445.00  2446.0 2447.00 2449.00
                    *

       188          KK   ON-40   BASIN
       189          BA  0.0019
       190          LG    0.26    0.25    5.05    0.35      13
       191          UC   0.185   0.260
       192          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
       193          UA     100
                    *
1                                            HEC-1 INPUT                                              PAGE  6

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


       194          KK   CP040 COMBINE
       195          HC       2
                    *

       196          KK  SOF-30   BASIN
       197          BA   0.007
       198          LG    0.35    0.36    5.05    0.27       0
       199          UC   0.166   0.146
       200          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
       201          UA     100
                    *

       202          KK  SROF30   ROUTE
       203          RS       1    FLOW
       204          RC   0.035   0.035   0.035     386  0.0214 2484.00
       205          RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
       206          RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
                    *

       207          KK  SON-26   BASIN
       208          BA   0.001
       209          LG    0.35    0.36    5.05    0.27       0
       210          UC   0.138   0.279
       211          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
       212          UA     100
                    *

       213          KK  SCP026 COMBINE
       214          HC       2
```

```
            137           .           .       CPP40..........................
                          .           .           V
                          .           .           V
            139           .           .        DETA
                          .           .           V
                          .           .           V
            146           .           .       RDETA
                          .           .           .
                          .           .           .
            151           .           .           .       PON30
                          .           .           .           V
                          .           .           .           V
            157           .           .           .      RPON30
                          .           .           .           .
                          .           .           .           .
            162           .           .           .           .       PON50
                          .           .           .           .           .
                          .           .           .           .           .
            168           .           .           .           .           .       PON60
                          .           .           .           .           .           .
                          .           .           .           .           .           .
            174           .           .       CP060....................................
                          .           .           V
                          .           .           V
            176           .           .        DETB
                          .           .           V
                          .           .           V
            183           .           .       RDETB
                          .           .           .
                          .           .           .
            188           .           .           .       ON-40
                          .           .           .           .
                          .           .           .           .
            194           .           .       CP040............
                          .           .           .
                          .           .           .
            196           .           .           .      SOF-30
                          .           .           .           V
                          .           .           .           V
            202           .           .           .      SROF30
                          .           .           .           .
                          .           .           .           .
            207           .           .           .           .      SON-26
                          .           .           .           .           .
                          .           .           .           .           .
            213           .           .           .      SCP026............
                          .           .           .           V
                          .           .           .           V
            215           .           .           .      SR2628
                          .           .           .           .
                          .           .           .           .
            220           .           .           .           .      SON-28
                          .           .           .           .           .
                          .           .           .           .           .
            226           .           .           .      SCP028............
                          .           .           .           V
                          .           .           .           V
            228           .           .           .      SRET28
                          .           .           .           .
                          .           .           .           .
            233           .           .           .           .      SON-27
                          .           .           .           .           V
                          .           .           .           .           V
            239           .           .           .           .      SRET27
                          .           .           .           .           .
                          .           .           .           .           .
            244           .           .           .           .           .      SON-30
                          .           .           .           .           .           .
                          .           .           .           .           .           .
            250           .           .           .      SCP030........................
                          .           .           .           V
                          .           .           .           V
            252           .           .           .      RSON30
                          .           .           .           .
                          .           .           .           .
            257           .           .           .           .       PON70
                          .           .           .           .           .
                          .           .           .           .           .
            263           .           .           .       CPP70............
                          .           .           .           V
                          .           .           .           V
            265           .           .           .      RCPP70
                          .           .           .           .
                          .           .           .           .
            270           .           .           .           .       PON80
                          .           .           .           .           V
                          .           .           .           .           V
            276           .           .           .           .      RPON80
                          .           .           .           .           .
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281           .           .           .           .           .      PON100
              .           .           .           .           .           V
              .           .           .           .           .           V
287           .           .           .           .           .        DETC
              .           .           .           .           .           V
              .           .           .           .           .           V
294           .           .           .           .           .       RDETC
              .           .           .           .           .           .
              .           .           .           .           .           .
299           .           .           .           .           .           .       ON-75
              .           .           .           .           .           .           .
              .           .           .           .           .           .           .
305           .           .           .       CP075....................................
              .           .           .           V
              .           .           .           V
307           .           .           .      RCP075
              .           .           .           .
              .           .           .           .
312           .           .           .           .       ON-70
              .           .           .           .           .
              .           .           .           .           .
318           .           .           .           .           .      PON110
              .           .           .           .           .           V
              .           .           .           .           .           V
324           .           .           .           .           .        DETD
              .           .           .           .           .           .
              .           .           .           .           .           .
331           .           .           .       CP070........................
              .           .           .           .
              .           .           .           .
333           .           .           .           .      SOF-25
              .           .           .           .           V
              .           .           .           .           V
339           .           .           .           .      SROF25
              .           .           .           .           .
              .           .           .           .           .
344           .           .           .           .           .      SON-22
              .           .           .           .           .           .
              .           .           .           .           .           .
350           .           .           .           .      SCP022............
              .           .           .           .           V
              .           .           .           .           V
352           .           .           .           .      SR2225
              .           .           .           .           .
              .           .           .           .           .
357           .           .           .           .           .      SON-25
              .           .           .           .           .           .
              .           .           .           .           .           .
363           .           .           .           .           .           .      SON-24
              .           .           .           .           .           .           V
              .           .           .           .           .           .           V
369           .           .           .           .           .           .      SRET24
              .           .           .           .           .           .           .
              .           .           .           .           .           .           .
374           .           .           .           .      SCP025........................
              .           .           .           .           V
              .           .           .           .           V
376           .           .           .           .      RSON25
              .           .           .           .           .
              .           .           .           .           .
381           .           .           .           .           .       PON90
              .           .           .           .           .           V
              .           .           .           .           .           V
387           .           .           .           .           .      RPON90
              .           .           .           .           .           .
              .           .           .           .           .           .
392           .           .           .           .           .           .      ON-130
              .           .           .           .           .           .           .
              .           .           .           .           .           .           .
398           .           .           .           .       CP130........................

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
****************************************
 *                                       *                                             *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                             *   U.S. ARMY CORPS OF ENGINEERS
*
 *             JUN   1998                *                                             *   HYDROLOGIC ENGINEERING CENTER
*
 *          VERSION 4.1                  *                                             *         609 SECOND STREET
*
 *                                       *                                             *     DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   22DEC16  TIME  15:45:15   *                                             *         (916) 756-1104
*
 *                                       *                                             *
*
 *****************************************
****************************************
```

```
                  *

  215             KK  SR2628   ROUTE
  216             RS       1    FLOW
  217             RC   0.035   0.035   0.035     740  0.0214 2484.00
  218             RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
  219             RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
                  *

  220             KK  SON-28   BASIN
  221             BA   0.010
  222             LG    0.31    0.26    5.05    0.26      15
  223             UC   0.133   0.106
  224             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  225             UA     100
                  *

  226             KK  SCP028 COMBINE
  227             HC       2
                  *
1                                                 HEC-1 INPUT                                        PAGE  7

 LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  228             KK  SRET28 STORAGE
  229             RS       1    STOR
  230             SV            0.11    0.26    0.30    0.35    0.40    0.46
  231             SQ            3.94    6.13   11.27   20.23   31.64   45.04
  232             SE  2475.0 2476.00 2477.00 2477.30 2477.50 2477.80 2478.00
                  *

  233             KK  SON-27   BASIN
  234             BA   0.009
  235             LG    0.30    0.25    5.58    0.20      17
  236             UC   0.139   0.168
  237             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  238             UA     100
                  *

  239             KK  SRET27 STORAGE
  240             RS       1    STOR
  241             SV            0.18    0.39    0.64    0.78
  242             SQ            2.00    3.30    4.22    4.61
  243             SE  2472.0 2473.00 2474.00 2475.00 2475.50
                  *

  244             KK  SON-30   BASIN
  245             BA   0.001
  246             LG    0.35    0.36    5.05    0.27       0
  247             UC   0.112   0.177
  248             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  249             UA     100
                  *

  250             KK  SCP030 COMBINE
  251             HC       3
                  *

  252             KK  RSON30   ROUTE
  253             RS       1    FLOW
  254             RC   0.035   0.035   0.035     320  0.0188 2471.00
  255             RX    0.00   17.00   25.00   30.00   34.00   37.00   40.00   45.00
  256             RY  2471.0 2470.00 2469.00 2468.00 2468.00 2469.00 2470.00 2471.00
                  *

  257             KK   PON70   BASIN
  258             BA  0.0026
  259             LG    0.10    0.25    5.05    0.44       5
  260             UC   0.267   0.430
  261             UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  262             UA     100
                  *
1                                                 HEC-1 INPUT                                        PAGE  8

 LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  263             KK   CPP70 COMBINE
  264             HC       2
                  *

  265             KK  RCPP70   ROUTE
  266             RS       1    FLOW
  267             RC   0.035   0.035   0.035    1046  0.0239 2458.00
  268             RX    0.00    4.00   12.00   23.00   32.00   41.00   44.00   47.00
  269             RY  2458.0 2457.00 2456.00 2455.00 2455.00 2456.00 2457.00 2458.00
                  *

  270             KK   PON80   BASIN
```

```
271    BA  0.0004
272    LG    0.10    0.25    5.05    0.37       5
273    UC   0.282   0.354
274    UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
275    UA     100
       *

276    KK  RPON80   ROUTE
277    RS       1    FLOW
278    RC   0.035   0.035   0.035    1104  0.0281 2458.00
279    RX    0.00    4.00   12.00   23.00   32.00   41.00   44.00   47.00
280    RY  2458.0 2457.00 2456.00 2455.00 2455.00 2456.00 2457.00 2458.00
       *

281    KK  PON100   BASIN
282    BA  0.0057
283    LG    0.28    0.25    5.05    0.34      14
284    UC   0.191   0.199
285    UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
286    UA     100
       *

287    KK    DETC
288    KM   DETENTION BASIN C
289    RS       1    STOR       0
290    SA    .164   0.202   0.243   0.288
291    SE       0     1.0     2.0     3.0
292    SS     2.6      12     2.3     1.5
293    SL     1.0  0.1963     0.6     0.5
       *

294    KK   RDETC   ROUTE
295    RS       1    FLOW
296    RC   0.035   0.035   0.035     575  0.0296 2458.00
297    RX    0.00    4.00   12.00   23.00   32.00   41.00   44.00   47.00
298    RY  2458.0 2457.00 2456.00 2455.00 2455.00 2456.00 2457.00 2458.00
       *
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```
299    KK   ON-75   BASIN
300    BA  0.0061
301    LG    0.16    0.25    5.05    0.40       8
302    UC   0.322   0.536
303    UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
304    UA     100
       *

305    KK   CP075 COMBINE
306    HC       4
       *

307    KK  RCP075   ROUTE
308    RS       1    FLOW
309    RC   0.035   0.035   0.035     250   0.032 2449.00
310    RX    0.00    2.00    9.00   16.00   19.00   24.00   34.00   47.00
311    RY  2449.0 2448.00 2447.00 2446.00 2446.00 2447.00 2448.00 2449.00
       *

312    KK   ON-70   BASIN
313    BA  0.0004
314    LG    0.10    0.25    4.33    0.62       5
315    UC   0.136   0.125
316    UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
317    UA     100
       *

318    KK  PON110   BASIN
319    BA  0.0101
320    LG    0.26    0.25    4.96    0.36      13
321    UC   0.250   0.314
322    UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
323    UA     100
       *

324    KK    DETD
325    KM   DETENTION BASIN D
326    RS       1    STOR       0
327    SA   0.174   0.211   0.250   0.294
328    SE       0     1.0     2.0     3.0
329    SS     2.6      12     2.3     1.5
330    SL    0.75  0.1963     0.6     0.5
       *

331    KK   CP070 COMBINE
332    HC       3
       *
```

```
 333            KK  SOF-25   BASIN
 334            BA   0.112
 335            LG    0.32    0.33    5.71    0.22      12
 336            UC   0.376   0.375
 337            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 338            UA     100
                *
```



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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 339            KK  SROF25   ROUTE
 340            RS       1    FLOW
 341            RC   0.035   0.035   0.035    1880  0.0164 2486.00
 342            RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
 343            RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
                *

 344            KK  SON-22   BASIN
 345            BA   0.015
 346            LG    0.34    0.36    6.00    0.17       5
 347            UC   0.288   0.479
 348            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 349            UA     100
                *

 350            KK  SCP022 COMBINE
 351            HC       2
                *

 352            KK  SR2225   ROUTE
 353            RS       1    FLOW
 354            RC   0.035   0.035   0.035     398  0.0164 2486.00
 355            RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
 356            RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
                *

 357            KK  SON-25   BASIN
 358            BA   0.002
 359            LG    0.34    0.37    6.00    0.17       4
 360            UC   0.130   0.210
 361            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 362            UA     100
                *

 363            KK  SON-24   BASIN
 364            BA   0.003
 365            LG    0.32    0.31    6.00    0.17      11
 366            UC   0.154   0.144
 367            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 368            UA     100
                *

 369            KK  SRET24 STORAGE
 370            RS       1    STOR
 371            SV            0.12    0.26    0.44
 372            SQ            0.82    1.25    1.57
 373            SE  2467.0 2468.00 2469.00 2470.00

                *
```



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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 374            KK  SCP025 COMBINE
 375            HC       3
                *

 376            KK  RSON25   ROUTE
 377            RS       1    FLOW
 378            RC   0.035   0.035   0.035     643  0.0249 2456.00
 379            RX    0.00   13.00   16.00   19.00   31.00   33.00   36.00   39.00
 380            RY  2456.0 2455.00 2454.00 2453.00 2453.00 2454.00 2455.00 2456.00
                *

 381            KK   PON90   BASIN
 382            BA  0.0004
 383            LG    0.10    0.25    5.05    0.44       5
 384            UC   0.152   0.178
 385            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 386            UA     100
                *

 387            KK  RPON90   ROUTE
 388            RS       1    FLOW
 389            RC   0.035   0.035   0.035     666  0.0330 2456.00
 390            RX    0.00   13.00   16.00   19.00   31.00   33.00   36.00   39.00
 391            RY  2456.0 2455.00 2454.00 2453.00 2453.00 2454.00 2455.00 2456.00
```

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                            *

            392             KK  ON-130   BASIN
            393             BA  0.0035
            394             LG    0.10     0.25     5.24     0.40        5
            395             UC   0.337    0.681
            396             UA       0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
            397             UA     100
                            *

            398             KK    CP130 COMBINE
            399             HC       3
                            *
            400             ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING           (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR         (<---) RETURN OF DIVERTED OR PUMPED FLOW

     11      OF-10
                 .
                 .
     21          .       ON-10
                 .           .
                 .           .
     27          .           .       ON-20
                 .           .           .
                 .           .           .
     33          .           .           .       ON-30
                 .           .           .           .
                 .           .           .           .
     39          .           .           .           .       ON-50
                 .           .           .           .           .
                 .           .           .           .           .
     45          .           .           .           .           .       ON-80
                 .           .           .           .           .           .
                 .           .           .           .           .           .
     51          .           .           .           .           .           .       ON-90
                 .           .           .           .           .           .           .
                 .           .           .           .           .           .           .
     57          .           .           .           .           .           .           .      ON-100
                 .           .           .           .           .           .           .           .
                 .           .           .           .           .           .           .           .
     63          .           .           .           .           .           .           .           .      ON-110
                 .           .           .           .           .           .           .           .           .
                 .           .           .           .           .           .           .           .           .
     69     CP BDY................................................................................................
                 .
                 .
     71          .      ON-120
                 .           .
                 .           .
     77          .           .      ON-140
                 .           .           .
                 .           .           .
     83          .           .           .      ON-150
                 .           .           .           .
                 .           .           .           .
     89          .      CPBDY2........................
                 .           .
                 .           .
     91          .           .      AON-20
                 .           .           V
                 .           .           V
     97          .           .      ARET20
                 .           .           V
                 .           .           V
    102          .           .      RAON20
                 .           .           .
                 .           .           .
    107          .           .           .       PON20
                 .           .           .           .
                 .           .           .           .
    113          .           .       CP020............
                 .           .           V
                 .           .           V
    115          .           .      RCP020
                 .           .           .
                 .           .           .
    120          .           .           .       PON10
                 .           .           .           V
                 .           .           .           V
    126          .           .           .      RPON10
                 .           .           .           .
                 .           .           .           .
    131          .           .           .           .       PON40
                 .           .           .           .           .
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                              Flood Control District of Maricopa County
                              BLACK MOUNTAIN_PROP - BLACK MOUNTAIN PROPOSED CONDITIONS
                              2 YEAR
                              6 Hour  Storm
                              Unit Hydrograph: Clark
                              Storm: Multiple
                              10/18/2016

    9 IO         OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT         HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE     1JAN99  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     7JAN99  ENDING DATE
                      NDTIME       2235  ENDING TIME
                       ICENT         19  CENTURY MARK

                   COMPUTATION INTERVAL     .08 HOURS
                        TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	OF-10	0.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-10	1.	4.17	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-20	0.	4.17	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-30	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-50	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-80	1.	4.17	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-90	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-100	0.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-110	0.	4.00	0.	0.	0.	.00		
+	9 COMBINED AT	CP BDY	3.	4.08	0.	0.	0.	.01		
+	HYDROGRAPH AT	ON-120	1.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-140	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-150	1.	4.08	0.	0.	0.	.00		
+	3 COMBINED AT	CPBDY2	2.	4.08	0.	0.	0.	.00		
	HYDROGRAPH AT									

+		AON-20	11.	4.08	1.	0.	0.	.02		
+	ROUTED TO	ARET20	3.	4.42	1.	0.	0.	.02		
+									2482.86	4.42
+	ROUTED TO	RAON20	3.	4.42	1.	0.	0.	.02		
+									2475.18	4.42
+	HYDROGRAPH AT	PON20	1.	4.08	0.	0.	0.	.00		
+	2 COMBINED AT	CP020	3.	4.33	1.	0.	0.	.02		
+	ROUTED TO	RCP020	3.	4.33	1.	0.	0.	.02		
+									2468.49	4.33
+	HYDROGRAPH AT	PON10	1.	4.08	0.	0.	0.	.00		
+	ROUTED TO	RPON10	1.	4.08	0.	0.	0.	.00		
+									2468.31	4.08
+	HYDROGRAPH AT	PON40	0.	4.17	0.	0.	0.	.00		
+	3 COMBINED AT	CPP40	4.	4.25	1.	0.	0.	.02		
+	ROUTED TO	DETA	3.	4.67	1.	0.	0.	.02		
+									1.52	4.67
+	ROUTED TO	RDETA	3.	4.67	1.	0.	0.	.02		
+									2454.53	4.67
+	HYDROGRAPH AT	PON30	0.	4.17	0.	0.	0.	.00		
+	ROUTED TO	RPON30	0.	4.25	0.	0.	0.	.00		
+									2457.17	4.25
+	HYDROGRAPH AT	PON50	1.	4.17	0.	0.	0.	.00		
+	HYDROGRAPH AT	PON60	8.	4.08	1.	0.	0.	.02		
+	4 COMBINED AT	CP060	9.	4.08	2.	0.	0.	.04		
+	ROUTED TO	DETB	5.	4.75	2.	0.	0.	.04		
+									2.14	4.75
+	ROUTED TO	RDETB	3.	5.08	2.	0.	0.	.04		
+									2445.07	5.08
+	HYDROGRAPH AT	ON-40	1.	4.08	0.	0.	0.	.00		
+	2 COMBINED AT	CP040	3.	5.08	2.	0.	0.	.05		
+	HYDROGRAPH AT	SOF-30	3.	4.08	0.	0.	0.	.01		
+	ROUTED TO	SROF30	3.	4.17	0.	0.	0.	.01		
+									2476.06	4.17
+	HYDROGRAPH AT	SON-26	0.	4.08	0.	0.	0.	.00		
+	2 COMBINED AT	SCP026	4.	4.17	0.	0.	0.	.01		
+	ROUTED TO	SR2628	3.	4.17	0.	0.	0.	.01		
+									2476.06	4.17
+	HYDROGRAPH AT	SON-28	8.	4.00	1.	0.	0.	.01		

	2 COMBINED AT									
+		SCP028	9.	4.08	1.	0.	0.	.02		
	ROUTED TO									
+		SRET28	5.	4.25	1.	0.	0.	.02		
+									2476.32	4.25
	HYDROGRAPH AT									
+		SON-27	7.	4.00	1.	0.	0.	.01		
	ROUTED TO									
+		SRET27	2.	4.33	1.	0.	0.	.01		
+									2472.93	4.33
	HYDROGRAPH AT									
+		SON-30	0.	4.08	0.	0.	0.	.00		
	3 COMBINED AT									
+		SCP030	7.	4.25	1.	0.	0.	.03		
	ROUTED TO									
+		RSON30	7.	4.25	1.	0.	0.	.03		
+									2468.42	4.25
	HYDROGRAPH AT									
+		PON70	1.	4.17	0.	0.	0.	.00		
	2 COMBINED AT									
+		CPP70	7.	4.25	1.	0.	0.	.03		
	ROUTED TO									
+		RCPP70	7.	4.42	1.	0.	0.	.03		
+									2455.25	4.42
	HYDROGRAPH AT									
+		PON80	0.	4.17	0.	0.	0.	.00		
	ROUTED TO									
+		RPON80	0.	4.33	0.	0.	0.	.00		
+									2455.01	4.33
	HYDROGRAPH AT									
+		PON100	3.	4.08	0.	0.	0.	.01		
	ROUTED TO									
+		DETC	0.	.00	0.	0.	0.	.01		
+									.74	7.17
	ROUTED TO									
+		RDETC	0.	.00	0.	0.	0.	.01		
+									2455.00	.00
	HYDROGRAPH AT									
+		ON-75	2.	4.25	0.	0.	0.	.01		
	4 COMBINED AT									
+		CP075	9.	4.33	2.	0.	0.	.04		
	ROUTED TO									
+		RCP075	9.	4.33	2.	0.	0.	.04		
+									2446.44	4.33
	HYDROGRAPH AT									
+		ON-70	0.	4.08	0.	0.	0.	.00		
	HYDROGRAPH AT									
+		PON110	4.	4.08	0.	0.	0.	.01		
	ROUTED TO									
+		DETD	0.	4.92	0.	0.	0.	.01		
+									1.02	4.92
	3 COMBINED AT									
+		CP070	9.	4.42	2.	0.	0.	.05		
	HYDROGRAPH AT									
+		SOF-25	44.	4.25	5.	1.	0.	.11		
	ROUTED TO									
+		SROF25	38.	4.33	5.	1.	0.	.11		
+									2477.08	4.33
	HYDROGRAPH AT									
+		SON-22	5.	4.25	1.	0.	0.	.01		
	2 COMBINED AT									
+		SCP022	42.	4.33	6.	1.	0.	.13		
	ROUTED TO									

```
+                       SR2225       42.    4.33          6.         1.         0.        .13
+                                                                                               2477.12      4.33

         HYDROGRAPH AT
+                       SON-25        1.    4.08          0.         0.         0.        .00

         HYDROGRAPH AT
+                       SON-24        2.    4.08          0.         0.         0.        .00

         ROUTED TO
+                       SRET24        0.    4.42          0.         0.         0.        .00
+                                                                                               2467.47      4.42

         3 COMBINED AT
+                       SCP025       42.    4.33          6.         2.         1.        .13

         ROUTED TO
+                       RSON25       43.    4.42          6.         2.         1.        .13
+                                                                                               2453.66      4.42

         HYDROGRAPH AT
+                        PON90        0.    4.08          0.         0.         0.        .00

         ROUTED TO
+                       RPON90        0.    4.17          0.         0.         0.        .00
+                                                                                               2453.01      4.17

         HYDROGRAPH AT
+                       ON-130        1.    4.25          0.         0.         0.        .00

         3 COMBINED AT
+                        CP130       43.    4.42          6.         2.         1.        .14


*** NORMAL END OF HEC-1 ***
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1*****************************************                                                       *****************************************
 *                                       *                                                       *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                       *   U.S. ARMY CORPS OF ENGINEERS        *
 *              JUN   1998               *                                                       *   HYDROLOGIC ENGINEERING CENTER       *
 *           VERSION 4.1                 *                                                       *         609 SECOND STREET             *
 *                                       *                                                       *      DAVIS, CALIFORNIA 95616          *
 * RUN DATE   22DEC16  TIME  15:43:52    *                                                       *         (916) 756-1104                *
 *                                       *                                                       *                                       *
*****************************************                                                       *****************************************



                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


  THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

  THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
  THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
  NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
  DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
  KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                          HEC-1 INPUT                                          PAGE  1

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    1          ID         Flood Control District of Maricopa County
    2          ID         BLACK MOUNTAIN_PROP - BLACK MOUNTAIN PROPOSED CONDITIONS
    3          ID         10 YEAR
    4          ID         6 Hour  Storm
    5          ID         Unit Hydrograph: Clark
    6          ID         Storm: Multiple
    7          ID         12/22/2016
               *DIAGRAM
    8          IT       5 1JAN99       0    2000
    9          IO       5
   10          IN      15
               *

   11          KK   OF-10   BASIN
   12          BA  0.0005
   13          PB   2.067
   14          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
   15          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
   16          PC   0.962   0.972   0.983   0.991   1.000
   17          LG    0.10    0.25    5.05    0.44       5
   18          UC   0.128   0.147
   19          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   20          UA     100
               *

   21          KK   ON-10   BASIN
   22          BA  0.0018
   23          LG    0.10    0.25    5.05    0.44       5
   24          UC   0.192   0.324
   25          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   26          UA     100
               *

   27          KK   ON-20   BASIN
   28          BA  0.0009
   29          LG    0.12    0.25    5.05    0.42       6
   30          UC   0.159   0.295
   31          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   32          UA     100
               *

   33          KK   ON-30   BASIN
   34          BA  0.0004
```

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     35          LG    0.10    0.25    5.05    0.44       5
     36          UC   0.082   0.052
     37          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     38          UA     100
                 *

     39          KK   ON-50   BASIN
     40          BA  0.0002
     41          LG    0.10    0.25    5.05    0.44       5
     42          UC   0.056   0.019
     43          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     44          UA     100
                 *
1                                        HEC-1 INPUT                                          PAGE  2

   LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


     45          KK   ON-80   BASIN
     46          BA  0.0031
     47          LG    0.12    0.25    5.05    0.43       6
     48          UC   0.207   0.302
     49          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     50          UA     100
                 *

     51          KK   ON-90   BASIN
     52          BA  0.0001
     53          LG    0.10    0.25    4.33    0.62       5
     54          UC   0.078   0.028
     55          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     56          UA     100
                 *

     57          KK  ON-100   BASIN
     58          BA  0.0003
     59          LG    0.10    0.25    4.33    0.62       5
     60          UC   0.106   0.095
     61          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     62          UA     100
                 *

     63          KK  ON-110   BASIN
     64          BA  0.0004
     65          LG    0.10    0.25    4.58    0.55       5
     66          UC   0.085   0.054
     67          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     68          UA     100
                 *

     69          KK  CP BDY COMBINE
     70          HC       9
                 *

     71          KK  ON-120   BASIN
     72          BA  0.0019
     73          LG    0.19    0.25    5.05    0.39      10
     74          UC   0.152   0.189
     75          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     76          UA     100
                 *

     77          KK  ON-140   BASIN
     78          BA  0.0002
     79          LG    0.10    0.25    5.46    0.35       5
     80          UC   0.092   0.059
     81          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     82          UA     100
                 *
1                                        HEC-1 INPUT                                          PAGE  3

   LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


     83          KK  ON-150   BASIN
     84          BA   0.001
     85          LG    0.10    0.25    6.00    0.28       5
     86          UC   0.122   0.140
     87          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     88          UA     100
                 *

     89          KK  CPBDY2 COMBINE
     90          HC       3
                 *

     91          KK  AON-20   BASIN
     92          BA   0.018
     93          LG    0.31    0.28    5.05    0.27      13
     94          UC   0.191   0.198
```

```
 95          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 96          UA     100
             *

 97          KK  ARET20 STORAGE
 98          RS       1    STOR
 99          SV            0.30    0.46    0.64    0.76    0.84    0.96    1.04
100          SQ            3.62    5.53    9.66   13.16   15.81   20.15   29.72
101          SE  2482.0 2483.00 2483.50 2484.00 2484.30 2484.50 2484.80 2485.00
             *

102          KK  RAON20   ROUTE
103          RS       1    FLOW
104          RC   0.035   0.035   0.035     141  0.0071 2478.00
105          RX    0.00    5.00   14.00   23.00   37.00   42.00   46.00   51.00
106          RY  2478.0 2477.00 2476.00 2475.00 2475.00 2476.00 2477.00 2478.00
             *

107          KK   PON20   BASIN
108          BA  0.0012
109          LG    0.10    0.25    5.05    0.44       5
110          UC   0.134   0.185
111          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
112          UA     100
             *

113          KK   CP020 COMBINE
114          HC       2
             *

115          KK  RCP020   ROUTE
116          RS       1    FLOW
117          RC   0.035   0.035   0.035     454  0.0330 2469.00
118          RX    0.00    2.00    3.00    4.00    4.01    5.00    6.00    8.00
119          RY  2469.0 2468.50 2468.25 2468.00 2468.00 2468.25 2468.50 2469.00
             *
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


120          KK   PON10   BASIN
121          BA  0.0019
122          LG    0.13    0.25    5.05    0.42       7
123          UC   0.141   0.152
124          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
125          UA     100
             *

126          KK  RPON10   ROUTE
127          RS       1    FLOW
128          RC   0.035   0.035   0.035     348  0.0402 2469.00
129          RX    0.00    2.00    3.00    4.00    4.01    5.00    6.00    8.00
130          RY  2469.0 2468.50 2468.25 2468.00 2468.00 2468.25 2468.50 2469.00
             *

131          KK   PON40   BASIN
132          BA  0.0013
133          LG    0.13    0.25    5.05    0.42       7
134          UC   0.178   0.334
135          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
136          UA     100
             *

137          KK   CPP40 COMBINE
138          HC       3
             *

139          KK    DETA
140          KM   DETENTION BASIN A
141          RS       1    STOR       0
142          SA   0.098    .126    .161
143          SE       0     1.0     2.0
144          SS     1.4      24     2.3     1.5
145          SL    0.75  0.1963     0.6     0.5
             *

146          KK   RDETA   ROUTE
147          RS       1    FLOW
148          RC   0.035   0.035   0.035     529  0.0246 2456.00
149          RX    0.00    4.00    6.00    8.00    8.01   10.00   12.00   16.00
150          RY  2456.0 2455.00 2454.50 2454.00 2454.00 2454.50 2455.00 2456.00
             *

151          KK   PON30   BASIN
152          BA  0.0004
153          LG    0.10    0.25    5.05    0.44       5
154          UC   0.199   0.191
155          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
156          UA     100
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LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 157      KK  RPON30    ROUTE
 158      RS       1     FLOW
 159      RC   0.035    0.035    0.035      623   0.0241 2458.00
 160      RX    0.00     2.00     3.00     4.00     4.01     5.00     6.00     8.00
 161      RY  2458.0  2457.50  2457.25  2457.00  2457.00  2457.25  2457.50  2458.00
          *

 162      KK   PON50    BASIN
 163      BA  0.0018
 164      LG    0.16     0.25     5.05     0.41        8
 165      UC   0.179    0.301
 166      UA       0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 167      UA     100
          *

 168      KK   PON60    BASIN
 169      BA  0.0187
 170      LG    0.28     0.25     5.05     0.34       14
 171      UC   0.231    0.244
 172      UA       0      5.0     16.0     30.0     65.0     77.0     84.0     90.0     94.0     97.0
 173      UA     100
          *

 174      KK   CP060  COMBINE
 175      HC       4
          *

 176      KK    DetB
 177      KM   DETENTION BASIN B
 178      RS       1     STOR        0
 179      SA    .135     .166     .200     .235
 180      SE       0      1.0      2.0      3.0
 181      SS     2.0       24      2.3      1.5
 182      SL    0.83   0.3526      0.6      0.5
          *

 183      KK   RDETB    ROUTE
 184      RS       1     FLOW
 185      RC   0.035    0.035    0.035      350   0.0229 2449.00
 186      RX    0.00     4.00     8.00    12.00    32.01    36.00    40.00    44.00
 187      RY  2449.0  2447.00   2446.0  2445.00  2445.00   2446.0  2447.00  2449.00
          *

 188      KK   ON-40    BASIN
 189      BA  0.0019
 190      LG    0.26     0.25     5.05     0.35       13
 191      UC   0.160    0.221
 192      UA       0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 193      UA     100
          *
```



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LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 194      KK   CP040  COMBINE
 195      HC       2
          *

 196      KK  SOF-30    BASIN
 197      BA   0.007
 198      LG    0.35     0.36     5.05     0.27        0
 199      UC   0.166    0.146
 200      UA       0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 201      UA     100
          *

 202      KK  SROF30    ROUTE
 203      RS       1     FLOW
 204      RC   0.035    0.035    0.035      386   0.0214 2484.00
 205      RX    0.00    37.00    45.00    52.00    66.00    81.00    96.00   153.00
 206      RY  2484.0  2480.00  2478.00  2476.00  2476.00  2478.00  2480.00  2484.00
          *

 207      KK  SON-26    BASIN
 208      BA   0.001
 209      LG    0.35     0.36     5.05     0.27        0
 210      UC   0.138    0.279
 211      UA       0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 212      UA     100
          *

 213      KK  SCP026  COMBINE
 214      HC       2
```

```
                    *

     215            KK  SR2628   ROUTE
     216            RS       1    FLOW
     217            RC   0.035   0.035   0.035     740  0.0214 2484.00
     218            RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
     219            RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
                    *

     220            KK  SON-28   BASIN
     221            BA   0.010
     222            LG    0.31    0.26    5.05    0.26      15
     223            UC   0.133   0.106
     224            UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
     225            UA     100
                    *

     226            KK  SCP028 COMBINE
     227            HC       2
                    *
```



```
    LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     228            KK  SRET28 STORAGE
     229            RS       1    STOR
     230            SV            0.11    0.26    0.30    0.35    0.40    0.46
     231            SQ            3.94    6.13   11.27   20.23   31.64   45.04
     232            SE  2475.0 2476.00 2477.00 2477.30 2477.50 2477.80 2478.00
                    *

     233            KK  SON-27   BASIN
     234            BA   0.009
     235            LG    0.30    0.25    5.58    0.20      17
     236            UC   0.139   0.168
     237            UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
     238            UA     100
                    *

     239            KK  SRET27 STORAGE
     240            RS       1    STOR
     241            SV            0.18    0.39    0.64    0.78
     242            SQ            2.00    3.30    4.22    4.61
     243            SE  2472.0 2473.00 2474.00 2475.00 2475.50
                    *

     244            KK  SON-30   BASIN
     245            BA   0.001
     246            LG    0.35    0.36    5.05    0.27       0
     247            UC   0.112   0.177
     248            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     249            UA     100
                    *

     250            KK  SCP030 COMBINE
     251            HC       3
                    *

     252            KK  RSON30   ROUTE
     253            RS       1    FLOW
     254            RC   0.035   0.035   0.035     320  0.0188 2471.00
     255            RX    0.00   17.00   25.00   30.00   34.00   37.00   40.00   45.00
     256            RY  2471.0 2470.00 2469.00 2468.00 2468.00 2469.00 2470.00 2471.00
                    *

     257            KK   PON70   BASIN
     258            BA  0.0026
     259            LG    0.10    0.25    5.05    0.44       5
     260            UC   0.229   0.362
     261            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
     262            UA     100
                    *
```



```
    LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     263            KK   CPP70 COMBINE
     264            HC       2
                    *

     265            KK  RCPP70   ROUTE
     266            RS       1    FLOW
     267            RC   0.035   0.035   0.035    1046  0.0239 2458.00
     268            RX    0.00    4.00   12.00   23.00   32.00   41.00   44.00   47.00
     269            RY  2458.0 2457.00 2456.00 2455.00 2455.00 2456.00 2457.00 2458.00
                    *

     270            KK   PON80   BASIN
```

```
 271          BA  0.0004
 272          LG    0.10    0.25    5.05    0.37       5
 273          UC   0.243   0.300
 274          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 275          UA     100
              *

 276          KK  RPON80   ROUTE
 277          RS       1    FLOW
 278          RC   0.035   0.035   0.035    1104  0.0281 2458.00
 279          RX    0.00    4.00   12.00   23.00   32.00   41.00   44.00   47.00
 280          RY  2458.0 2457.00 2456.00 2455.00 2455.00 2456.00 2457.00 2458.00
              *

 281          KK  PON100   BASIN
 282          BA  0.0057
 283          LG    0.28    0.25    5.05    0.34      14
 284          UC   0.165   0.170
 285          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 286          UA     100
              *

 287          KK    DETC
 288          KM   DETENTION BASIN C
 289          RS       1    STOR       0
 290          SA    .164   0.202   0.243   0.288
 291          SE       0     1.0     2.0     3.0
 292          SS     2.6      12     2.3     1.5
 293          SL     1.0  0.1963     0.6     0.5
              *

 294          KK   RDETC   ROUTE
 295          RS       1    FLOW
 296          RC   0.035   0.035   0.035     575  0.0296 2458.00
 297          RX    0.00    4.00   12.00   23.00   32.00   41.00   44.00   47.00
 298          RY  2458.0 2457.00 2456.00 2455.00 2455.00 2456.00 2457.00 2458.00
              *
1                                        HEC-1 INPUT                                            PAGE  9

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 299          KK   ON-75   BASIN
 300          BA  0.0061
 301          LG    0.16    0.25    5.05    0.40       8
 302          UC   0.277   0.453
 303          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 304          UA     100
              *

 305          KK   CP075 COMBINE
 306          HC       4
              *

 307          KK  RCP075   ROUTE
 308          RS       1    FLOW
 309          RC   0.035   0.035   0.035     250   0.032 2449.00
 310          RX    0.00    2.00    9.00   16.00   19.00   24.00   34.00   47.00
 311          RY  2449.0 2448.00 2447.00 2446.00 2446.00 2447.00 2448.00 2449.00
              *

 312          KK   ON-70   BASIN
 313          BA  0.0004
 314          LG    0.10    0.25    4.33    0.62       5
 315          UC   0.114   0.103
 316          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 317          UA     100
              *

 318          KK  PON110   BASIN
 319          BA  0.0101
 320          LG    0.26    0.25    4.96    0.36      13
 321          UC   0.216   0.267
 322          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 323          UA     100
              *

 324          KK    DETD
 325          KM   DETENTION BASIN D
 326          RS       1    STOR       0
 327          SA   0.174   0.211   0.250   0.294
 328          SE       0     1.0     2.0     3.0
 329          SS     2.6      12     2.3     1.5
 330          SL    0.75  0.1963     0.6     0.5
              *

 331          KK   CP070 COMBINE
 332          HC       3
              *
```

```
 333            KK  SOF-25   BASIN
 334            BA   0.112
 335            LG    0.32    0.33    5.71    0.22      12
 336            UC   0.376   0.375
 337            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 338            UA     100
                *
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 339            KK  SROF25   ROUTE
 340            RS       1    FLOW
 341            RC   0.035   0.035   0.035    1880  0.0164 2486.00
 342            RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
 343            RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
                *

 344            KK  SON-22   BASIN
 345            BA   0.015
 346            LG    0.34    0.36    6.00    0.17       5
 347            UC   0.288   0.479
 348            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 349            UA     100
                *

 350            KK  SCP022 COMBINE
 351            HC       2
                *

 352            KK  SR2225   ROUTE
 353            RS       1    FLOW
 354            RC   0.035   0.035   0.035     398  0.0164 2486.00
 355            RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
 356            RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
                *

 357            KK  SON-25   BASIN
 358            BA   0.002
 359            LG    0.34    0.37    6.00    0.17       4
 360            UC   0.130   0.210
 361            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 362            UA     100
                *

 363            KK  SON-24   BASIN
 364            BA   0.003
 365            LG    0.32    0.31    6.00    0.17      11
 366            UC   0.154   0.144
 367            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 368            UA     100
                *

 369            KK  SRET24 STORAGE
 370            RS       1    STOR
 371            SV            0.12    0.26    0.44
 372            SQ            0.82    1.25    1.57
 373            SE  2467.0 2468.00 2469.00 2470.00

                *
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 374            KK  SCP025 COMBINE
 375            HC       3
                *

 376            KK  RSON25   ROUTE
 377            RS       1    FLOW
 378            RC   0.035   0.035   0.035     643  0.0249 2456.00
 379            RX    0.00   13.00   16.00   19.00   31.00   33.00   36.00   39.00
 380            RY  2456.0 2455.00 2454.00 2453.00 2453.00 2454.00 2455.00 2456.00
                *

 381            KK   PON90   BASIN
 382            BA  0.0004
 383            LG    0.10    0.25    5.05    0.44       5
 384            UC   0.130   0.150
 385            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 386            UA     100
                *

 387            KK  RPON90   ROUTE
 388            RS       1    FLOW
 389            RC   0.035   0.035   0.035     666  0.0330 2456.00
 390            RX    0.00   13.00   16.00   19.00   31.00   33.00   36.00   39.00
 391            RY  2456.0 2455.00 2454.00 2453.00 2453.00 2454.00 2455.00 2456.00
```

```
                          *

            392           KK  ON-130   BASIN
            393           BA  0.0035
            394           LG    0.10    0.25    5.24    0.40       5
            395           UC   0.289   0.575
            396           UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
            397           UA     100
                          *

            398           KK   CP130 COMBINE
            399           HC       3
                          *
            400           ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    11       OF-10
                 .
                 .
    21           .       ON-10
                 .           .
                 .           .
    27           .           .       ON-20
                 .           .           .
                 .           .           .
    33           .           .           .       ON-30
                 .           .           .           .
                 .           .           .           .
    39           .           .           .           .       ON-50
                 .           .           .           .           .
                 .           .           .           .           .
    45           .           .           .           .           .       ON-80
                 .           .           .           .           .           .
                 .           .           .           .           .           .
    51           .           .           .           .           .           .       ON-90
                 .           .           .           .           .           .           .
                 .           .           .           .           .           .           .
    57           .           .           .           .           .           .           .      ON-100
                 .           .           .           .           .           .           .           .
                 .           .           .           .           .           .           .           .
    63           .           .           .           .           .           .           .           .      ON-110
                 .           .           .           .           .           .           .           .           .
                 .           .           .           .           .           .           .           .           .
    69      CP BDY................................................................................................
                 .
                 .
    71           .      ON-120
                 .           .
                 .           .
    77           .           .      ON-140
                 .           .           .
                 .           .           .
    83           .           .           .      ON-150
                 .           .           .           .
                 .           .           .           .
    89           .      CPBDY2........................
                 .           .
                 .           .
    91           .           .      AON-20
                 .           .           V
                 .           .           V
    97           .           .      ARET20
                 .           .           V
                 .           .           V
   102           .           .      RAON20
                 .           .           .
                 .           .           .
   107           .           .           .       PON20
                 .           .           .           .
                 .           .           .           .
   113           .           .       CP020............
                 .           .           V
                 .           .           V
   115           .           .      RCP020
                 .           .           .
                 .           .           .
   120           .           .           .       PON10
                 .           .           .           V
                 .           .           .           V
   126           .           .           .      RPON10
                 .           .           .           .
                 .           .           .           .
   131           .           .           .           .       PON40
                 .           .           .           .           .
                 .           .           .           .           .
```

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137            .           .       CPP40....................................
               .           .           V
               .           .           V
139            .           .        DETA
               .           .           V
               .           .           V
146            .           .       RDETA
               .           .           .
               .           .           .
151            .           .           .       PON30
               .           .           .           V
               .           .           .           V
157            .           .           .      RPON30
               .           .           .           .
               .           .           .           .
162            .           .           .           .       PON50
               .           .           .           .           .
               .           .           .           .           .
168            .           .           .           .           .       PON60
               .           .           .           .           .           .
               .           .           .           .           .           .
174            .           .       CP060....................................
               .           .           V
               .           .           V
176            .           .        DetB
               .           .           V
               .           .           V
183            .           .       RDETB
               .           .           .
               .           .           .
188            .           .           .       ON-40
               .           .           .           .
               .           .           .           .
194            .           .       CP040............
               .           .           .
               .           .           .
196            .           .           .      SOF-30
               .           .           .           V
               .           .           .           V
202            .           .           .      SROF30
               .           .           .           .
               .           .           .           .
207            .           .           .           .      SON-26
               .           .           .           .           .
               .           .           .           .           .
213            .           .           .      SCP026............
               .           .           .           V
               .           .           .           V
215            .           .           .      SR2628
               .           .           .           .
               .           .           .           .
220            .           .           .           .      SON-28
               .           .           .           .           .
               .           .           .           .           .
226            .           .           .      SCP028............
               .           .           .           V
               .           .           .           V
228            .           .           .      SRET28
               .           .           .           .
               .           .           .           .
233            .           .           .           .      SON-27
               .           .           .           .           V
               .           .           .           .           V
239            .           .           .           .      SRET27
               .           .           .           .           .
               .           .           .           .           .
244            .           .           .           .           .      SON-30
               .           .           .           .           .           .
               .           .           .           .           .           .
250            .           .           .      SCP030........................
               .           .           .           V
               .           .           .           V
252            .           .           .      RSON30
               .           .           .           .
               .           .           .           .
257            .           .           .           .       PON70
               .           .           .           .           .
               .           .           .           .           .
263            .           .           .       CPP70............
               .           .           .           V
               .           .           .           V
265            .           .           .      RCPP70
               .           .           .           .
               .           .           .           .
270            .           .           .           .       PON80
               .           .           .           .           V
               .           .           .           .           V
276            .           .           .           .      RPON80
               .           .           .           .           .
               .           .           .           .           .
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    281           .           .           .           .           .      PON100
                  .           .           .           .           .           V
                  .           .           .           .           .           V
    287           .           .           .           .           .        DETC
                  .           .           .           .           .           V
                  .           .           .           .           .           V
    294           .           .           .           .           .       RDETC
                  .           .           .           .           .           .
                  .           .           .           .           .           .
    299           .           .           .           .           .           .       ON-75
                  .           .           .           .           .           .           .
                  .           .           .           .           .           .           .
    305           .           .           .     CP075....................................
                  .           .           .           V
                  .           .           .           V
    307           .           .           .      RCP075
                  .           .           .           .
                  .           .           .           .
    312           .           .           .           .       ON-70
                  .           .           .           .           .
                  .           .           .           .           .
    318           .           .           .           .           .      PON110
                  .           .           .           .           .           V
                  .           .           .           .           .           V
    324           .           .           .           .           .        DETD
                  .           .           .           .           .           .
                  .           .           .           .           .           .
    331           .           .           .     CP070........................
                  .           .           .           .
                  .           .           .           .
    333           .           .           .           .      SOF-25
                  .           .           .           .           V
                  .           .           .           .           V
    339           .           .           .           .      SROF25
                  .           .           .           .           .
                  .           .           .           .           .
    344           .           .           .           .           .      SON-22
                  .           .           .           .           .           .
                  .           .           .           .           .           .
    350           .           .           .           .      SCP022............
                  .           .           .           .           V
                  .           .           .           .           V
    352           .           .           .           .      SR2225
                  .           .           .           .           .
                  .           .           .           .           .
    357           .           .           .           .           .      SON-25
                  .           .           .           .           .           .
                  .           .           .           .           .           .
    363           .           .           .           .           .           .      SON-24
                  .           .           .           .           .           .           V
                  .           .           .           .           .           .           V
    369           .           .           .           .           .           .      SRET24
                  .           .           .           .           .           .           .
                  .           .           .           .           .           .           .
    374           .           .           .           .      SCP025........................
                  .           .           .           .           V
                  .           .           .           .           V
    376           .           .           .           .      RSON25
                  .           .           .           .           .
                  .           .           .           .           .
    381           .           .           .           .           .       PON90
                  .           .           .           .           .           V
                  .           .           .           .           .           V
    387           .           .           .           .           .      RPON90
                  .           .           .           .           .           .
                  .           .           .           .           .           .
    392           .           .           .           .           .           .      ON-130
                  .           .           .           .           .           .           .
                  .           .           .           .           .           .           .
    398           .           .           .           .       CP130........................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
****************************************
 *                                       *                                                   *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                   *   U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998              *                                                   *   HYDROLOGIC ENGINEERING CENTER
*
 *             VERSION 4.1               *                                                   *         609 SECOND STREET
*
 *                                       *                                                   *      DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   22DEC16  TIME  15:43:52   *                                                   *          (916) 756-1104
*
 *                                       *                                                   *
*
 *****************************************
****************************************
```

Flood Control District of Maricopa County
BLACK MOUNTAIN_PROP - BLACK MOUNTAIN PROPOSED CONDITIONS
10 YEAR
6 Hour Storm
Unit Hydrograph: Clark
Storm: Multiple
10/18/2016

```
9 IO          OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

  IT          HYDROGRAPH TIME DATA
                     NMIN           5  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1JAN99  STARTING DATE
                    ITIME        0000  STARTING TIME
                       NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     7JAN99  ENDING DATE
                   NDTIME        2235  ENDING TIME
                    ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE  166.58 HOURS

       ENGLISH UNITS
            DRAINAGE AREA         SQUARE MILES
            PRECIPITATION DEPTH   INCHES
            LENGTH, ELEVATION     FEET
            FLOW                  CUBIC FEET PER SECOND
            STORAGE VOLUME        ACRE-FEET
            SURFACE AREA          ACRES
            TEMPERATURE           DEGREES FAHRENHEIT
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	OF-10	1.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-10	1.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-20	1.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-30	1.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-50	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-80	3.	4.17	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-90	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-100	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-110	1.	4.00	0.	0.	0.	.00		
+	9 COMBINED AT	CP BDY	7.	4.08	1.	0.	0.	.01		
+	HYDROGRAPH AT	ON-120	2.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-140	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-150	1.	4.00	0.	0.	0.	.00		
+	3 COMBINED AT	CPBDY2	4.	4.08	0.	0.	0.	.00		
	HYDROGRAPH AT									

	Operation	Station								
+		AON-20	22.	4.08	2.	0.	0.	.02		
+ +	ROUTED TO	ARET20	7.	4.33	2.	0.	0.	.02	2483.66	4.33
+ +	ROUTED TO	RAON20	7.	4.42	2.	0.	0.	.02	2475.29	4.42
+	HYDROGRAPH AT	PON20	1.	4.08	0.	0.	0.	.00		
+	2 COMBINED AT	CP020	7.	4.33	2.	0.	0.	.02		
+ +	ROUTED TO	RCP020	7.	4.42	2.	0.	0.	.02	2468.66	4.42
+	HYDROGRAPH AT	PON10	2.	4.08	0.	0.	0.	.00		
+ +	ROUTED TO	RPON10	2.	4.08	0.	0.	0.	.00	2468.42	4.08
+	HYDROGRAPH AT	PON40	1.	4.08	0.	0.	0.	.00		
+	3 COMBINED AT	CPP40	9.	4.17	2.	1.	0.	.02		
+ +	ROUTED TO	DETA	9.	4.33	2.	0.	0.	.02	1.67	4.33
+ +	ROUTED TO	RDETA	9.	4.33	2.	0.	0.	.02	2454.76	4.33
+	HYDROGRAPH AT	PON30	0.	4.08	0.	0.	0.	.00		
+ +	ROUTED TO	RPON30	0.	4.17	0.	0.	0.	.00	2457.24	4.17
+	HYDROGRAPH AT	PON50	2.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	PON60	20.	4.08	2.	0.	0.	.02		
+	4 COMBINED AT	CP060	22.	4.08	4.	1.	0.	.04		
+ +	ROUTED TO	DetB	20.	4.25	4.	1.	0.	.04	2.46	4.25
+ +	ROUTED TO	RDETB	13.	4.58	4.	1.	0.	.04	2445.24	4.58
+	HYDROGRAPH AT	ON-40	2.	4.08	0.	0.	0.	.00		
+	2 COMBINED AT	CP040	13.	4.58	4.	1.	0.	.05		
+	HYDROGRAPH AT	SOF-30	9.	4.08	0.	0.	0.	.01		
+ +	ROUTED TO	SROF30	8.	4.08	0.	0.	0.	.01	2476.16	4.08
+	HYDROGRAPH AT	SON-26	1.	4.08	0.	0.	0.	.00		
+	2 COMBINED AT	SCP026	9.	4.08	1.	0.	0.	.01		
+ +	ROUTED TO	SR2628	8.	4.17	1.	0.	0.	.01	2476.16	4.17
+	HYDROGRAPH AT	SON-28	17.	4.00	1.	0.	0.	.01		

2 COMBINED AT	SCP028	21.	4.08	2.	0.	0.	.02		
ROUTED TO	SRET28	15.	4.17	2.	0.	0.	.02	2477.39	4.17
HYDROGRAPH AT	SON-27	13.	4.00	1.	0.	0.	.01		
ROUTED TO	SRET27	3.	4.33	1.	0.	0.	.01	2473.70	4.33
HYDROGRAPH AT	SON-30	1.	4.00	0.	0.	0.	.00		
3 COMBINED AT	SCP030	19.	4.17	3.	1.	0.	.03		
ROUTED TO	RSON30	18.	4.25	3.	1.	0.	.03	2468.72	4.25
HYDROGRAPH AT	PON70	2.	4.17	0.	0.	0.	.00		
2 COMBINED AT	CPP70	20.	4.25	3.	1.	0.	.03		
ROUTED TO	RCPP70	18.	4.25	3.	1.	0.	.03	2455.43	4.25
HYDROGRAPH AT	PON80	0.	4.17	0.	0.	0.	.00		
ROUTED TO	RPON80	0.	4.25	0.	0.	0.	.00	2455.01	4.25
HYDROGRAPH AT	PON100	7.	4.00	1.	0.	0.	.01		
ROUTED TO	DETC	1.	4.58	0.	0.	0.	.01	1.28	4.58
ROUTED TO	RDETC	0.	4.67	0.	0.	0.	.01	2455.02	4.67
HYDROGRAPH AT	ON-75	4.	4.17	1.	0.	0.	.01		
4 COMBINED AT	CP075	22.	4.25	3.	1.	0.	.04		
ROUTED TO	RCP075	22.	4.33	3.	1.	0.	.04	2446.70	4.33
HYDROGRAPH AT	ON-70	1.	4.00	0.	0.	0.	.00		
HYDROGRAPH AT	PON110	10.	4.08	1.	0.	0.	.01		
ROUTED TO	DETD	1.	4.75	1.	0.	0.	.01	1.84	4.83
3 COMBINED AT	CP070	23.	4.33	4.	1.	0.	.05		
HYDROGRAPH AT	SOF-25	92.	4.25	10.	3.	1.	.11		
ROUTED TO	SROF25	83.	4.33	10.	3.	1.	.11	2477.54	4.33
HYDROGRAPH AT	SON-22	10.	4.17	1.	0.	0.	.01		
2 COMBINED AT	SCP022	92.	4.33	12.	3.	1.	.13		
ROUTED TO									

```
+                            SR2225      92.    4.33        12.         3.         1.        .13
+                                                                                                  2477.61        4.33

            HYDROGRAPH AT
+                            SON-25       2.    4.08         0.         0.         0.        .00

            HYDROGRAPH AT
+                            SON-24       4.    4.08         0.         0.         0.        .00

            ROUTED TO
+                            SRET24       1.    4.42         0.         0.         0.        .00
+                                                                                                  2467.93        4.42

            3 COMBINED AT
+                            SCP025      94.    4.33        12.         3.         1.        .13

            ROUTED TO
+                            RSON25      93.    4.33        12.         3.         1.        .13
+                                                                                                  2454.03        4.33

            HYDROGRAPH AT
+                             PON90       0.    4.08         0.         0.         0.        .00

            ROUTED TO
+                            RPON90       0.    4.08         0.         0.         0.        .00
+                                                                                                  2453.02        4.08

            HYDROGRAPH AT
+                            ON-130       2.    4.25         0.         0.         0.        .00

            3 COMBINED AT
+                             CP130      95.    4.33        12.         3.         1.        .14


*** NORMAL END OF HEC-1 ***
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```
1*****************************************                                                    
***************************************
 *                                        *                                                  *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                                                  *   U.S. ARMY CORPS OF ENGINEERS
*
 *             JUN   1998                 *                                                  *   HYDROLOGIC ENGINEERING CENTER
*
 *          VERSION 4.1                   *                                                  *         609 SECOND STREET
*
 *                                        *                                                  *      DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   22DEC16  TIME  15:37:12    *                                                  *          (916) 756-1104
*
 *                                        *                                                  *
*
 *****************************************
***************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

```
THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
```



```
 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    1          ID        Flood Control District of Maricopa County
    2          ID        BLACK MOUNTAIN_PROP - BLACK MOUNTAIN PROPOSED CONDITIONS
    3          ID        100 YEAR
    4          ID        6 Hour  Storm
    5          ID        Unit Hydrograph: Clark
    6          ID        Storm: Single
    7          ID        12/22/2016
               *DIAGRAM
    8          IT       5  1JAN99       0    2000
    9          IO       5
   10          IN      15
               *

   11          KK   OF-10   BASIN
   12          BA  0.0005
   13          PB   3.143
   14          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
   15          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
   16          PC   0.962   0.972   0.983   0.991   1.000
   17          LG    0.10    0.25    5.05    0.44       5
   18          UC   0.098   0.109
   19          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   20          UA     100
               *

   21          KK   ON-10   BASIN
   22          BA  0.0018
   23          LG    0.10    0.25    5.05    0.44       5
   24          UC   0.147   0.240
   25          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   26          UA     100
               *

   27          KK   ON-20   BASIN
   28          BA  0.0009
   29          LG    0.12    0.25    5.05    0.42       6
   30          UC   0.122   0.219
   31          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   32          UA     100
               *

   33          KK   ON-30   BASIN
   34          BA  0.0004
```

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 35          LG     0.10     0.25     5.05     0.44        5
 36          UC    0.063    0.039
 37          UA        0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 38          UA      100
             *

 39          KK    ON-50    BASIN
 40          BA   0.0002
 41          LG     0.10     0.25     5.05     0.44        5
 42          UC    0.043    0.014
 43          UA        0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 44          UA      100
             *
1                                       HEC-1 INPUT                                                      PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 45          KK    ON-80    BASIN
 46          BA   0.0031
 47          LG     0.12     0.25     5.05     0.43        6
 48          UC    0.158    0.225
 49          UA        0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 50          UA      100
             *

 51          KK    ON-90    BASIN
 52          BA   0.0001
 53          LG     0.10     0.25     4.33     0.62        5
 54          UC    0.059    0.021
 55          UA        0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 56          UA      100
             *

 57          KK   ON-100    BASIN
 58          BA   0.0003
 59          LG     0.10     0.25     4.33     0.62        5
 60          UC    0.081    0.070
 61          UA        0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 62          UA      100
             *

 63          KK   ON-110    BASIN
 64          BA   0.0004
 65          LG     0.10     0.25     4.58     0.55        5
 66          UC    0.065    0.040
 67          UA        0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 68          UA      100
             *

 69          KK   CP BDY COMBINE
 70          HC        9
             *

 71          KK   ON-120    BASIN
 72          BA   0.0019
 73          LG     0.19     0.25     5.05     0.39       10
 74          UC    0.117    0.141
 75          UA        0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 76          UA      100
             *

 77          KK   ON-140    BASIN
 78          BA   0.0002
 79          LG     0.10     0.25     5.46     0.35        5
 80          UC    0.070    0.044
 81          UA        0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 82          UA      100
             *
1                                       HEC-1 INPUT                                                      PAGE  3

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 83          KK   ON-150    BASIN
 84          BA    0.001
 85          LG     0.10     0.25     6.00     0.28        5
 86          UC    0.094    0.104
 87          UA        0      3.0      5.0      8.0     12.0     20.0     43.0     75.0     90.0     96.0
 88          UA      100
             *

 89          KK   CPBDY2 COMBINE
 90          HC        3
             *

 91          KK   AON-20    BASIN
 92          BA    0.018
 93          LG     0.31     0.28     5.05     0.27       13
 94          UC    0.191    0.198
```

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  95          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  96          UA     100
              *

  97          KK  ARET20 STORAGE
  98          RS       1    STOR
  99          SV            0.30    0.46    0.64    0.76    0.84    0.96    1.04
 100          SQ            3.62    5.53    9.66   13.16   15.81   20.15   29.72
 101          SE  2482.0 2483.00 2483.50 2484.00 2484.30 2484.50 2484.80 2485.00
              *

 102          KK  RAON20   ROUTE
 103          RS       1    FLOW
 104          RC   0.035   0.035   0.035     141  0.0071 2478.00
 105          RX    0.00    5.00   14.00   23.00   37.00   42.00   46.00   51.00
 106          RY  2478.0 2477.00 2476.00 2475.00 2475.00 2476.00 2477.00 2478.00
              *

 107          KK   PON20   BASIN
 108          BA  0.0012
 109          LG    0.10    0.25    5.05    0.44       5
 110          UC   0.102   0.137
 111          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 112          UA     100
              *

 113          KK   CP020 COMBINE
 114          HC       2
              *

 115          KK  RCP020   ROUTE
 116          RS       1    FLOW
 117          RC   0.035   0.035   0.035     454  0.0330 2469.00
 118          RX    0.00    2.00    3.00    4.00    4.01    5.00    6.00    8.00
 119          RY  2469.0 2468.50 2468.25 2468.00 2468.00 2468.25 2468.50 2469.00
              *
1                                          HEC-1 INPUT                                            PAGE  4

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 120          KK   PON10   BASIN
 121          BA  0.0019
 122          LG    0.13    0.25    5.05    0.42       7
 123          UC   0.108   0.114
 124          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 125          UA     100
              *

 126          KK  RPON10   ROUTE
 127          RS       1    FLOW
 128          RC   0.035   0.035   0.035     348  0.0402 2469.00
 129          RX    0.00    2.00    3.00    4.00    4.01    5.00    6.00    8.00
 130          RY  2469.0 2468.50 2468.25 2468.00 2468.00 2468.25 2468.50 2469.00
              *

 131          KK   PON40   BASIN
 132          BA  0.0013
 133          LG    0.13    0.25    5.05    0.42       7
 134          UC   0.137   0.249
 135          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 136          UA     100
              *

 137          KK   CPP40 COMBINE
 138          HC       3
              *

 139          KK    DETA
 140          KM   DETENTION BASIN A
 141          RS       1    STOR       0
 142          SA   0.098    .126    .161
 143          SE       0     1.0     2.0
 144          SS     1.4      24     2.3     1.5
 145          SL    0.75  0.1963     0.6     0.5
              *

 146          KK   RDETA   ROUTE
 147          RS       1    FLOW
 148          RC   0.035   0.035   0.035     529  0.0246 2456.00
 149          RX    0.00    4.00    6.00    8.00    8.01   10.00   12.00   16.00
 150          RY  2456.0 2455.00 2454.50 2454.00 2454.00 2454.50 2455.00 2456.00
              *

 151          KK   PON30   BASIN
 152          BA  0.0004
 153          LG    0.10    0.25    5.05    0.44       5
 154          UC   0.152   0.142
 155          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 156          UA     100
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 LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  157      KK  RPON30   ROUTE
  158      RS       1    FLOW
  159      RC   0.035   0.035   0.035     623  0.0241 2458.00
  160      RX    0.00    2.00    3.00    4.00    4.01    5.00    6.00    8.00
  161      RY  2458.0 2457.50 2457.25 2457.00 2457.00 2457.25 2457.50 2458.00
           *

  162      KK   PON50   BASIN
  163      BA  0.0018
  164      LG    0.16    0.25    5.05    0.41       8
  165      UC   0.138   0.224
  166      UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  167      UA     100
           *

  168      KK   PON60   BASIN
  169      BA  0.0187
  170      LG    0.28    0.25    5.05    0.34      14
  171      UC   0.179   0.184
  172      UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  173      UA     100
           *

  174      KK   CP060 COMBINE
  175      HC       4
           *

  176      KK    DETB
  177      KM   DETENTION BASIN B
  178      RS       1    STOR       0
  179      SA   0.135    .166    .200    .235
  180      SE       0     1.0     2.0     3.0
  181      SS     2.0      24     2.3     1.5
  182      SL    0.83  0.3526     0.6     0.5
           *

  183      KK   RDETB   ROUTE
  184      RS       1    FLOW
  185      RC   0.035   0.035   0.035     350  0.0229 2449.00
  186      RX    0.00    4.00    8.00   12.00   32.01   36.00   40.00   44.00
  187      RY  2449.0 2447.00  2446.0 2445.00 2445.00  2446.0 2447.00 2449.00
           *

  188      KK   ON-40   BASIN
  189      BA  0.0019
  190      LG    0.26    0.25    5.05    0.35      13
  191      UC   0.123   0.166
  192      UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  193      UA     100
           *
```



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 LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  194      KK   CP040 COMBINE
  195      HC       2
           *

  196      KK  SOF-30   BASIN
  197      BA   0.007
  198      LG    0.35    0.36    5.05    0.27       0
  199      UC   0.166   0.146
  200      UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  201      UA     100
           *

  202      KK  SROF30   ROUTE
  203      RS       1    FLOW
  204      RC   0.035   0.035   0.035     386  0.0214 2484.00
  205      RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
  206      RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
           *

  207      KK  SON-26   BASIN
  208      BA   0.001
  209      LG    0.35    0.36    5.05    0.27       0
  210      UC   0.138   0.279
  211      UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  212      UA     100
           *

  213      KK  SCP026 COMBINE
  214      HC       2
```

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                  *

   215            KK  SR2628   ROUTE
   216            RS       1    FLOW
   217            RC   0.035   0.035   0.035     740  0.0214 2484.00
   218            RX    0.00   37.00   45.00   52.00   66.00   81.00   96.00  153.00
   219            RY  2484.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2484.00
                  *

   220            KK  SON-28   BASIN
   221            BA   0.010
   222            LG    0.31    0.26    5.05    0.26      15
   223            UC   0.133   0.106
   224            UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
   225            UA     100
                  *

   226            KK  SCP028 COMBINE
   227            HC       2
                  *
1                                         HEC-1 INPUT                                             PAGE  7

  LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


   228            KK  SRET28 STORAGE
   229            RS       1    STOR
   230            SV            0.11    0.26    0.30    0.35    0.40    0.46
   231            SQ            3.94    6.13   11.27   20.23   31.64   45.04
   232            SE  2475.0 2476.00 2477.00 2477.30 2477.50 2477.80 2478.00
                  *

   233            KK  SON-27   BASIN
   234            BA   0.009
   235            LG    0.30    0.25    5.58    0.20      17
   236            UC   0.139   0.168
   237            UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
   238            UA     100
                  *

   239            KK  SRET27 STORAGE
   240            RS       1    STOR
   241            SV            0.18    0.39    0.64    0.78
   242            SQ            2.00    3.30    4.22    4.61
   243            SE  2472.0 2473.00 2474.00 2475.00 2475.50
                  *

   244            KK  SON-30   BASIN
   245            BA   0.001
   246            LG    0.35    0.36    5.05    0.27       0
   247            UC   0.112   0.177
   248            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   249            UA     100
                  *

   250            KK  SCP030 COMBINE
   251            HC       3
                  *

   252            KK  RSON30   ROUTE
   253            RS       1    FLOW
   254            RC   0.035   0.035   0.035     320  0.0188 2471.00
   255            RX    0.00   17.00   25.00   30.00   34.00   37.00   40.00   45.00
   256            RY  2471.0 2470.00 2469.00 2468.00 2468.00 2469.00 2470.00 2471.00
                  *

   257            KK   PON70   BASIN
   258            BA  0.0026
   259            LG    0.10    0.25    5.05    0.44       5
   260            UC   0.175   0.269
   261            UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   262            UA     100
                  *
1                                         HEC-1 INPUT                                             PAGE  8

  LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


   263            KK   CPP70 COMBINE
   264            HC       2
                  *

   265            KK  RCP070   ROUTE
   266            RS       1    FLOW
   267            RC   0.035   0.035   0.035    1046  0.0239 2458.00
   268            RX    0.00    4.00   12.00   23.00   32.00   41.00   44.00   47.00
   269            RY  2458.0 2457.00 2456.00 2455.00 2455.00 2456.00 2457.00 2458.00
                  *

   270            KK   PON80   BASIN
```

```
 271          BA  0.0004
 272          LG    0.10    0.25    5.05    0.37       5
 273          UC   0.186   0.223
 274          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 275          UA     100
              *

 276          KK  RPON80   ROUTE
 277          RS       1    FLOW
 278          RC   0.035   0.035   0.035    1104  0.0281 2458.00
 279          RX    0.00    4.00   12.00   23.00   32.00   41.00   44.00   47.00
 280          RY  2458.0 2457.00 2456.00 2455.00 2455.00 2456.00 2457.00 2458.00
              *

 281          KK  PON100   BASIN
 282          BA  0.0057
 283          LG    0.28    0.25    5.05    0.34      14
 284          UC   0.128   0.127
 285          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 286          UA     100
              *

 287          KK    DETC
 288          KM   DETENTION BASIN C
 289          RS       1    STOR       0
 290          SA    .164   0.202   0.243   0.288
 291          SE       0     1.0     2.0     3.0
 292          SS     2.6      12     2.3     1.5
 293          SL     1.0  0.1963     0.6     0.5
              *

 294          KK   RDETC   ROUTE
 295          RS       1    FLOW
 296          RC   0.035   0.035   0.035     575  0.0296 2458.00
 297          RX    0.00    4.00   12.00   23.00   32.00   41.00   44.00   47.00
 298          RY  2458.0 2457.00 2456.00 2455.00 2455.00 2456.00 2457.00 2458.00
              *
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 299          KK   ON-75   BASIN
 300          BA  0.0061
 301          LG    0.16    0.25    5.05    0.40       8
 302          UC   0.213   0.338
 303          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 304          UA     100
              *

 305          KK   CP075 COMBINE
 306          HC       4
              *

 307          KK  RCP075   ROUTE
 308          RS       1    FLOW
 309          RC   0.035   0.035   0.035     250   0.032 2449.00
 310          RX    0.00    2.00    9.00   16.00   19.00   24.00   34.00   47.00
 311          RY  2449.0 2448.00 2447.00 2446.00 2446.00 2447.00 2448.00 2449.00
              *

 312          KK   ON-70   BASIN
 313          BA  0.0004
 314          LG    0.10    0.25    4.33    0.62       5
 315          UC   0.087   0.076
 316          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
 317          UA     100
              *

 318          KK  PON110   BASIN
 319          BA  0.0101
 320          LG    0.26    0.25    4.96    0.36      13
 321          UC   0.167   0.200
 322          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 323          UA     100
              *

 324          KK    DETD
 325          KM   DETENTION BASIN D
 326          RS       1    STOR       0
 327          SA   0.174   0.211   0.250   0.294
 328          SE       0     1.0     2.0     3.0
 329          SS     2.6      12     2.3     1.5
 330          SL    0.75  0.1963     0.6     0.5
              *

 331          KK   CP070 COMBINE
 332          HC       3
              *
```

```
  333          KK  SOF-25   BASIN
  334          BA   0.112
  335          LG    0.32    0.33    5.71    0.22      12
  336          UC   0.376   0.375
  337          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  338          UA     100
               *
1                                        HEC-1 INPUT                                          PAGE 10

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  339          KK  SROF25   ROUTE
  340          RS       1    FLOW
  341          RC   0.035   0.035   0.035    1880  0.0164 2486.00
  342          RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
  343          RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
               *

  344          KK  SON-22   BASIN
  345          BA   0.015
  346          LG    0.34    0.36    6.00    0.17       5
  347          UC   0.288   0.479
  348          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  349          UA     100
               *

  350          KK  SCP022 COMBINE
  351          HC       2
               *

  352          KK  SR2225   ROUTE
  353          RS       1    FLOW
  354          RC   0.035   0.035   0.035     398  0.0164 2486.00
  355          RX    0.00   29.00   41.00   47.00   50.00   64.00   95.00  128.00
  356          RY  2486.0 2480.00 2478.00 2476.00 2476.00 2478.00 2480.00 2486.00
               *

  357          KK  SON-25   BASIN
  358          BA   0.002
  359          LG    0.34    0.37    6.00    0.17       4
  360          UC   0.130   0.210
  361          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  362          UA     100
               *

  363          KK  SON-24   BASIN
  364          BA   0.003
  365          LG    0.32    0.31    6.00    0.17      11
  366          UC   0.154   0.144
  367          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  368          UA     100
               *

  369          KK  SRET24 STORAGE
  370          RS       1    STOR
  371          SV            0.12    0.26    0.44
  372          SQ            0.82    1.25    1.57
  373          SE  2467.0 2468.00 2469.00 2470.00

               *
1                                        HEC-1 INPUT                                          PAGE 11

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  374          KK  SCP025 COMBINE
  375          HC       3
               *

  376          KK  RSON25   ROUTE
  377          RS       1    FLOW
  378          RC   0.035   0.035   0.035     643  0.0249 2456.00
  379          RX    0.00   13.00   16.00   19.00   31.00   33.00   36.00   39.00
  380          RY  2456.0 2455.00 2454.00 2453.00 2453.00 2454.00 2455.00 2456.00
               *

  381          KK   PON90   BASIN
  382          BA  0.0004
  383          LG    0.10    0.25    5.05    0.44       5
  384          UC   0.099   0.111
  385          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
  386          UA     100
               *

  387          KK  RPON90   ROUTE
  388          RS       1    FLOW
  389          RC   0.035   0.035   0.035     666  0.0330 2456.00
  390          RX    0.00   13.00   16.00   19.00   31.00   33.00   36.00   39.00
  391          RY  2456.0 2455.00 2454.00 2453.00 2453.00 2454.00 2455.00 2456.00
```

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                     *

   392               KK  ON-130   BASIN
   393               BA  0.0035
   394               LG    0.10    0.25    5.24    0.40       5
   395               UC   0.221   0.427
   396               UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
   397               UA     100
                     *

   398               KK   CP130 COMBINE
   399               HC       3
                     *
   400               ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    11       OF-10
                 .
                 .
    21           .       ON-10
                 .           .
                 .           .
    27           .           .       ON-20
                 .           .           .
                 .           .           .
    33           .           .           .       ON-30
                 .           .           .           .
                 .           .           .           .
    39           .           .           .           .       ON-50
                 .           .           .           .           .
                 .           .           .           .           .
    45           .           .           .           .           .       ON-80
                 .           .           .           .           .           .
                 .           .           .           .           .           .
    51           .           .           .           .           .           .       ON-90
                 .           .           .           .           .           .           .
                 .           .           .           .           .           .           .
    57           .           .           .           .           .           .           .      ON-100
                 .           .           .           .           .           .           .           .
                 .           .           .           .           .           .           .           .
    63           .           .           .           .           .           .           .           .      ON-110
                 .           .           .           .           .           .           .           .           .
                 .           .           .           .           .           .           .           .           .
    69      CP BDY................................................................................................
                 .
                 .
    71           .      ON-120
                 .           .
                 .           .
    77           .           .      ON-140
                 .           .           .
                 .           .           .
    83           .           .           .      ON-150
                 .           .           .           .
                 .           .           .           .
    89           .      CPBDY2........................
                 .           .
                 .           .
    91           .           .      AON-20
                 .           .           V
                 .           .           V
    97           .           .      ARET20
                 .           .           V
                 .           .           V
   102           .           .      RAON20
                 .           .           .
                 .           .           .
   107           .           .           .       PON20
                 .           .           .           .
                 .           .           .           .
   113           .           .       CP020............
                 .           .           V
                 .           .           V
   115           .           .      RCP020
                 .           .           .
                 .           .           .
   120           .           .           .       PON10
                 .           .           .           V
                 .           .           .           V
   126           .           .           .      RPON10
                 .           .           .           .
                 .           .           .           .
   131           .           .           .           .       PON40
                 .           .           .           .           .
                 .           .           .           .           .
```

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137            .           .       CPP40........................
               .           .           V
               .           .           V
139            .           .        DETA
               .           .           V
               .           .           V
146            .           .       RDETA
               .           .           .
               .           .           .
151            .           .           .       PON30
               .           .           .           V
               .           .           .           V
157            .           .           .      RPON30
               .           .           .           .
               .           .           .           .
162            .           .           .           .       PON50
               .           .           .           .           .
               .           .           .           .           .
168            .           .           .           .           .       PON60
               .           .           .           .           .           .
               .           .           .           .           .           .
174            .           .       CP060....................................
               .           .           V
               .           .           V
176            .           .        DETB
               .           .           V
               .           .           V
183            .           .       RDETB
               .           .           .
               .           .           .
188            .           .           .       ON-40
               .           .           .           .
               .           .           .           .
194            .           .       CP040............
               .           .           .
               .           .           .
196            .           .           .      SOF-30
               .           .           .           V
               .           .           .           V
202            .           .           .      SROF30
               .           .           .           .
               .           .           .           .
207            .           .           .           .      SON-26
               .           .           .           .           .
               .           .           .           .           .
213            .           .           .      SCP026............
               .           .           .           V
               .           .           .           V
215            .           .           .      SR2628
               .           .           .           .
               .           .           .           .
220            .           .           .           .      SON-28
               .           .           .           .           .
               .           .           .           .           .
226            .           .           .      SCP028............
               .           .           .           V
               .           .           .           V
228            .           .           .      SRET28
               .           .           .           .
               .           .           .           .
233            .           .           .           .      SON-27
               .           .           .           .           V
               .           .           .           .           V
239            .           .           .           .      SRET27
               .           .           .           .           .
               .           .           .           .           .
244            .           .           .           .           .      SON-30
               .           .           .           .           .           .
               .           .           .           .           .           .
250            .           .           .      SCP030........................
               .           .           .           V
               .           .           .           V
252            .           .           .      RSON30
               .           .           .           .
               .           .           .           .
257            .           .           .           .       PON70
               .           .           .           .           .
               .           .           .           .           .
263            .           .           .       CPP70............
               .           .           .           V
               .           .           .           V
265            .           .           .      RCP070
               .           .           .           .
               .           .           .           .
270            .           .           .           .       PON80
               .           .           .           .           V
               .           .           .           .           V
276            .           .           .           .      RPON80
               .           .           .           .           .
               .           .           .           .           .
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 281    .     .     .     .     .   PON100
        .     .     .     .     .        V
        .     .     .     .     .        V
 287    .     .     .     .     .     DETC
        .     .     .     .     .        V
        .     .     .     .     .        V
 294    .     .     .     .     .    RDETC
        .     .     .     .     .        .
        .     .     .     .     .        .
 299    .     .     .     .     .        .     ON-75
        .     .     .     .     .        .         .
        .     .     .     .     .        .         .
 305    .     .     .   CP075.............................
        .     .     .       V
        .     .     .       V
 307    .     .     .  RCP075
        .     .     .       .
        .     .     .       .
 312    .     .     .       .    ON-70
        .     .     .       .        .
        .     .     .       .        .
 318    .     .     .       .        .   PON110
        .     .     .       .        .        V
        .     .     .       .        .        V
 324    .     .     .       .        .     DETD
        .     .     .       .        .        .
        .     .     .       .        .        .
 331    .     .     .   CP070.....................
        .     .     .       .
        .     .     .       .
 333    .     .     .       .   SOF-25
        .     .     .       .        V
        .     .     .       .        V
 339    .     .     .       .   SROF25
        .     .     .       .        .
        .     .     .       .        .
 344    .     .     .       .        .   SON-22
        .     .     .       .        .        .
        .     .     .       .        .        .
 350    .     .     .       .   SCP022...........
        .     .     .       .        V
        .     .     .       .        V
 352    .     .     .       .   SR2225
        .     .     .       .        .
        .     .     .       .        .
 357    .     .     .       .        .   SON-25
        .     .     .       .        .        .
        .     .     .       .        .        .
 363    .     .     .       .        .        .    SON-24
        .     .     .       .        .        .         V
        .     .     .       .        .        .         V
 369    .     .     .       .        .        .    SRET24
        .     .     .       .        .        .         .
        .     .     .       .        .        .         .
 374    .     .     .       .   SCP025.....................
        .     .     .       .        V
        .     .     .       .        V
 376    .     .     .       .   RSON25
        .     .     .       .        .
        .     .     .       .        .
 381    .     .     .       .        .    PON90
        .     .     .       .        .        V
        .     .     .       .        .        V
 387    .     .     .       .        .   RPON90
        .     .     .       .        .        .
        .     .     .       .        .        .
 392    .     .     .       .        .        .    ON-130
        .     .     .       .        .        .         .
        .     .     .       .        .        .         .
 398    .     .     .       .    CP130.....................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
****************************************
 *                                       *                              *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                              *   U.S. ARMY CORPS OF ENGINEERS
*
 *             JUN   1998                *                              *   HYDROLOGIC ENGINEERING CENTER
*
 *           VERSION 4.1                 *                              *         609 SECOND STREET
*
 *                                       *                              *      DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   22DEC16  TIME  15:37:12   *                              *          (916) 756-1104
*
 *                                       *                              *
*
 *****************************************
****************************************
```

Flood Control District of Maricopa County
BLACK MOUNTAIN_PROP - BLACK MOUNTAIN PROPOSED CONDITIONS
100 YEAR
6 Hour Storm
Unit Hydrograph: Clark
Storm: Single
10/18/2016

```
9 IO          OUTPUT CONTROL VARIABLES
                   IPRNT           5  PRINT CONTROL
                   IPLOT           0  PLOT CONTROL
                   QSCAL          0.  HYDROGRAPH PLOT SCALE

  IT          HYDROGRAPH TIME DATA
                    NMIN           5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1JAN99  STARTING DATE
                   ITIME        0000  STARTING TIME
                      NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      7JAN99  ENDING DATE
                  NDTIME        2235  ENDING TIME
                   ICENT          19  CENTURY MARK

            COMPUTATION INTERVAL     .08 HOURS
                 TOTAL TIME BASE  166.58 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	OF-10	1.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-10	3.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-20	2.	4.08	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-30	1.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-50	1.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-80	6.	4.08	1.	0.	0.	.00		
+	HYDROGRAPH AT	ON-90	0.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-100	1.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-110	1.	4.00	0.	0.	0.	.00		
+	9 COMBINED AT	CP BDY	15.	4.00	1.	0.	0.	.01		
+	HYDROGRAPH AT	ON-120	5.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-140	1.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	ON-150	3.	4.00	0.	0.	0.	.00		
+	3 COMBINED AT	CPBDY2	8.	4.00	1.	0.	0.	.00		
	HYDROGRAPH AT									

	AON-20	39.	4.08	3.	1.	0.	.02		
ROUTED TO	ARET20	18.	4.33	3.	1.	0.	.02	2484.65	4.33
ROUTED TO	RAON20	18.	4.33	3.	1.	0.	.02	2475.51	4.33
HYDROGRAPH AT	PON20	3.	4.00	0.	0.	0.	.00		
2 COMBINED AT	CP020	19.	4.33	4.	1.	0.	.02		
ROUTED TO	RCP020	19.	4.33	4.	1.	0.	.02	2468.96	4.33
HYDROGRAPH AT	PON10	5.	4.00	0.	0.	0.	.00		
ROUTED TO	RPON10	5.	4.00	0.	0.	0.	.00	2468.55	4.00
HYDROGRAPH AT	PON40	2.	4.08	0.	0.	0.	.00		
3 COMBINED AT	CPP40	21.	4.25	4.	1.	0.	.02		
ROUTED TO	DETA	21.	4.25	4.	1.	0.	.02	1.91	4.25
ROUTED TO	RDETA	21.	4.33	4.	1.	0.	.02	2455.04	4.33
HYDROGRAPH AT	PON30	1.	4.08	0.	0.	0.	.00		
ROUTED TO	RPON30	1.	4.08	0.	0.	0.	.00	2457.32	4.08
HYDROGRAPH AT	PON50	4.	4.08	0.	0.	0.	.00		
HYDROGRAPH AT	PON60	41.	4.00	3.	1.	0.	.02		
4 COMBINED AT	CP060	58.	4.08	8.	2.	1.	.04		
ROUTED TO	DETB	56.	4.17	7.	2.	1.	.04	2.98	4.17
ROUTED TO	RDETB	40.	4.33	7.	2.	1.	.04	2445.48	4.33
HYDROGRAPH AT	ON-40	4.	4.00	0.	0.	0.	.00		
2 COMBINED AT	CP040	41.	4.33	8.	2.	1.	.05		
HYDROGRAPH AT	SOF-30	17.	4.08	1.	0.	0.	.01		
ROUTED TO	SROF30	16.	4.08	1.	0.	0.	.01	2476.31	4.08
HYDROGRAPH AT	SON-26	2.	4.08	0.	0.	0.	.00		
2 COMBINED AT	SCP026	18.	4.08	1.	0.	0.	.01		
ROUTED TO	SR2628	17.	4.17	1.	0.	0.	.01	2476.32	4.17
HYDROGRAPH AT	SON-28	29.	4.00	2.	0.	0.	.01		

+	2 COMBINED AT	SCP028	38.	4.08	3.	1.	0.	.02		
+	ROUTED TO	SRET28	36.	4.08	3.	1.	0.	.02		
+									2477.87	4.08
+	HYDROGRAPH AT	SON-27	23.	4.00	2.	0.	0.	.01		
+	ROUTED TO	SRET27	4.	4.42	2.	0.	0.	.01		
+									2475.04	4.42
+	HYDROGRAPH AT	SON-30	2.	4.00	0.	0.	0.	.00		
+	3 COMBINED AT	SCP030	42.	4.08	5.	1.	0.	.03		
+	ROUTED TO	RSON30	41.	4.08	5.	1.	0.	.03		
+									2469.06	4.08
+	HYDROGRAPH AT	PON70	5.	4.08	0.	0.	0.	.00		
+	2 COMBINED AT	CPP70	46.	4.08	6.	1.	0.	.03		
+	ROUTED TO	RCP070	44.	4.17	6.	1.	0.	.03		
+									2455.68	4.17
+	HYDROGRAPH AT	PON80	1.	4.08	0.	0.	0.	.00		
+	ROUTED TO	RPON80	1.	4.25	0.	0.	0.	.00		
+									2455.03	4.25
+	HYDROGRAPH AT	PON100	15.	4.00	1.	0.	0.	.01		
+	ROUTED TO	DETC	1.	4.42	1.	0.	0.	.01		
+									2.23	4.50
+	ROUTED TO	RDETC	1.	4.58	1.	0.	0.	.01		
+									2455.05	4.58
+	HYDROGRAPH AT	ON-75	10.	4.17	1.	0.	0.	.01		
+	4 COMBINED AT	CP075	55.	4.17	7.	2.	1.	.04		
+	ROUTED TO	RCP075	55.	4.17	7.	2.	1.	.04		
+									2447.04	4.17
+	HYDROGRAPH AT	ON-70	1.	4.00	0.	0.	0.	.00		
+	HYDROGRAPH AT	PON110	21.	4.00	2.	0.	0.	.01		
+	ROUTED TO	DETD	7.	4.33	1.	0.	0.	.01		
+									2.94	4.33
+	3 COMBINED AT	CP070	56.	4.25	9.	2.	1.	.05		
+	HYDROGRAPH AT	SOF-25	172.	4.25	21.	5.	2.	.11		
+	ROUTED TO	SROF25	162.	4.33	21.	5.	2.	.11		
+									2478.02	4.33
+	HYDROGRAPH AT	SON-22	20.	4.17	3.	1.	0.	.01		
+	2 COMBINED AT	SCP022	180.	4.33	24.	6.	2.	.13		
	ROUTED TO									

HEC-1 Detention Basins											
Detention Basin A			Detention Basin B			Detention Basin C			Detention Basin D		
Depth (ft)	Surface Area (ac)	ΔV (af)	Depth (ft)	Surface Area (ac)	ΔV (af)	Depth (ft)	Surface Area (ac)	ΔV (af)	Depth (ft)	Surface Area (ac)	ΔV (af)
0	0.098	--	0	0.135	--	0	0.164	--	0	0.174	--
1	0.126	0.11	1	0.166	0.15	1	0.202	0.18	1	0.211	0.19
2	0.161	0.14	2	0.200	0.18	2	0.243	0.22	2	0.250	0.23
--	--	--	3	0.235	0.22	3	0.288	0.27	3	0.294	0.27
V_{total}=		**0.25**	**V_{total}=**		**0.55**	**V_{total}=**		**0.67**	**V_{total}=**		**0.69**

```
                    HEC-RAS Version 4.1.0 Jan 2010
                    U.S. Army Corps of Engineers
                    Hydrologic Engineering Center
                          609 Second Street
                          Davis, California

    X     X  XXXXXX   XXXX        XXXX      XX     XXXX
    X     X  X       X    X       X   X    X  X   X
    X     X  X       X            X   X   X    X  X
    XXXXXXX  XXXX    X      XXX   XXXX    XXXXXX   XXXX
    X     X  X       X            X  X    X    X       X
    X     X  X       X    X       X   X   X    X       X
    X     X  XXXXXX   XXXX        X    X  X    X  XXXXX
```

PROJECT DATA
Project Title: BlackMountain
Project File : BlackMountain.prj
Run Date and Time: 11/2/2016 11:10:03 AM

Project in English units

PLAN DATA

Plan Title: ExistingConditions_BM
Plan File :
k:\TUC_WaterResources\Shift\PHX\291015001_BlackMountain\Design\Drainage\HECRAS\BlackMountain.p01

Geometry Title: ExistingConditions_BM
Geometry File :
k:\TUC_WaterResources\Shift\PHX\291015001_BlackMountain\Design\Drainage\HECRAS\BlackMountain.g01

Flow Title : ExistingConditions_100yr
Flow File :
k:\TUC_WaterResources\Shift\PHX\291015001_BlackMountain\Design\Drainage\HECRAS\BlackMountain.f01

Plan Summary Information:

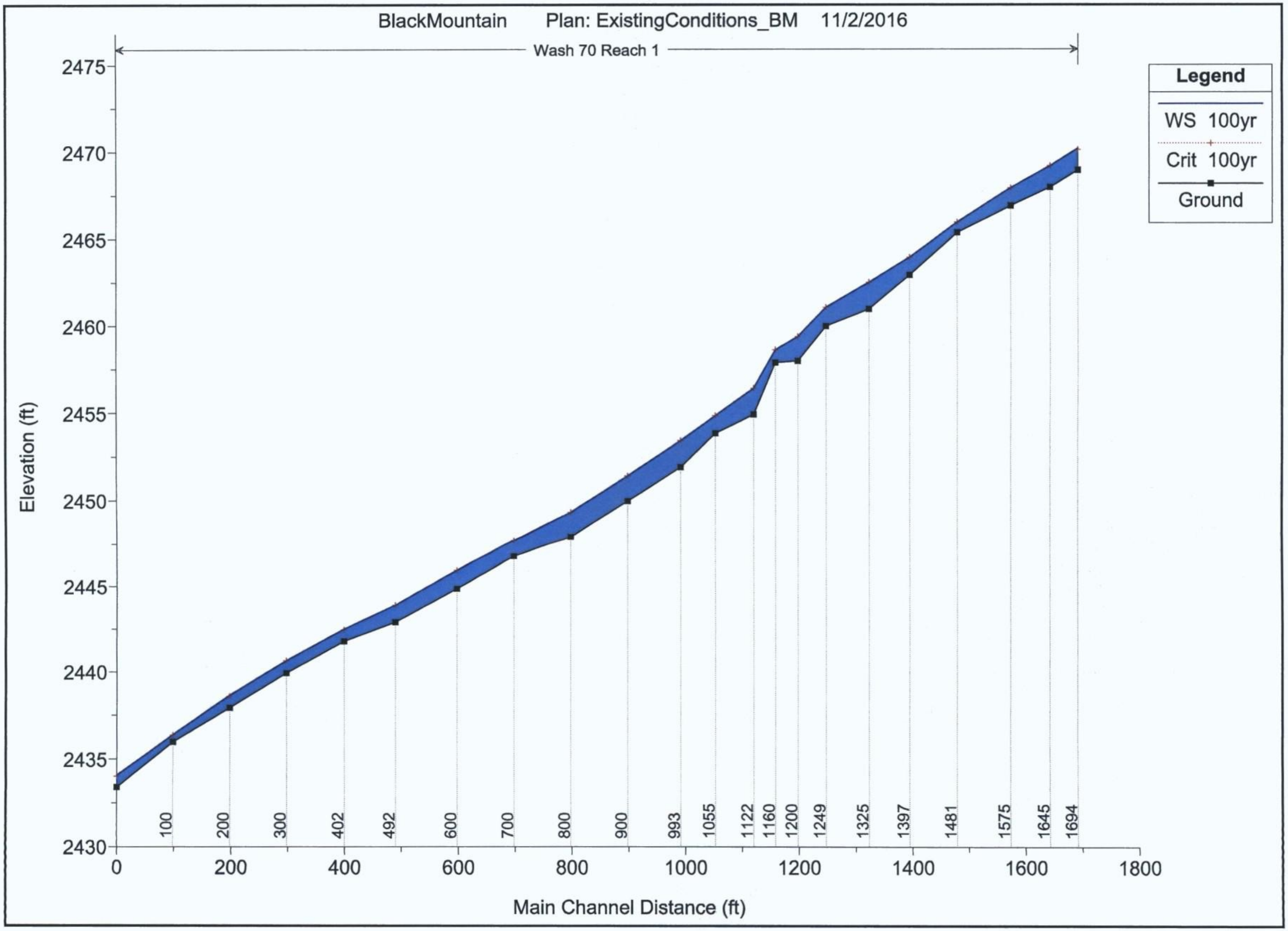
Number of:	Cross Sections	= 29	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

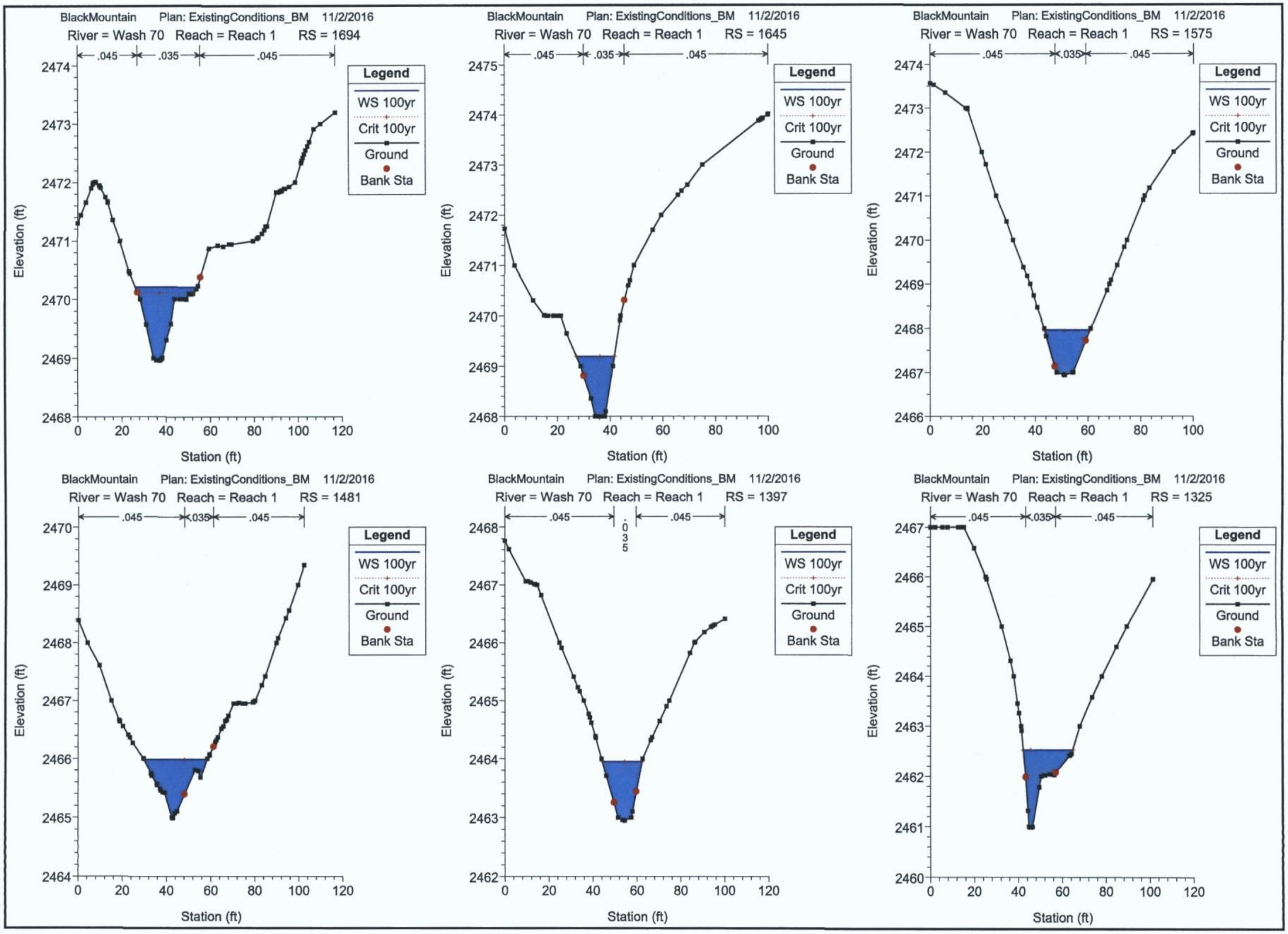
Computational Information
- Water surface calculation tolerance = 0.01
- Critical depth calculation tolerance = 0.01
- Maximum number of iterations = 20
- Maximum difference tolerance = 0.3
- Flow tolerance factor = 0.001

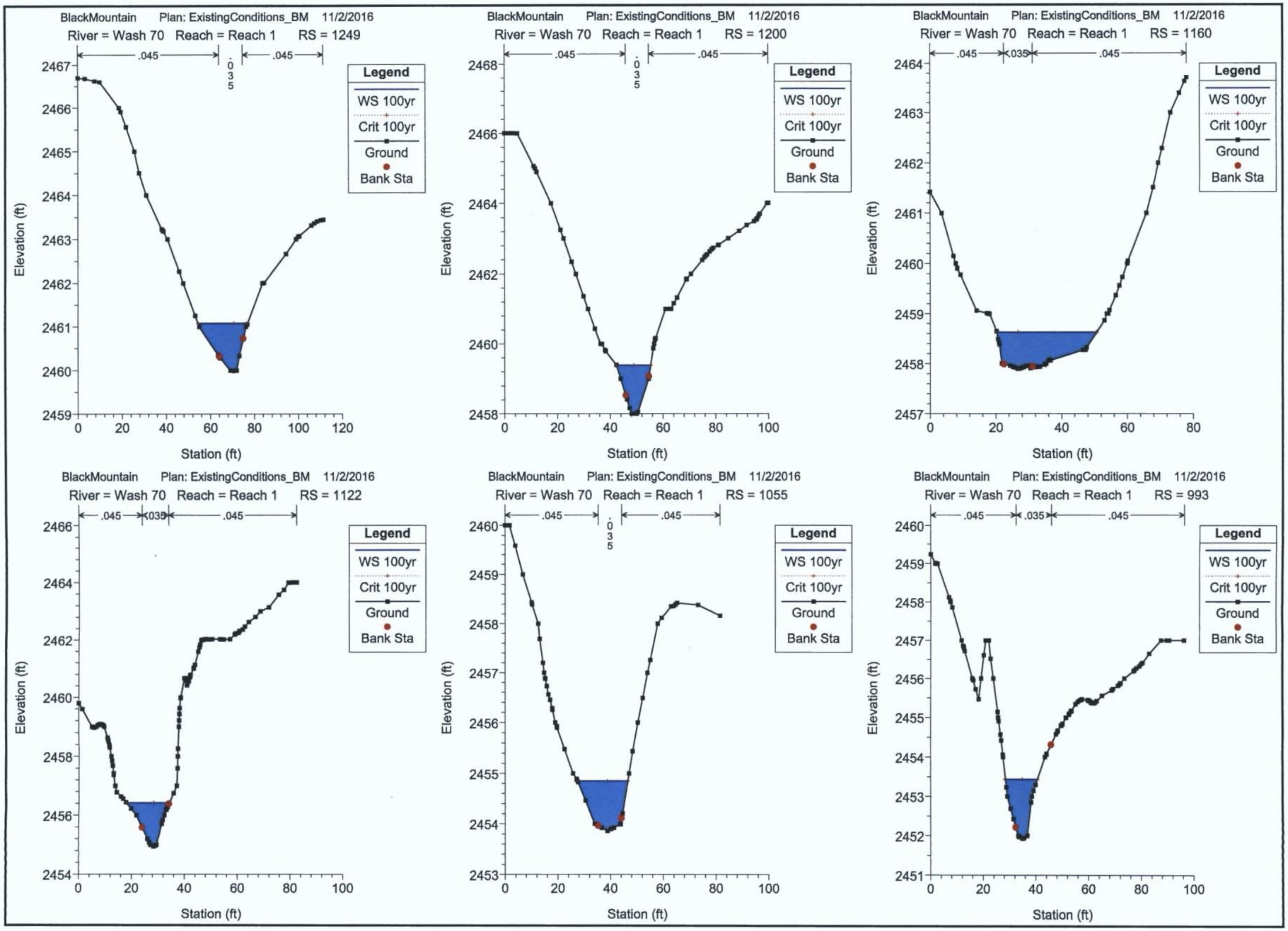
Computation Options
- Critical depth computed at all cross sections
- Conveyance Calculation Method: At breaks in n values only
- Friction Slope Method: Average Conveyance
- Computational Flow Regime: Subcritical Flow

HEC-RAS Plan: ExistingCond River: Wash 70 Reach: Reach 1 Profile: 100yr

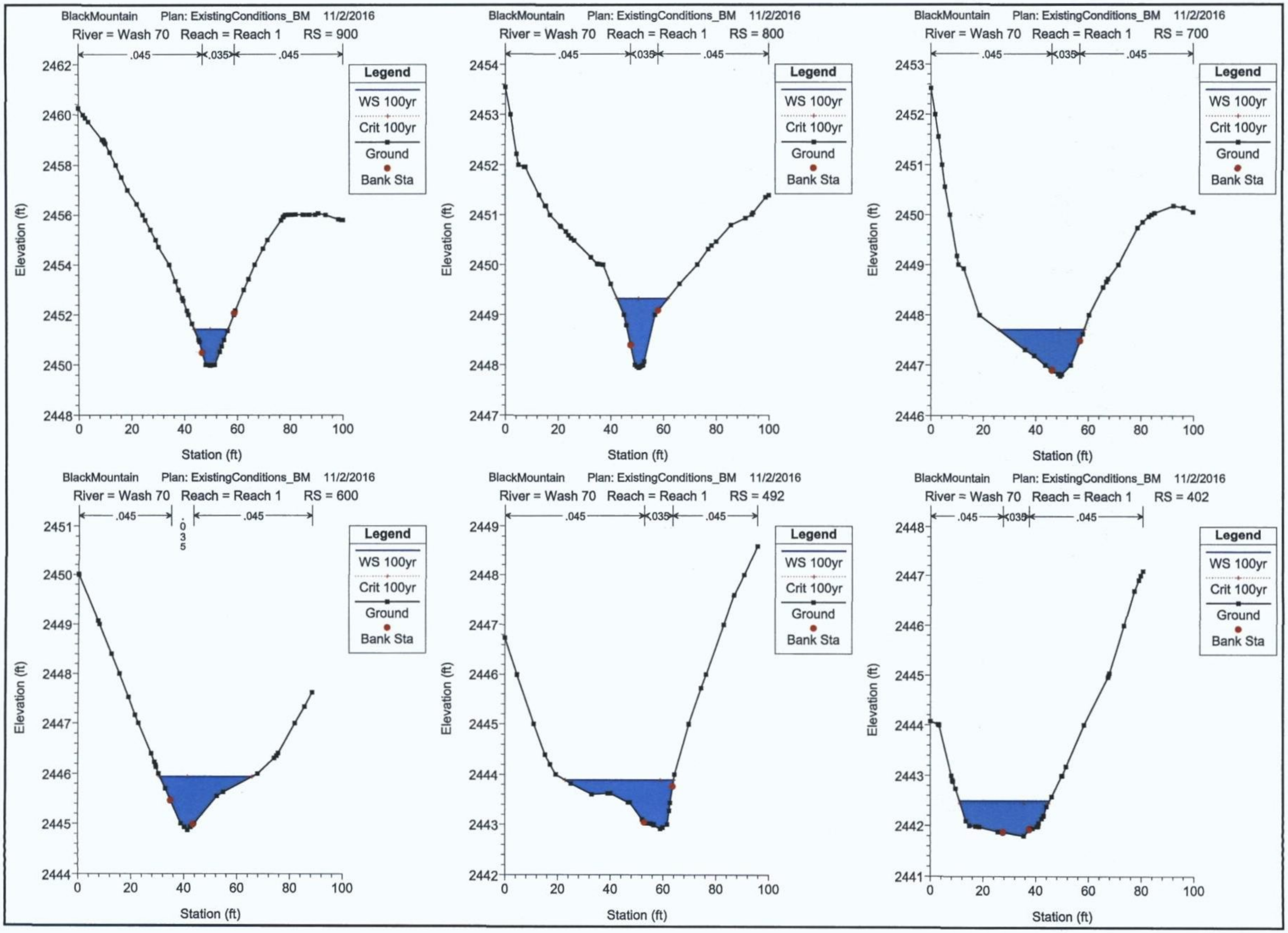
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1694	100yr	50	2468.96	2470.20	2470.11	2470.38	0.013984	3.36	14.932860	27.96	0.80
Reach 1	1645	100yr	50	2468.00	2469.19	2469.19	2469.58	0.018425	5.05	10.235050	14.31	0.97
Reach 1	1575	100yr	50	2466.94	2467.95	2467.94	2468.29	0.016748	4.80	11.395480	17.13	0.93
Reach 1	1481	100yr	50	2465.39	2465.98	2465.98	2466.22	0.031957	3.19	13.060340	28.54	1.07
Reach 1	1397	100yr	50	2462.95	2463.95	2463.95	2464.30	0.016035	4.96	11.616950	18.14	0.93
Reach 1	1325	100yr	57	2460.99	2462.52	2462.52	2462.85	0.016931	4.74	13.408380	22.56	0.92
Reach 1	1249	100yr	57	2459.99	2461.08	2461.08	2461.41	0.015797	4.95	13.894860	22.49	0.92
Reach 1	1200	100yr	57	2458.00	2459.39	2459.39	2459.86	0.017204	5.71	10.951490	13.00	0.98
Reach 1	1160	100yr	57	2457.90	2458.62	2458.62	2458.88	0.022072	4.90	15.651680	30.38	1.04
Reach 1	1122	100yr	57	2454.94	2456.41	2456.41	2456.83	0.016949	5.34	11.967420	16.20	0.95
Reach 1	1055	100yr	57	2453.86	2454.85	2454.85	2455.23	0.018127	5.41	12.955130	19.04	0.99
Reach 1	993	100yr	57	2451.93	2453.43	2453.43	2453.88	0.018664	5.68	11.116230	12.12	1.00
Reach 1	900	100yr	57	2449.98	2451.41	2451.41	2451.86	0.017366	5.52	11.047640	12.74	0.97
Reach 1	800	100yr	57	2447.94	2449.32	2449.32	2449.71	0.015901	5.18	12.488610	19.13	0.93
Reach 1	700	100yr	57	2446.79	2447.71	2447.71	2447.97	0.019996	4.77	15.879550	32.49	1.00
Reach 1	600	100yr	57	2444.87	2445.94	2445.94	2446.21	0.016122	4.91	16.967150	34.83	0.93
Reach 1	492	100yr	57	2442.91	2443.89	2443.89	2444.11	0.014190	4.42	18.519180	41.06	0.86
Reach 1	402	100yr	57	2441.80	2442.49	2442.45	2442.69	0.018068	4.29	17.527020	34.17	0.94
Reach 1	300	100yr	57	2439.95	2440.65	2440.65	2440.90	0.021629	4.87	16.182060	33.70	1.03
Reach 1	200	100yr	57	2437.93	2438.64	2438.59	2438.82	0.018331	4.41	18.377780	38.88	0.95
Reach 1	100	100yr	57	2435.99	2436.37	2436.36	2436.51	0.031105	3.90	20.435900	68.52	1.12
Reach 1	2	100yr	57	2433.42	2434.08	2434.03	2434.26	0.018734	3.52	18.099390	48.66	0.90

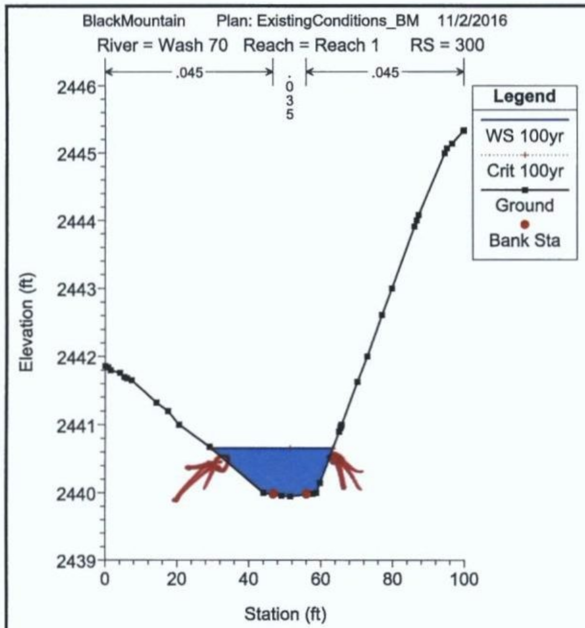

BlackMountain Plan: ExistingConditions_BM 11/2/2016
Wash 70 Reach 1
Legend
WS 100yr
Crit 100yr
Ground
Elevation (ft)
2475
2470
2465
2460
2455
2450
2445
2440
2435
2430
100
200
300
402
492
600
700
800
900
993
1055
1122
1160
1200
1249
1325
1397
1481
1575
1645
1694
0
200
400
600
800
1000
1200
1400
1600
1800
Main Channel Distance (ft)

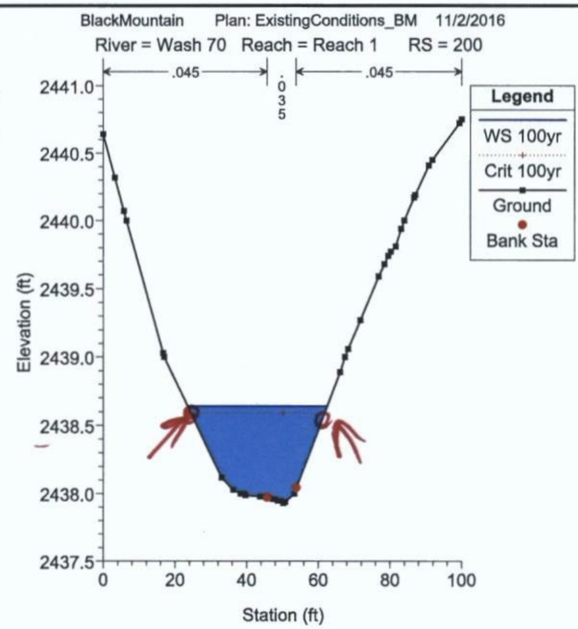

BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1694
.045
.035
.045
Legend
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1645
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1575
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1481
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1397
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1325

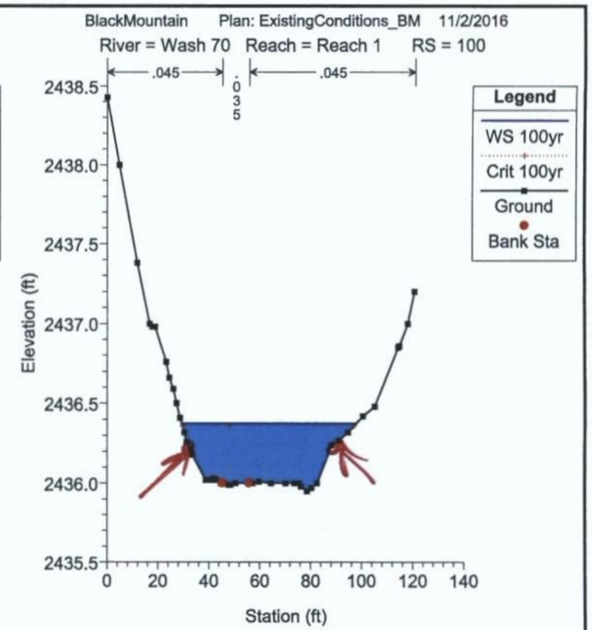


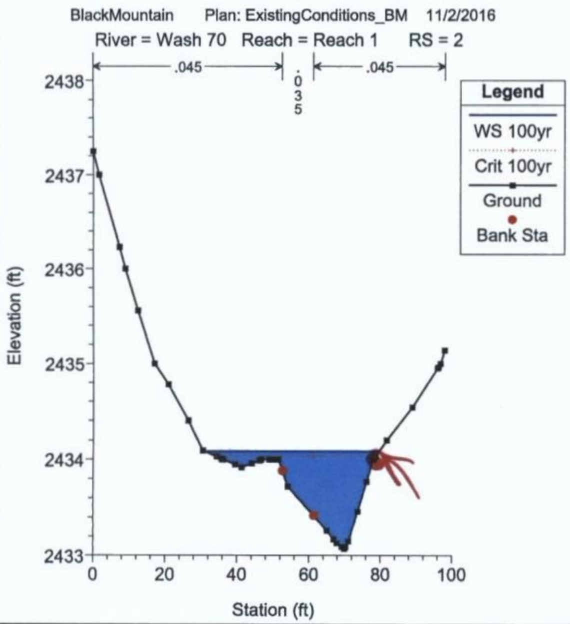
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1249
.045
.035
.045
Legend
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1200
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1160
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1122
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 1055
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 993


BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 900
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 800
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 700
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 600
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 492
BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 402
.045
.035
Legend
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 300
.045
.035
.045
Legend
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

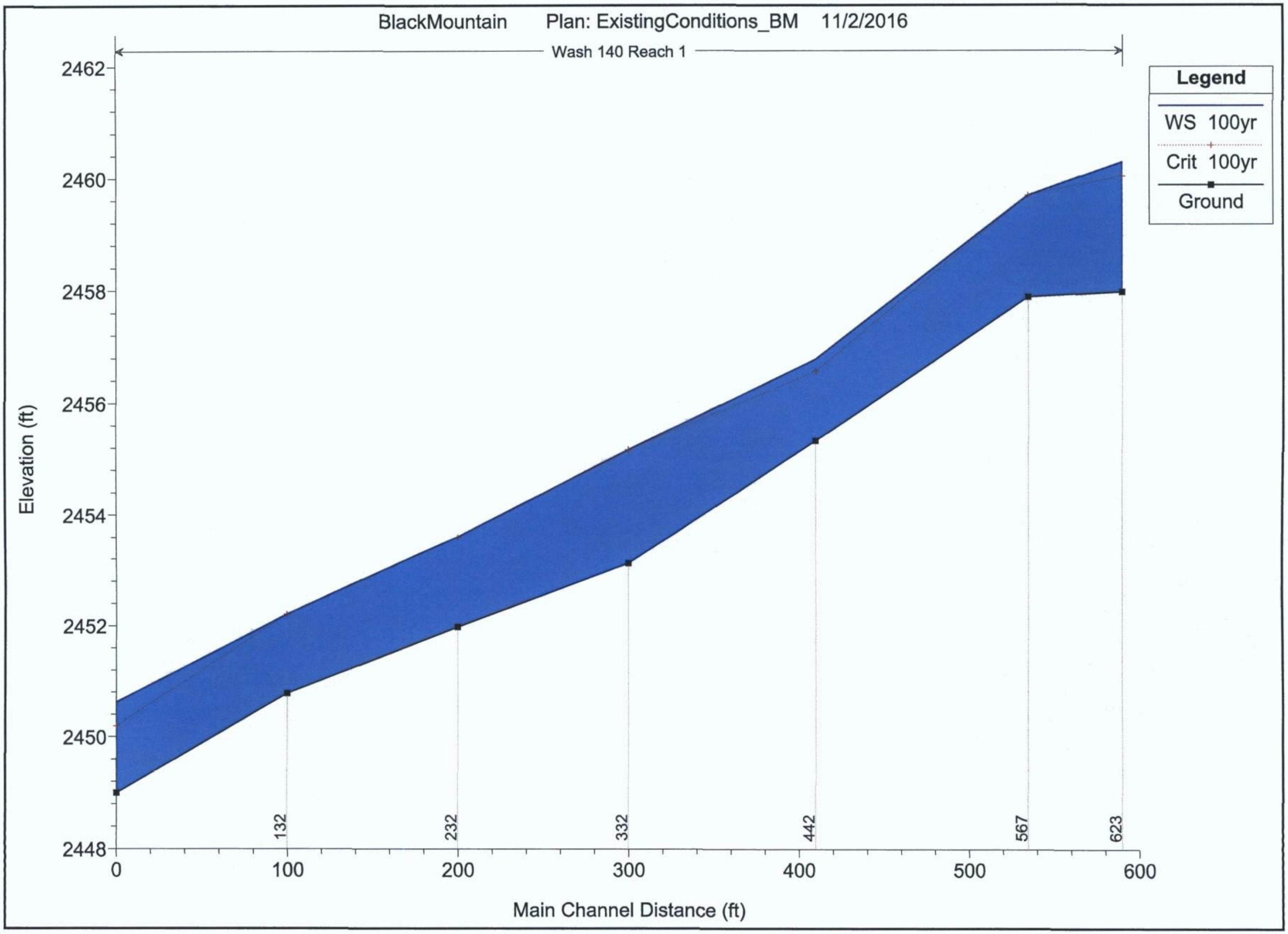

BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 200
.045
.035
.045
Legend
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 100
.045
.035
.045
Legend
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

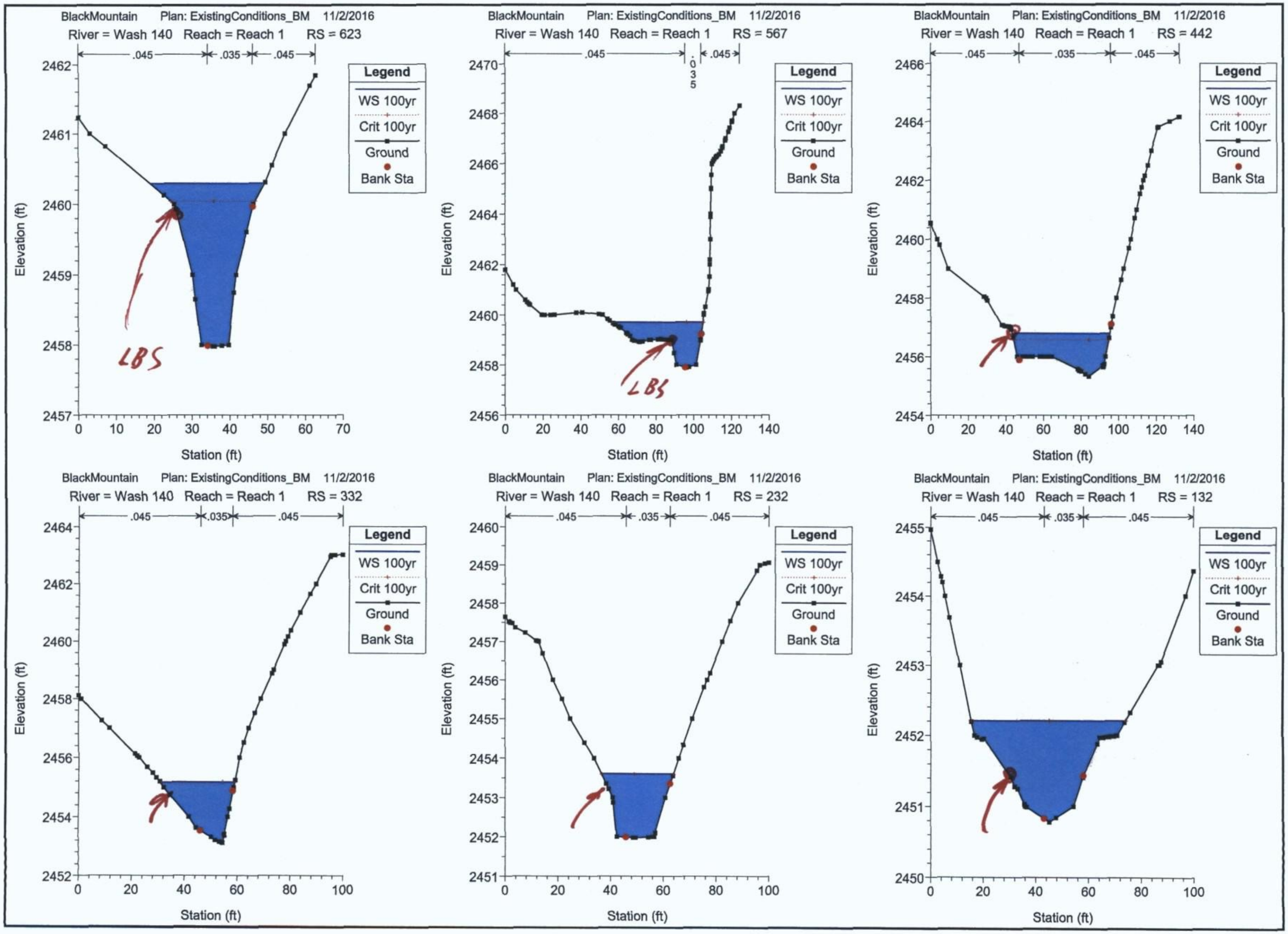

BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 70 Reach = Reach 1 RS = 2
.045
.035
.045
Legend
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

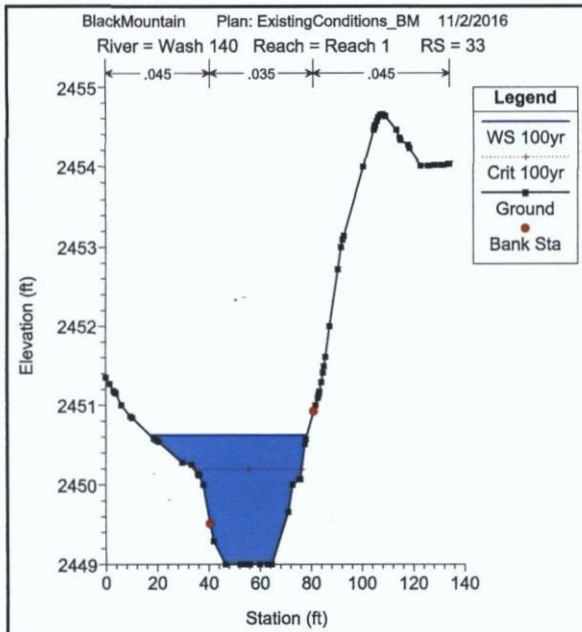
HEC-RAS Plan: ExistingCond River: Wash 140 Reach: Reach 1 Profile: 100yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	623	100yr	187	2457.98	2460.29	2460.04	2460.94	0.014948	7.13	33.054720	30.27	0.98
Reach 1	567	100yr	187	2457.89	2459.70	2459.70	2460.13	0.014955	6.80	42.690110	48.43	0.96
Reach 1	442	100yr	187	2455.33	2456.79	2456.57	2457.02	0.008659	3.89	49.129730	51.88	0.69
Reach 1	332	100yr	187	2453.12	2455.17	2455.17	2455.79	0.014612	7.02	33.144140	28.11	0.96
Reach 1	232	100yr	187	2451.98	2453.60	2453.59	2454.22	0.017044	6.75	31.402220	27.38	1.02
Reach 1	132	100yr	187	2450.78	2452.21	2452.21	2452.58	0.014323	5.87	44.602770	58.77	0.93
Reach 1	33	100yr	187	2449.00	2450.62	2450.19	2450.81	0.005001	3.59	57.450110	60.98	0.55


BlackMountain Plan: ExistingConditions_BM 11/2/2016
Wash 140 Reach 1
Legend
WS 100yr
Crit 100yr
Ground
Elevation (ft)
2462
2460
2458
2456
2454
2452
2450
2448
132
232
332
442
567
623
0
100
200
300
400
500
600
Main Channel Distance (ft)

SUBMIT DIGITAL HEC-RAS
MODEL. REVISE BANK STATIONS. (TYP)





BlackMountain Plan: ExistingConditions_BM 11/2/2016
River = Wash 140 Reach = Reach 1 RS = 33
.045
.035
.045
Legend
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
2455
2454
2453
2452
2451
2450
2449
0
20
40
60
80
100
120
140

Culvert Designer/Analyzer Report
Entrance

Analysis Component			
Storm Event	Design	Discharge	46.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	46.00 cfs	Check Discharge	0.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	46.00 cfs	Bottom Elevation	63.00 ft
Depth	0.83 ft	Velocity	4.15 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-24 inch Circular	46.00 cfs	68.44 ft	12.32 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Entrance

Component:Culvert-1

Culvert Summary

Computed Headwater Eleva	68.44 ft	Discharge	46.00 cfs
Inlet Control HW Elev.	68.44 ft	Tailwater Elevation	63.83 ft
Outlet Control HW Elev.	68.22 ft	Control Type	Inlet Control
Headwater Depth/Height	1.72		

Grades

Upstream Invert	65.00 ft	Downstream Invert	63.00 ft
Length	60.00 ft	Constructed Slope	0.033333 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	1.15 ft
Slope Type	Steep	Normal Depth	1.07 ft
Flow Regime	Supercritical	Critical Depth	1.71 ft
Velocity Downstream	12.32 ft/s	Critical Slope	0.009682 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	2		

Outlet Control Properties

Outlet Control HW Elev.	68.22 ft	Upstream Velocity Head	1.01 ft
Ke	0.50	Entrance Loss	0.50 ft

Inlet Control Properties

Inlet Control HW Elev.	68.44 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	6.3 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Lot 4

Analysis Component			
Storm Event	Design	Discharge	19.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	19.00 cfs	Check Discharge	0.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	19.00 cfs	Bottom Elevation	67.00 ft
Depth	0.62 ft	Velocity	2.44 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-24 inch Circular	19.00 cfs	70.29 ft	7.46 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
Lot 4

Component:Culvert-1

Culvert Summary

Computed Headwater Eleva	70.29 ft	Discharge	19.00 cfs
Inlet Control HW Elev.	70.29 ft	Tailwater Elevation	67.62 ft
Outlet Control HW Elev.	70.27 ft	Control Type	Inlet Control
Headwater Depth/Height	1.39		

Grades

Upstream Invert	67.50 ft	Downstream Invert	67.00 ft
Length	60.00 ft	Constructed Slope	0.008333 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	1.51 ft
Slope Type	Steep	Normal Depth	1.51 ft
Flow Regime	Supercritical	Critical Depth	1.57 ft
Velocity Downstream	7.46 ft/s	Critical Slope	0.007688 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	70.27 ft	Upstream Velocity Head	0.80 ft
Ke	0.50	Entrance Loss	0.40 ft

Inlet Control Properties

Inlet Control HW Elev.	70.29 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	3.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Appendix D

Exhibits

GRAPHIC SCALE IN FEET

NORTH

RESERVE AT BLACK MOUNTAIN
FIGURE 1
CONTEXT AERIAL
MAP
DATE: 11/1/2016
SCOTTSDALE, ARIZONA

Kimley»Horn

K:\PHX_Civil\291015001 - Black Mountain\CADD\Exhibits\Drainage Fig 1 Context Aeiral.dwg Nov 01, 2016 kyle.campbell


84th St
86th Pl
87th Pl
Hawknest Rd
Arroyo Seco Rd
Cavalry Dr
Pima Rd
HW 4C
Pipe 4
HW 4A
CB 4B
HW 5B
Culvert 5
XS 3
COFF 15
OFF 15
ROFF 15
Channel 2
CON 02
ON 02
OFF 05
RON 02
Channel 1
Q2 Pre = 11
Q2 Post = 12
Q10 Pre = 31
Q10 Post = 31
Q100 Pre = 73
Q100 Post = 69
CON 05
Channel 3
HW 5A
ON 05
CB 3A
HW 8B
Culvert 8
HW 8A
MH 3B
Pipe 3
XS 2
ON 10
Culvert 2
CON 10
RON 10
CON 08
Channel 4B
RET 10
Basin 1
HW = 2483.76
Q2 Pre = 7
Q2 Post = 3
Q10 Pre = 20
Q10 Post = 7
Q100 Pre = 48
Q100 Post = 29
XS 4
Weir/Spillway 1
HW 3C
RON 08
OFF 10
ON 08
Channel 4A
Culvert 7
Curb Opening 1
HW 7A
HW 7B
HW 6A
Culvert 6
ON 20
XS 2
Weir/Spillway 2
(Emergency Spillway)
CB 9A
Channel 6
Channel 5
Curb Opening 2
RET 20
Basin 2
HW = 2484.87
HW 6B
Pipe 9
ON 15
ON 25
Weir Structure 1A
Culvert 1
Q2 Pre = 4
Q2 Post = 3
Q10 Pre = 12
Q10 Post = 7
Q100 Pre = 29
Q100 Post = 23
Q2 Pre = 3
Q2 Post = 4
Q10 Pre = 8
Q10 Post = 8
Q100 Pre = 17
Q100 Post = 16
Q2 Pre = 1
Q2 Post = 1
Q10 Pre = 3
Q10 Post = 3
Q100 Pre = 6
Q100 Post = 6
LEGEND
ON XX HEC-1 SUB-BASIN ID
RON XX HEC-1 ROUTE ID
CON XX HEC-1 CONCENTRATION POINT ID
RET 10 HEC-1 RETENTION BASIN ID
FLOW DIRECTION
FLOWPATH
SUB-BASIN
N
W
E
S
0 50 100 200
Feet
Kimley»Horn
2014 KIMLEY-HORN AND ASSOCIATES, INC.
Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500
SCALE(H): 1"= 100
SCALE(V): NA
DESIGNED BY: MAW
DRAWN BY: JAG
CHECKED BY: MAW
DATE: MAY 2014
CITY OF SCOTTSDALE
ANDALUZA
PROPOSED CONDITIONS
FIGURE 4
PROJECT NO.
191069015
DRAWING NAME
Proposed_Conditions.mxd

Soils Map

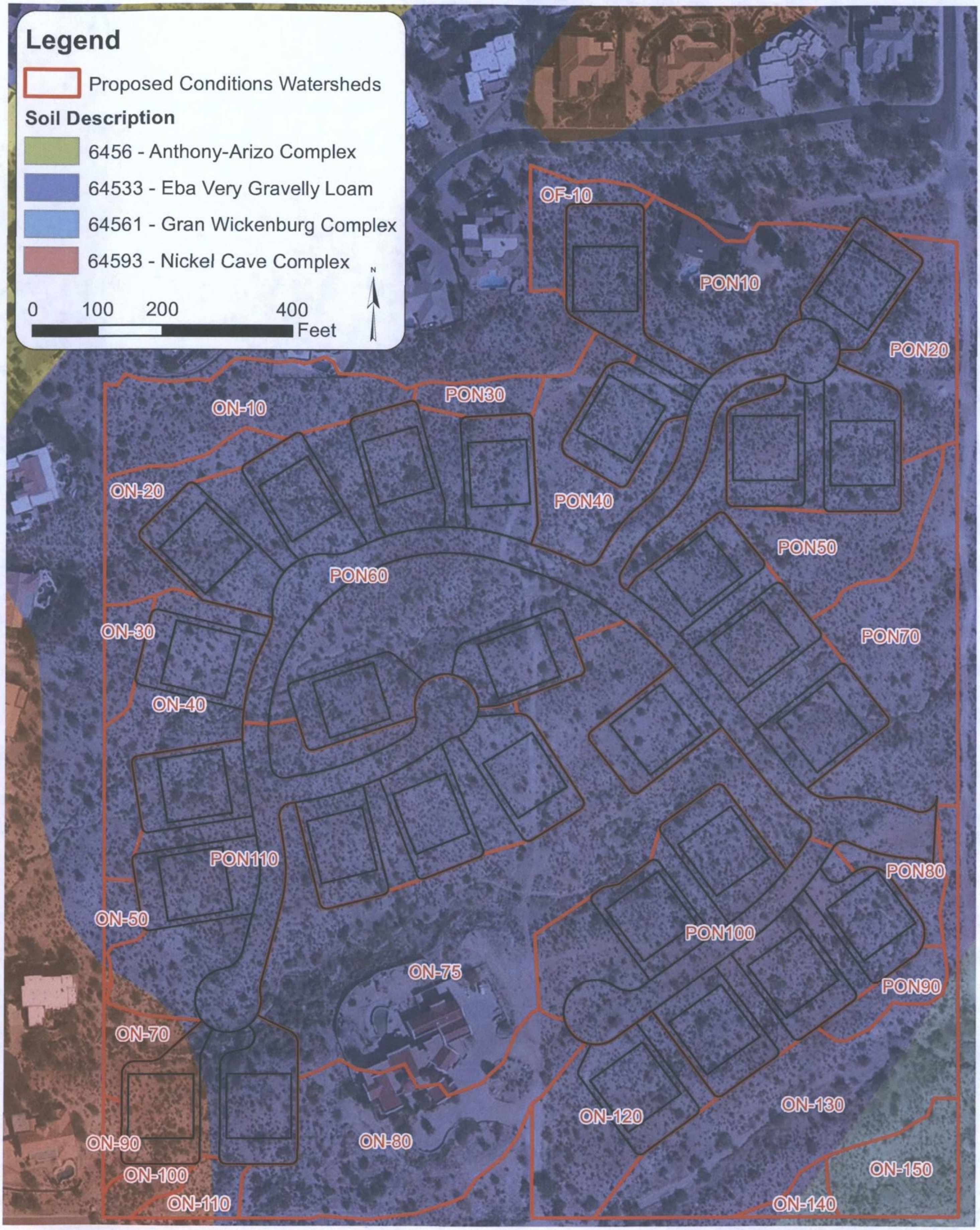
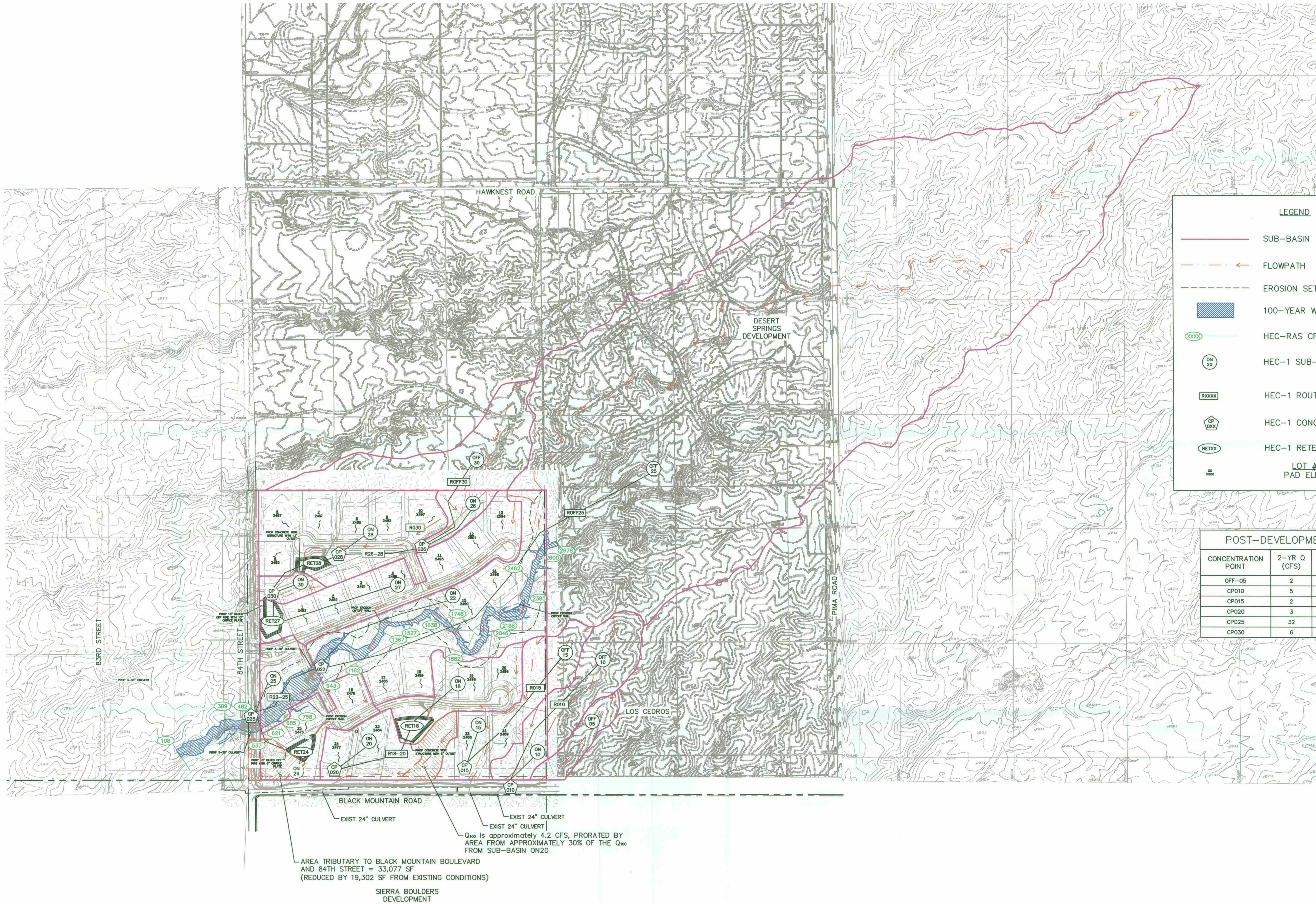


FIGURE 4

Kimley»Horn

RESERVE AT BLACK MOUNTAIN



LEGEND

- SUB-BASIN
- FLOWPATH
- EROSION SETBACK
- 100-YEAR WATER SURFACE LIMITS
- HEC-RAS CROSS SECTION
- HEC-1 SUB-BASIN ID
- HEC-1 ROUTE ID
- HEC-1 CONCENTRATION POINT ID
- HEC-1 RETENTION BASIN ID
- LOT # / PAD ELEV

POST-DEVELOPMENT RUNOFF

CONCENTRATION POINT	2-YR Q (CFS)	10-YR Q (CFS)	100-YR Q (CFS)
OFF-05	2	3	6
CP010	5	9	17
CP015	2	5	11
CP020	3	7	15
CP025	32	78	186
CP030	6	17	43

GRAPHIC SCALE
200 0 100 200 400
(IN FEET)

NO.	REVISION	BY	DATE	APPR.

Kimley-Horn
© 2014 KIMLEY-HORN AND ASSOCIATES, INC.
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE (H): 1"=200'
SCALE (V): NONE
DESIGNED BY: ZRS
DRAWN BY: ZRS
CHECKED BY: ZRS
DATE: MAY 2014

CITY OF SCOTTSDALE
SIERRA HIGHLANDS
PROPOSED CONDITIONS
FIGURE 4

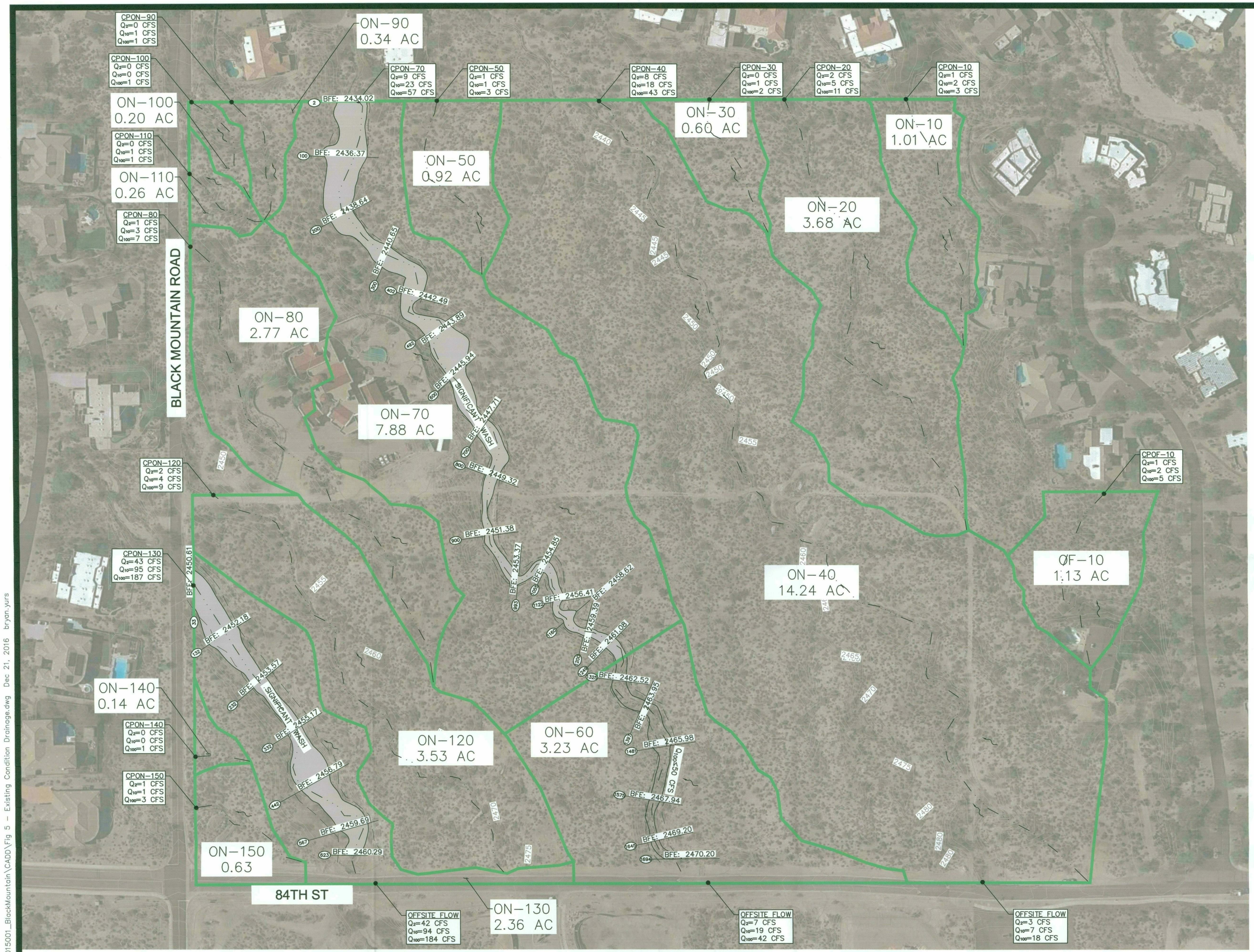
FIGURE 3 1-17-2014

PROJECT NO.
191822000

DRAWING NAME
FIGURE 4

1 OF 1

K:\PHX_Civil\191822000-Sierra Highlands\CADD\Exhibits\WolfRes\Proposed_Drainage_Map.dwg Nov 21, 2014 derrick.turner



EXISTING RUNOFF (CFS)			
CP	2 YEAR	10 YEAR	100 YEAR
OF-10	1	2	5
ON-10	1	2	3
ON-20	2	5	11
ON-30	0	1	2
ON-40	8	18	43
ON-50	1	1	3
ON-70	9	23	57
ON-80	1	3	7
ON-90	0	1	1
ON-100	0	0	1
ON-110	0	1	1
ON-120	2	4	9
ON-130	43	95	187
ON-140	0	0	1
ON-150	1	1	3

GRAPHIC SCALE IN FEET
0 40 80 160

NORTH

LEGEND

- SUB-BASIN LIMIT
- STREAM CENTERLINE
- EROSION HAZARD SETBACK
- FLOW ARROW
- SIGNIFICANT WASH LIMITS
- (938) HEC-RAS RIVER STATION

RESERVE AT BLACK MOUNTAIN
FIGURE 5
EXISTING CONDITIONS
DRAINAGE MAP
DATE: 12/21/2016
SCOTTSDALE, ARIZONA

Kimley»Horn

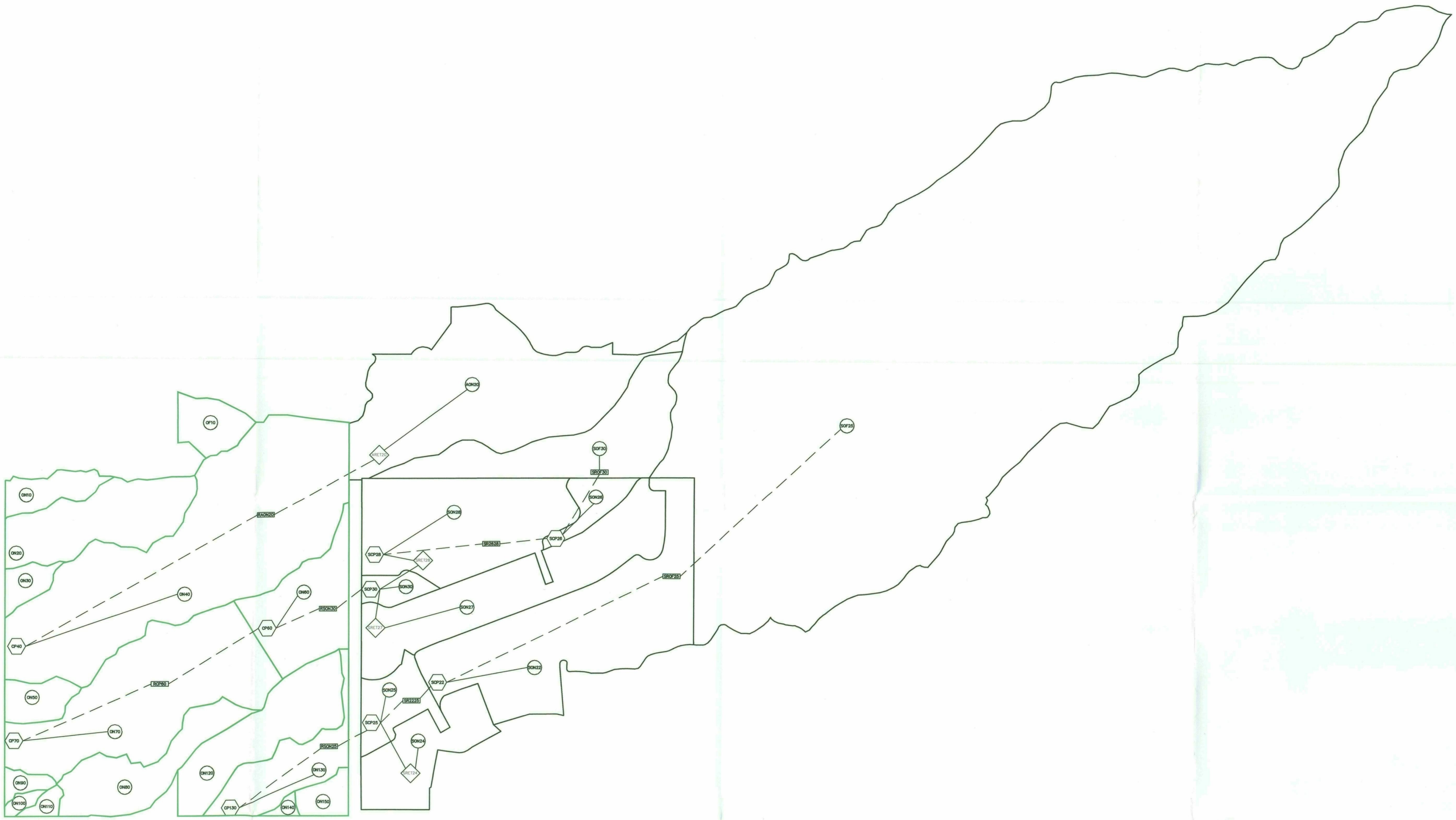
K:\TUC_WaterResources\Shift\PHX\291015001_BlackMountain\CADD\Fig 5 - Existing Condition Drainage.dwg Dec 21, 2016 bryan.yurs

Proposed Conditions Land Use Map

FIGURE 7

Kimley»Horn

RESERVE AT BLACK MOUNTAIN



LEGEND

- ONSITE SUB-BASIN LIMIT
- OFFSITE SUBBASIN LIMIT
- XXXX HEC-1 SUBBASIN ID
- XXXX HEC-1 ROUTE ID
- XXXX HEC-1 DETENTION BASIN
- XXXX HEC-1 CONCENTRATION POINT

GRAPHIC SCALE IN FEET
0 100 200 400

NORTH

RESERVE AT BLACK MOUNTAIN
FIGURE 6
EXISTING CONDITIONS
HEC-1 SCHEMATIC
DATE: 12/21/2016
SCOTTSDALE, ARIZONA

Kimley»Horn

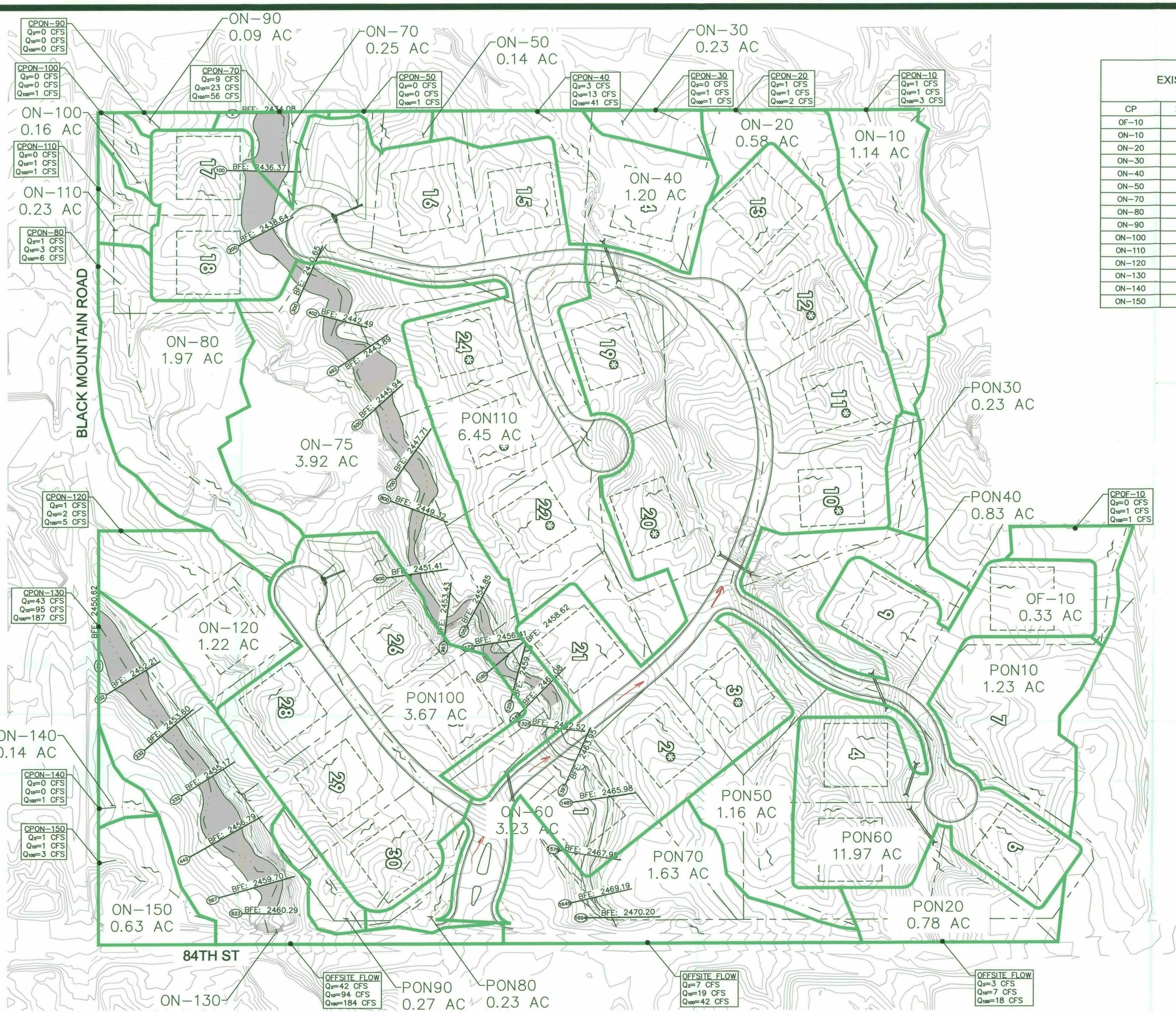
K:\TUC_WaterResources\Shift\PHX\291015001_BlackMountain\CADD\Fig 6 - HEC1 Existing.dwg Dec 21, 2016 bryan.yurs

ADD COLUMN FOR PROPOSED CONDITION NODE NAME WHEN DIFFERENT THAN EX CONDITION.

	EXISTING RUNOFF (CFS)			PROPOSED RUNOFF (CFS)		
CP	2 YEAR	10 YEAR	100 YEAR	2 YEAR	10 YEAR	100 YEAR
OF-10	1	2	5	0	1	1
ON-10	1	2	3	1	1	3
ON-20	2	5	11	0	1	2
ON-30	0	1	2	0	1	1
ON-40	8	18	43	3	13	41
ON-50	1	1	3	0	0	1
ON-70	9	23	57	9	23	~~56~~ 55
ON-80	1	3	7	1	3	6
ON-90	0	1	1	0	0	0
ON-100	0	0	1	0	0	1
ON-110	0	1	1	0	1	1
ON-120	2	4	9	1	2	5
ON-130	43	95	187	43	95	~~187~~ 180 ?
ON-140	0	0	1	0	0	1
ON-150	1	1	3	1	1	3

Node 5cP022?

• ADD PROPOSED CONTOUR LAYER.



LEGEND

SUB-BASIN LIMIT	BUILDING ENVELOPE
STREAM CENTERLINE	SIGNIFICANT WASH LIMITS
EROSION HAZARD SETBACK	HEC-RAS RIVER STATION
FLOW ARROW	

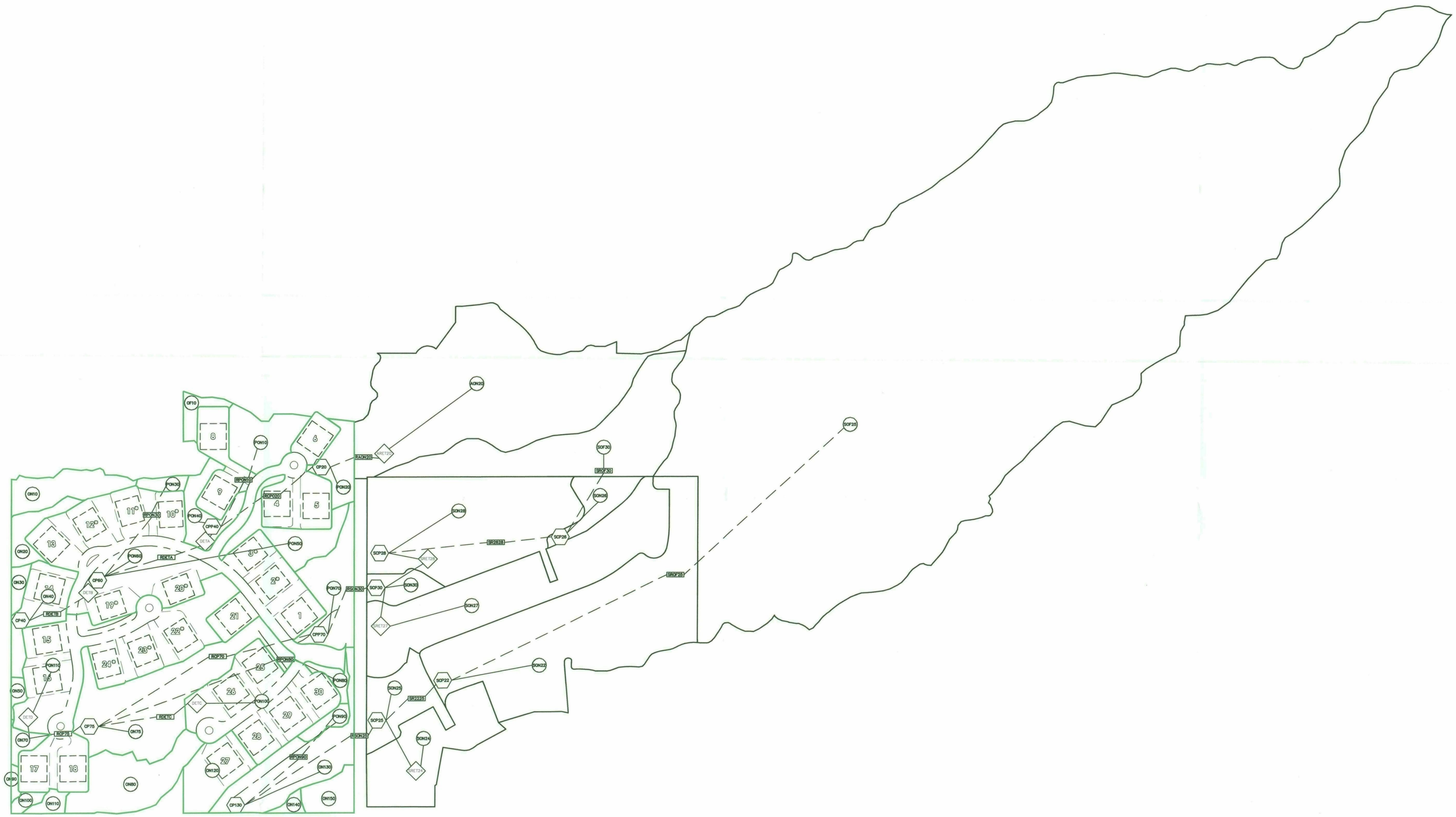
GRAPHIC SCALE IN FEET
0 40 80 160

NORTH

RESERVE AT BLACK MOUNTAIN
FIGURE 8
PROPOSED CONDITIONS
DRAINAGE MAP
DATE: 12/21/2016
SCOTTSDALE, ARIZONA

Kimley»Horn

K:\TUC_WaterResources\Shift\PHX\291015001_BlackMountain\CADD\Fig 8 - Proposed Conditions Drainage.dwg Dec 21, 2016 bryan.yurs



LEGEND

- ONSITE SUB-BASIN LIMIT
- OFFSITE SUBBASIN LIMIT
- XXXX HEC-1 SUBBASIN ID
- XXXX HEC-1 ROUTE ID
- XXXX HEC-1 DETENTION BASIN
- XXXX HEC-1 CONCENTRATION POINT

GRAPHIC SCALE IN FEET
0 100 200 400

NORTH

RESERVE AT BLACK MOUNTAIN
FIGURE 9
PROPOSED CONDITIONS
HEC-1 SCHEMATIC
DATE: 12/22/2016
SCOTTSDALE, ARIZONA

Kimley»Horn

K:\TUC_WaterResources\Shift\PHX\291015001_BlackMountain\CADD\Fig 9 - HEC1 Proposed.dwg Dec 22, 2016 bryan.yurs

Appendix E

Stormwater Storage Waiver

Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

___ - PA - ___ ___ - ZN - ___ ___ - UP - ___ ___ - DR - ___ ___ - PP - ___ PC# ___

The applicant/developer must complete and submit this form to the city for processing and obtain approval of waiver request ***before submitting improvement plans.*** Denial of the waiver may require the developer to submit a revised site plan to the Development Review Board.

Date 01/04/2016 **Project Name** Reserve at Black Mountain

Project Location Northwest corner of Black Mountain Road and 84th Street

Applicant Contact Andrew Jupp **Company Name** Kimley-Horn and Associates

Phone 602-994-7423 Fax 602-944-7423 E-mail andrew.jupp@kimley-horn.com

Address 7740 N. 16th Street, Suite 300, Phoenix, AZ 85020

Waiver Criteria

A project must meet at least one of three criteria listed below for the city to consider waiving some or all required stormwater storage. **However, regardless of the criteria, a waiver will only be granted if the applicant can demonstrate that the effect of a waiver will not increase the potential for flooding on any property.** Check the applicable box and provide a signed engineering report and supporting engineering analysis that demonstrate the project meets the criteria and that the effect of a waiver will not increase the potential for flooding on any property.

If the runoff for the project has been included in a storage facility at another location, the applicant must demonstrate that the stormwater storage facility was specifically designed to accommodate runoff from the subject property and that the runoff will be conveyed to this location through an adequately designed conveyance facility.

☐ 1. The development is adjacent to a conveyance facility that an engineering analysis shows is designed and constructed to handle the additional runoff from the site as a result of development.

☐ 2. The development is on a parcel less than one-half acre in size.

☑ 3. Stormwater storage requirements conflict with requirements of the Environmentally Sensitive Lands Ordinance (ESLO).

For a full storage waiver, a conflict with ESLO is limited to:

- Property located in the hillside landform as defined in the city Zoning Ordinance
- Property in the upper desert landform that has a land slope steeper than 5% as defined in the city Zoning Ordinance
- Property within the ESL zoning overlay district where the only viable location for a stormwater storage basin requires blasting

This full waiver only applies to those portions of property meeting one of these three requirements.

Partial waivers are available for projects or portions of properties within the Environmentally Sensitive Lands Zoning Overlay District, not meeting any of the three full waiver criteria above, if post-development peak discharge rates do not exceed pre-development conditions, based on the 10- and 100-year storm events.

By signing below, I certify that the stated project meets the waiver criteria selected above as demonstrated by the attached documentation.

[signature] 1/3/17

Engineer Date

Planning, Neighborhood & Transportation Division

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781

Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

___ - PA - ____ ____ - ZN - ____ ____ - UP - ____ ____ - DR - ____ ____ - PP - ____ PC#________

CITY STAFF TO COMPLETE THIS PAGE

Project Name ______________________________

Check Appropriate Boxes:

☐ Meets waiver criteria (specify): ☐ 1 ☐ 2 ☐ 3

☐ Recommend approve waiver.

☐ Recommend deny waiver:
- ☐ None of waiver criteria met.
- ☐ Downstream conditions prohibit waiver of any storage.
- ☐ Other:

Explain: ______________________________

____

☐ Return waiver request:
- ☐ Insufficient data provided.
- ☐ Other: ______________________________

Explain: ______________________________

____

Recommended Conditions of Waiver:

☐ All storage requirements waived.

☐ Post-development peak discharge rates do not exceed pre-development conditions.

☐ Other:

Explain: ______________________________

____

☐ **Waiver approved per above conditions.**

☐ **Waiver denied.**

______________________________ ______________

Floodplain Administrator or Designee Date

Planning, Neighborhood & Transportation Division

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781

Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

___ - PA - ___ ___ - ZN - ___ ___ - UP - ___ ___ - DR - ___ ___ - PP - ___ PC#___

In-Lieu Fee and In-Kind Contributions

In-lieu fees are only applicable to projects where post-development peak discharge rates exceed pre-development levels, based on the 10- and 100-year storm events. If the city grants a waiver, the developer is required to calculate and contribute an in-lieu fee based on what it would cost the city to provide a storage basin, sized as described below, including costs such as land acquisition, construction, landscaping, design, construction management, and maintenance over a 75-year design life. The fee for this cost is $1.87 per cubic foot of stormwater storage for a virtual storage basin designed to mitigate the increase in runoff associated with the 100-year/2-hour storm event. The applicant may submit site-specific in-lieu fee calculations subject to the Floodplain Administrator's approval.

The Floodplain Administrator considers in-kind contributions on a case-by-case basis. An in-kind contribution can serve as part of or instead of the calculated in-lieu fee. In-kind contributions must be stormwater related and must constitute a public benefit. In-lieu fees and in-kind contributions are subject to the approval of the Floodplain Administrator or designee.

Project Name ___________________________

The waived stormwater storage volume is calculated using a simplified approach as follows:

$V = \Delta CRA$; where

V = stormwater storage volume required, in cubic feet,
ΔC = increase in weighted average runoff coefficient over disturbed area ($C_{post} - C_{pre}$),
R = 100-year/2-hour precipitation depth, in feet (DSPM, Appendix 4-1D, page 11), and
A = area of disturbed ground, in square feet

Furthermore,

$V_w = V - V_p$; where
V_w = volume waived,
V = volume required, and
V_p = volume provided

R = ___________
ΔC = ___________
A = ___________
V = ___________
V_p = ___________
V_w = ___________

☐ An in-lieu fee will be paid, based on the following calculations and supporting documentation:
In-lieu fee ($) = V_w (cu. ft.) x $1.87 per cubic foot = ___________

☐ An in-kind contribution will be made, as follows:

____
____
____

☑ No in-lieu fee is required. Reason:
Stormwater storage requirements conflict with requirements of the Environmentally Sensitive Land Ordinance (ESLO).
____

Approved by:

___________________________ ___________
Floodplain Administrator or Designee Date

Planning, Neighborhood & Transportation Division

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781

WATER BASIS OF DESIGN

RESERVE AT Black Mountain

Accepted For:
City of Scottsdale
Water Resources Department
9379 E. San Salvador
Scottsdale, Arizona

By: R. SACKS
Date: 2/16/17

Prepared for:

Pinnacle Land Development, LLC
7440 E. Pinnacle Peak Road
Scottsdale, AZ 85255

Prepared by:

Kimley-Horn and Associates, Inc.
7740 N. 16th Street, Suite 300
Phoenix, Arizona 85020

Kimley»Horn

29101500
December 2016

Preliminary Water Basis of Design

RESERVE AT BLACK MOUNTAIN

Registered Professional Engineer (Civil)
CERTIFICATE NO.
49272
ANDREW M.
JUPP
Date Signed 12/22/16
ARIZONA, U.S.A.
Exp. Date 03/31/18

DECEMBER 19, 2016

Prepared By:

Kimley»Horn

Contents

Tables

Appendices

INTRODUCTION

INTENT

The purpose of this water report is to support the water system for the proposed Reserve at Black Mountain single-family residential development located at the northwest corner of Black Mountain Road and 84th Street in Scottsdale, Arizona. This report presents the basis of design criteria that will be used for the engineering design of the proposed development utilizing current water design standards and guidelines set forth by the City of Scottsdale, Arizona.

PROJECT DESCRIPTION

Black Mountain is located within Section 1 of Township 5 North, Range 4 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. The site is bound to the South by Black Mountain Road and 84th Street to the east. The site is surrounded by existing single family residential developments. See **Appendix A: Site Location Map.**

Black Mountain is a proposed 36-acre single-family residential subdivision, consisting of 30 new single-family residential units. The proposed zoning for the project is R1-43 ESL with amended standards with existing zoning of R-190 ESL.

DISTRIBUTION SYSTEM DESCRIPTION

EXISTING DISTRIBUTION SYSTEM

The site is surrounded by existing single-family residential development. Per the City of Scottsdale Quarter Section Map 59-47 there is an existing 12-inch DIP waterline in Black Mountain Road directly to the South of the site. An 12 -inch DIP waterline exists in 84th Street for the northern 620 feet of the adjacent frontage. This main then enters the subdivision to the East of 84th Street and loops down to the main in Black Mountain Road. The remainder of 84th Street does not contain existing waterline adjacent to the site

According to Figure 6.1-3 of the City of Scottsdale Design Standards and Policies Manual (DS&PM), the site is located in Pressure Zone 11 with existing ground elevation ranging from 2440 feet in the south to 2480 feet in the north. A Pressure Reducing Valve is located adjacent to the site in Black Mountain Road approximately 300 feet from the western boundary of the site forming the boundary the pressure zone.

The existing house located in the northeastern portion of site will continue to be serviced from the infrastructure in 84th Street. The house in the middle of the site will continue to be serviced from the infrastructure in Black Mountain Road.

PROPOSED DISTRIBUTION SYSTEM

The proposed Black Mountain site is in pressure zone 11. All lots on site will be serviced from a water main that connects to the existing 12" line east of the PRV in Black Mountain Road and the existing 8" line in 84th Street at Cassandra Way. The proposed on-site distribution system will consist of an 8" Class 350 DIP water line that will provide potable water and fire protection. Refer to **Appendix B** for the Proposed Water System Layout Exhibit.

BASIS OF DESIGN

DESIGN METHODOLOGY

The WaterCAD v8i water system modeling software distributed by Haestad Methods, Inc. was used to model the proposed water network. A fire flow test was performed to determine the residual and static pressures of the existing system. The fire flow test was performed on existing hydrants at 84th Street just south of Black Mountain Road. See **Appendix D** for complete fire flow test results.

According to Section 6-1.407 of the DSPM, distribution systems shall be designed with a minimum residual pressure of 50 psi and a maximum static pressure of 120 psi. For fire flow scenarios, a minimum design pressure of 30 psi is required.

WATER SYSTEM ANALYSIS

The proposed water distribution system was modeled under 4 design scenarios: Average Day, Max Day, Peak Hour and Max Day plus Fire Flow. Average Day Demands are based on Figure 6.1-2 in the DS&PM, with peaking factors per section 6-1.404. A fire flow of 1,000 gpm per section 6-1.501 of the DS&PM was used. See **Table 1** below for a summary of water demands.

Table 1 Water Demands

Land Use	Dwelling units (du)	Average Daily Demand (gpd/du)	Average Daily Flow (gpd)	ADF (gpm)	Max Day Flow (gpd)	MDF (gpm)	Peak Hour Flow (gpd)	PHF (gpm)
<2 du/ac	31	537.64	15,053	10.4	30,107	21.0	52,686	36.6

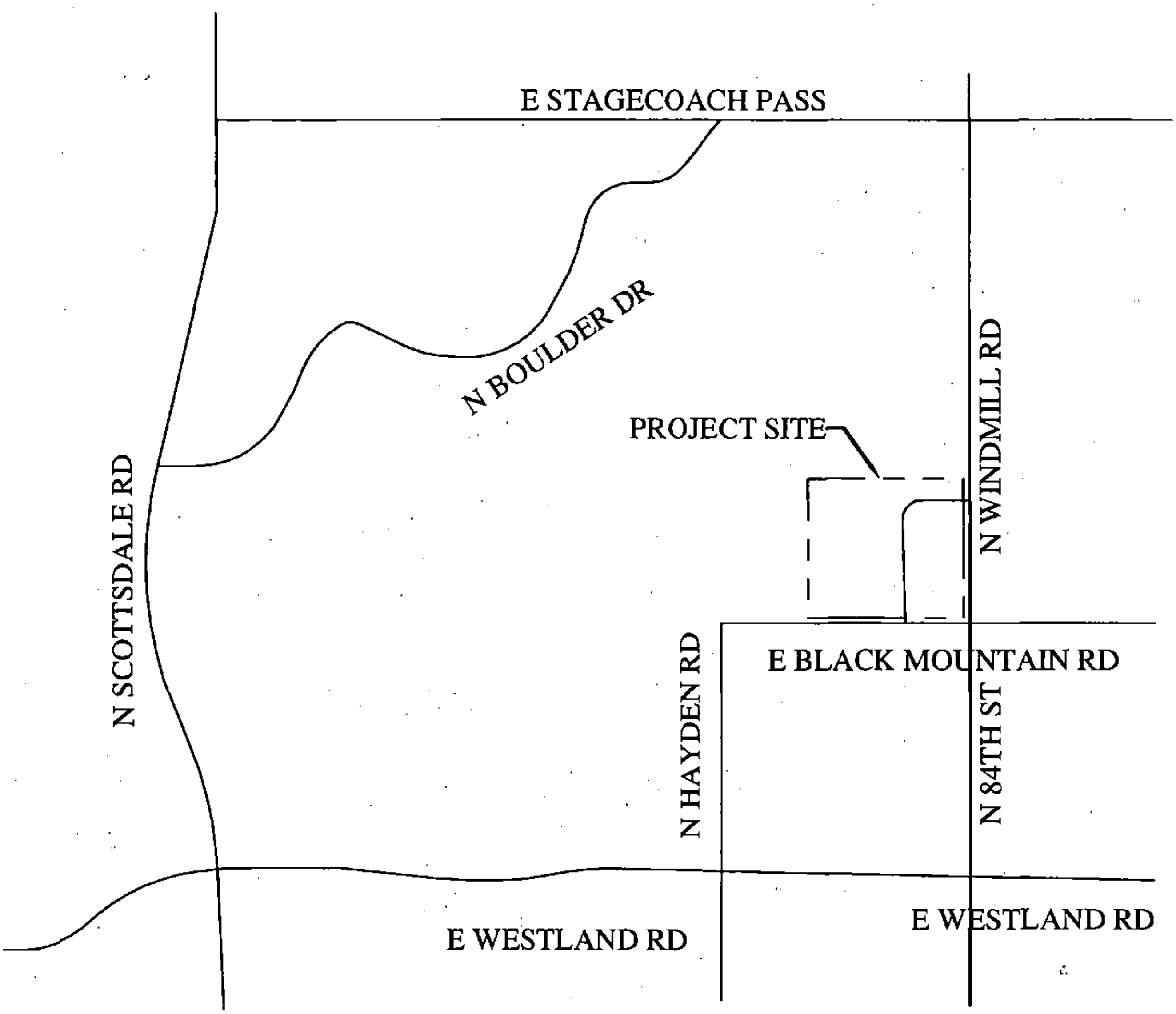
Average Day, Max Day, and Peak Hour Demands are applied at hydraulic model nodes based on number of adjacent proposed units. Fire flow demands are applied to all junctions within the project boundary.

RESULTS

Based on the fire flow tests performed and the results of the WaterCAD analysis, the proposed water system is capable of providing the required domestic flows at pressures ranging from 80 psi to 60 psi in the average day, max day, and peak hour scenarios. The fire flow pressures meet the minimum requirement of 30 psi, ranging from 30 psi to 45 psi.

Refer to **Appendix C** for the WaterCAD results.

Appendix A – Site Location Map



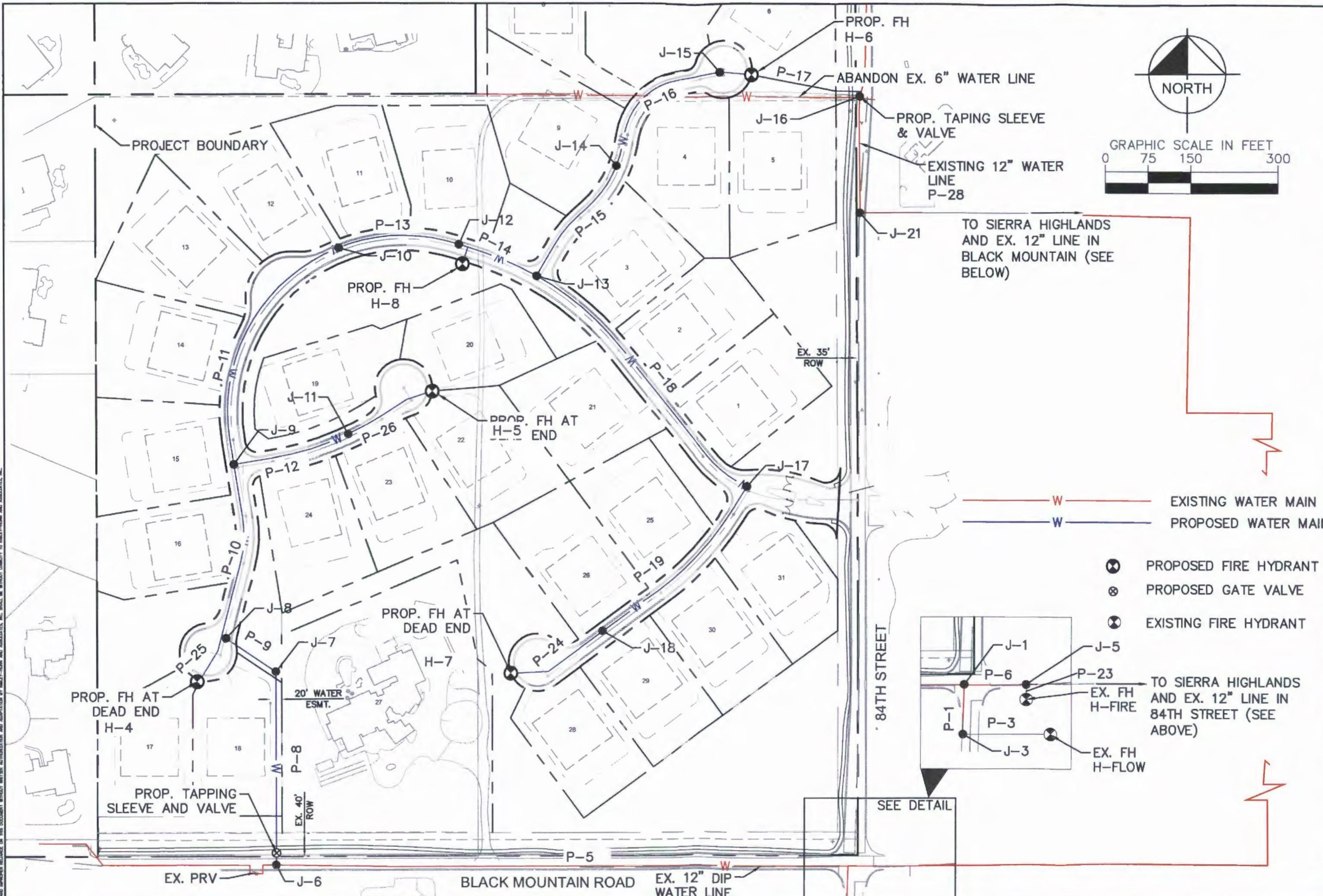
BLACK MOUNTAIN

VICINITY MAP

NTS

Kimley»Horn

Appendix B – Proposed Water System Layout



NO. | REVISION | DATE

Kimley»Horn

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7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE (H): 1"=40'
SCALE (V): NONE
DESIGNED BY:
DRAWN BY:
CHECKED BY:
DATE: DEC 2016

BLACK MOUNTAIN
WATER BOD
WATER SYSTEM LAYOUT
SCOTTSDALE ARIZONA

PROJECT NO.
291015001
DRAWING NAME

1 OF 1

Appendix C – WaterCAD Analysis Results

Average Day

Max Day

Peak Hour

Max Day Plus Fire Flow

Active Scenario: Average Day

FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
32	J-1	2,465.00	0.0000	2,631.59	72
35	J-3	2,460.00	0.0000	2,631.59	74
41	J-5	2,466.00	0.0000	2,631.59	72
42	J-6	2,442.00	0.0000	2,631.59	82
46	J-7	2,442.00	0.0000	2,631.59	82
47	J-8	2,442.00	0.6714	2,631.59	82
48	J-9	2,446.00	1.0071	2,631.59	80
49	J-10	2,451.00	1.3428	2,631.59	78
50	J-11	2,453.00	1.3428	2,631.59	77
51	J-12	2,460.00	0.3357	2,631.59	74
52	J-13	2,465.00	1.0071	2,631.59	72
53	J-14	2,471.00	1.0071	2,631.59	69
54	J-15	2,468.00	1.3428	2,631.59	71
55	J-16	2,482.00	0.0000	2,631.59	65
56	J-17	2,470.00	1.0071	2,631.59	70
57	J-18	2,458.00	1.3428	2,631.59	75
97	J-19	2,446.00	0.0000	2,631.59	80
98	J-20	2,456.00	0.0000	2,631.59	76
99	J-21	2,470.00	0.0000	2,631.59	70

Active Scenario: Average Day
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Headloss (ft)
P-1	199	J-1	J-3	12.0	130.0	0.0000	0.00	0.000	0.00
P-3	231	H-FLOW	J-3	8.0	130.0	0.0000	0.00	0.000	0.00
P-5	1,004	J-6	J-1	12.0	130.0	-5.3268	0.02	0.000	0.00
P-6	48	J-1	J-5	12.0	130.0	-5.3268	0.02	0.000	0.00
P-7	21	J-5	H-FIRE	6.0	130.0	-10.4068	0.12	0.000	0.00
P-8	335	J-6	J-7	8.0	130.0	5.3268	0.03	0.000	0.00
P-9	105	J-7	J-8	8.0	130.0	5.3268	0.03	0.000	0.00
P-10	309	J-8	J-9	8.0	130.0	4.6555	0.03	0.000	0.00
P-11	437	J-9	J-10	8.0	130.0	2.3055	0.01	0.000	0.00
P-13	197	J-10	J-12	8.0	130.0	0.9627	0.01	0.000	0.00
P-14	173	J-12	J-13	8.0	130.0	0.6270	0.00	0.000	0.00
P-15	226	J-13	J-14	8.0	130.0	-2.7301	0.02	0.000	0.00
P-16	308	J-14	J-15	8.0	130.0	-3.7372	0.02	0.000	0.00
P-17	219	J-15	J-16	8.0	130.0	-5.0800	0.03	0.000	0.00
P-18	517	J-13	J-17	8.0	130.0	2.3500	0.01	0.000	0.00
P-19	403	J-17	J-18	8.0	130.0	1.3429	0.01	0.000	0.00
P-22	9	R-1	PMP-1	100.0	130.0	10.4045	0.00	0.000	0.00
P-23	10	PMP-1	H-FIRE	100.0	130.0	10.4040	0.00	0.000	0.00
P-24	122	J-18	H-7	12.0	130.0	0.0001	0.00	0.000	0.00
P-25	94	J-8	H-4	12.0	130.0	-0.0001	0.00	0.000	0.00
P-26	92	J-11	H-5	12.0	130.0	0.0001	0.00	0.000	0.00
P-28	206	J-16	J-21	12.0	130.0	-5.0800	0.01	0.000	0.00
P-29	1,526	J-21	J-20	12.0	130.0	-5.0800	0.01	0.000	0.00
P-30	1,353	J-20	J-19	12.0	130.0	-5.0800	0.01	0.000	0.00
P-31	880	J-19	J-5	12.0	130.0	-5.0800	0.01	0.000	0.00
P-32	25	H-6	J-15	6.0	130.0	0.0000	0.00	0.000	0.00
P-12	276	J-9	J-11	8.0	130.0	1.3429	0.01	0.000	0.00
P-34	23	J-12	H-8	6.0	130.0	0.0000	0.00	0.000	0.00

Active Scenario: Average Day

FlexTable: Pump Table

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)
78	PMP-1	2,466.00	Fire Flow Test	On	2,466.00	2,631.59

Flow (Total) (gpm)	Pump Head (ft)
10.4045	165.59

Active Scenario: Max Day + FF

Fire Flow Node FlexTable: Fire Flow Report

Label	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)
H-FIRE	5	True	1,000.0000	1,287.4022	999.9999	1,287.4022	30	37	30	J-16
H-FLOW	5	True	1,000.0000	1,264.7939	999.9999	1,264.7939	30	36	30	J-16
H-4	5	True	1,000.0000	1,248.5557	999.9999	1,248.5557	30	44	30	J-16
H-5	5	True	1,000.0000	1,241.6906	999.9999	1,241.6906	30	35	30	J-16
H-6	5	True	1,000.0000	1,208.8417	999.9999	1,208.8417	30	32	30	J-16
H-7	20	True	1,000.0000	1,167.1859	999.9999	1,167.1859	30	31	30	J-17
H-8	5	True	1,000.0000	1,227.7716	999.9999	1,227.7716	30	35	30	J-16
J-1	5	True	1,000.0000	1,264.7928	999.9999	1,264.7928	30	37	30	J-16
J-3	5	True	1,000.0000	1,264.7924	999.9999	1,264.7924	30	39	30	J-16
J-5	5	True	1,000.0000	1,265.1691	999.9999	1,265.1691	30	37	30	J-16
J-6	5	True	1,000.0000	1,259.8054	999.9999	1,259.8054	30	46	30	J-16
J-7	5	True	1,000.0000	1,250.9987	999.9999	1,250.9987	30	45	30	J-16
J-8	5	True	1,000.0000	1,248.5549	1,001.3427	1,249.8977	30	45	30	J-16
J-9	5	True	1,000.0000	1,241.6871	1,002.0142	1,243.7013	30	42	30	J-16
J-10	5	True	1,000.0000	1,232.1951	1,002.6855	1,234.8807	30	40	30	J-16
J-11	5	True	1,000.0000	1,241.6920	1,002.6855	1,244.3777	30	36	30	J-16
J-12	5	True	1,000.0000	1,227.7725	1,000.6713	1,228.4437	30	36	30	J-16
J-13	5	True	1,000.0000	1,223.6821	1,002.0142	1,225.6964	30	35	30	J-16
J-14	5	True	1,000.0000	1,217.9137	1,002.0142	1,219.9280	30	33	30	J-16
J-15	5	True	1,000.0000	1,208.8385	1,002.6855	1,211.5242	30	35	30	J-16
J-16	3	True	1,000.0000	1,200.9063	999.9999	1,200.9063	30	30	34	H-6
J-17	3	True	1,000.0000	1,167.5867	1,002.0142	1,169.6010	30	30	33	J-16
J-18	20	True	1,000.0000	1,167.1926	1,002.6855	1,169.8783	30	31	30	J-17
J-19	5	True	1,000.0000	1,246.2762	999.9999	1,246.2762	30	45	30	J-16
J-20	5	True	1,000.0000	1,224.3459	999.9999	1,224.3459	30	41	30	J-16
J-21	5	True	1,000.0000	1,203.5238	999.9999	1,203.5238	30	35	30	J-16

Active Scenario: Max Day

FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
32	J-1	2,465.00	0.0000	2,631.56	72
35	J-3	2,460.00	0.0000	2,631.56	74
41	J-5	2,466.00	0.0000	2,631.56	72
42	J-6	2,442.00	0.0000	2,631.56	82
46	J-7	2,442.00	0.0000	2,631.56	82
47	J-8	2,442.00	1.3430	2,631.56	82
48	J-9	2,446.00	2.0145	2,631.56	80
49	J-10	2,451.00	2.6860	2,631.56	78
50	J-11	2,453.00	2.6860	2,631.56	77
51	J-12	2,460.00	0.6715	2,631.56	74
52	J-13	2,465.00	2.0145	2,631.56	72
53	J-14	2,471.00	2.0145	2,631.56	69
54	J-15	2,468.00	2.6860	2,631.56	71
55	J-16	2,482.00	0.0000	2,631.56	65
56	J-17	2,470.00	2.0145	2,631.56	70
57	J-18	2,458.00	2.6860	2,631.56	75
97	J-19	2,446.00	0.0000	2,631.56	80
98	J-20	2,456.00	0.0000	2,631.56	76
99	J-21	2,470.00	0.0000	2,631.56	70

Active Scenario: Max Day
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Headloss (ft)
P-1	199	J-1	J-3	12.0	130.0	0.0000	0.00	0.000	0.00
P-3	231	H-FLOW	J-3	8.0	130.0	0.0000	0.00	0.000	0.00
P-5	1,004	J-6	J-1	12.0	130.0	-10.6550	0.03	0.000	0.00
P-6	48	J-1	J-5	12.0	130.0	-10.6550	0.03	0.000	0.00
P-7	21	J-5	H-FIRE	6.0	130.0	-20.8165	0.24	0.000	0.00
P-8	335	J-6	J-7	8.0	130.0	10.6550	0.07	0.000	0.00
P-9	105	J-7	J-8	8.0	130.0	10.6550	0.07	0.000	0.00
P-10	309	J-8	J-9	8.0	130.0	9.3120	0.06	0.000	0.00
P-11	437	J-9	J-10	8.0	130.0	4.6115	0.03	0.000	0.00
P-13	197	J-10	J-12	8.0	130.0	1.9255	0.01	0.000	0.00
P-14	173	J-12	J-13	8.0	130.0	1.2540	0.01	0.000	0.00
P-15	226	J-13	J-14	8.0	130.0	-5.4610	0.03	0.000	0.00
P-16	308	J-14	J-15	8.0	130.0	-7.4755	0.05	0.000	0.00
P-17	219	J-15	J-16	8.0	130.0	-10.1616	0.06	0.000	0.00
P-18	517	J-13	J-17	8.0	130.0	4.7006	0.03	0.000	0.00
P-19	403	J-17	J-18	8.0	130.0	2.6861	0.02	0.000	0.00
P-22	9	R-1	PMP-1	100.0	130.0	20.8134	0.00	0.000	0.00
P-23	10	PMP-1	H-FIRE	100.0	130.0	20.8139	0.00	0.000	0.00
P-24	122	J-18	H-7	12.0	130.0	0.0001	0.00	0.000	0.00
P-25	94	J-8	H-4	12.0	130.0	0.0000	0.00	0.000	0.00
P-26	92	J-11	H-5	12.0	130.0	0.0000	0.00	0.000	0.00
P-28	206	J-16	J-21	12.0	130.0	-10.1616	0.03	0.000	0.00
P-29	1,526	J-21	J-20	12.0	130.0	-10.1616	0.03	0.000	0.00
P-30	1,353	J-20	J-19	12.0	130.0	-10.1616	0.03	0.000	0.00
P-31	880	J-19	J-5	12.0	130.0	-10.1616	0.03	0.000	0.00
P-32	25	H-6	J-15	6.0	130.0	0.0000	0.00	0.000	0.00
P-12	276	J-9	J-11	8.0	130.0	2.6860	0.02	0.000	0.00
P-34	23	J-12	H-8	6.0	130.0	0.0000	0.00	0.000	0.00

Active Scenario: Max Day
FlexTable: Pump Table

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)
78	PMP-1	2,466.00	Fire Flow Test	On	2,466.00	2,631.56

Flow (Total) (gpm)	Pump Head (ft)
20.8143	165.56

Active Scenario: Max Day
FlexTable: Reservoir Table

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
74	R-1	2,466.00	<None>	20.8134	2,466.00

Active Scenario: Peak Hour
FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
32	J-1	2,465.00	0.0000	2,631.49	72
35	J-3	2,460.00	0.0000	2,631.49	74
41	J-5	2,466.00	0.0000	2,631.49	72
42	J-6	2,442.00	0.0000	2,631.49	82
46	J-7	2,442.00	0.0000	2,631.48	82
47	J-8	2,442.00	2.3600	2,631.48	82
48	J-9	2,446.00	3.5400	2,631.48	80
49	J-10	2,451.00	4.7200	2,631.48	78
50	J-11	2,453.00	4.7200	2,631.48	77
51	J-12	2,460.00	1.1800	2,631.48	74
52	J-13	2,465.00	3.5400	2,631.48	72
53	J-14	2,471.00	3.5400	2,631.48	69
54	J-15	2,468.00	4.7200	2,631.48	71
55	J-16	2,482.00	0.0000	2,631.48	65
56	J-17	2,470.00	3.5400	2,631.48	70
57	J-18	2,458.00	4.7200	2,631.48	75
97	J-19	2,446.00	0.0000	2,631.49	80
98	J-20	2,456.00	0.0000	2,631.49	76
99	J-21	2,470.00	0.0000	2,631.48	70

Active Scenario: Peak Hour

FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Headloss (ft)
P-1	199	J-1	J-3	12.0	130.0	0.0020	0.00	0.000	0.00
P-3	231	H-FLOW	J-3	8.0	130.0	-0.0020	0.00	0.000	0.00
P-5	1,004	J-6	J-1	12.0	130.0	-18.7294	0.05	0.000	0.00
P-6	48	J-1	J-5	12.0	130.0	-18.7316	0.05	0.000	0.00
P-7	21	J-5	H-FIRE	6.0	130.0	-36.5939	0.42	0.000	0.00
P-8	335	J-6	J-7	8.0	130.0	18.7294	0.12	0.000	0.00
P-9	105	J-7	J-8	8.0	130.0	18.7294	0.12	0.000	0.00
P-10	309	J-8	J-9	8.0	130.0	16.3682	0.10	0.000	0.00
P-11	437	J-9	J-10	8.0	130.0	8.1060	0.05	0.000	0.00
P-13	197	J-10	J-12	8.0	130.0	3.3860	0.02	0.000	0.00
P-14	173	J-12	J-13	8.0	130.0	2.2028	0.01	0.000	0.00
P-15	226	J-13	J-14	8.0	130.0	-9.5994	0.06	0.000	0.00
P-16	308	J-14	J-15	8.0	130.0	-13.1394	0.08	0.000	0.00
P-17	219	J-15	J-16	8.0	130.0	-17.8623	0.11	0.000	0.00
P-18	517	J-13	J-17	8.0	130.0	8.2622	0.05	0.000	0.00
P-19	403	J-17	J-18	8.0	130.0	4.7222	0.03	0.000	0.00
P-22	9	R-1	PMP-1	100.0	130.0	36.5908	0.00	0.000	0.00
P-23	10	PMP-1	H-FIRE	100.0	130.0	36.5923	0.00	0.000	0.00
P-24	122	J-18	H-7	12.0	130.0	0.0020	0.00	0.000	0.00
P-25	94	J-8	H-4	12.0	130.0	0.0020	0.00	0.000	0.00
P-26	92	J-11	H-5	12.0	130.0	0.0020	0.00	0.000	0.00
P-28	206	J-16	J-21	12.0	130.0	-17.8623	0.05	0.000	0.00
P-29	1,526	J-21	J-20	12.0	130.0	-17.8623	0.05	0.000	0.00
P-30	1,353	J-20	J-19	12.0	130.0	-17.8623	0.05	0.000	0.00
P-31	880	J-19	J-5	12.0	130.0	-17.8623	0.05	0.000	0.00
P-32	25	H-6	J-15	6.0	130.0	-0.0020	0.00	0.000	0.00
P-12	276	J-9	J-11	8.0	130.0	4.7222	0.03	0.000	0.00
P-34	23	J-12	H-8	6.0	130.0	0.0020	0.00	0.000	0.00

Active Scenario: Peak Hour

FlexTable: Pump Table

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)
78	PMP-1	2,466.00	Fire Flow Test	On	2,466.00	2,631.49

Flow (Total) (gpm)	Pump Head (ft)
36.5910	165.49

Active Scenario: Peak Hour
FlexTable: Reservoir Table

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
74	R-1	2,466.00	<None>	36.5908	2,466.00

Appendix D – Fire Flow Test Results

E•J
Flow
Tests
FLOW TESTING SERVICES

Flow Test 1 Summary

EJ Flow Tests Project Name:	Sierra Highlands
EJ Flow Tests Project No.:	14101
Project Address:	East Black Mountain Road & North 84th Street, Scottsdale, Arizona 85266
Date of Flow Test:	September 3, 2014
Time of Flow Test:	7:15AM
Data is Current and Reliable Until:	March 3, 2015

City of Scottsdale requires a Maximum Static Pressure of 72 PSI for use as Safety Factor.

Raw Test Data:

Static Pressure: 85.0 psi
(measured in pounds per square inch)

Residual Pressure: 40.0 psi
(measured in pounds per square inch)

Pitot Pressure: 20.0 psi
(measured in pounds per square inch)

Number of Outlets Flowed: 2

Fire Hydrant Orifice Diameter: 2.5 inches
(measured in inches)

Coefficient of Discharge: 0.9
(0.9 smooth/round outlet, 0.8 square/sharp outlet, 0.7 square/raised outlet)

Flowing GPM: 1,501
(measured in gallons per minute)
GPM at 20 PSI: 1,831

Data with minimum safety factor of: 13 PSI :

Static Pressure: 72.0 psi
(measured in pounds per square inch)

Residual Pressure: 27.0 psi
(measured in pounds per square inch)

Main Size: 12 & 8
(measured in inches)

Approximate Distance Between Hydrants: 500 ft
(measured in feet)

Approx. Static/Residual Hydrant Elevation: 2,466 ft
(measured above sea level)

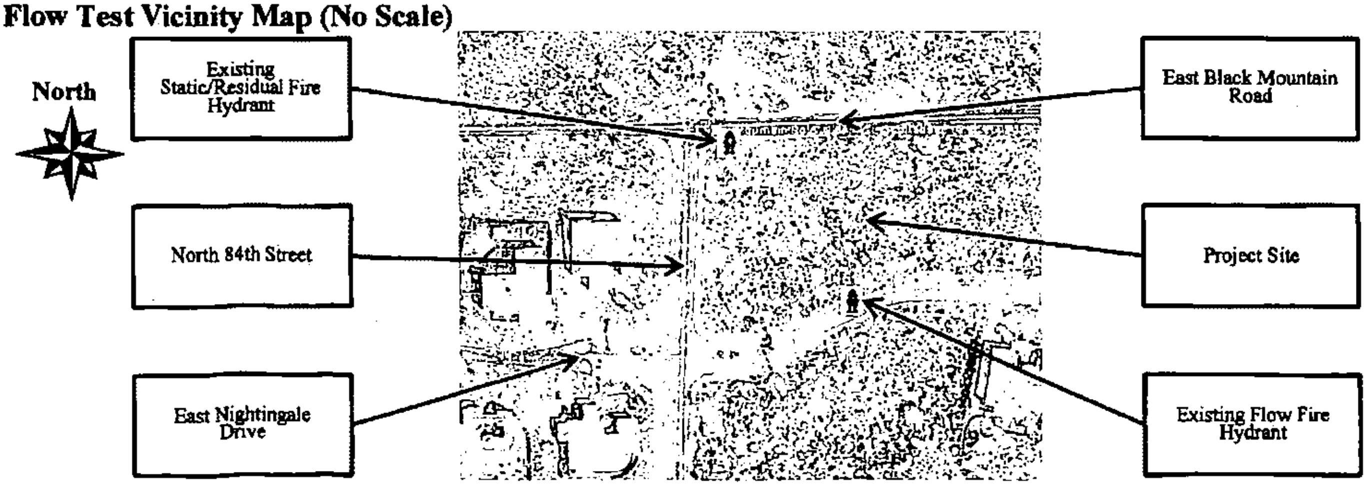
Approx. Flow Hydrant Elevation: 2,461 ft
(measured above sea level)

Flowing GPM: 1,501
(measured in gallons per minute)
GPM at 20 PSI: 1,623

Conducted by/Witnessed by/City Forces Contacted:

Conducted by: John Echeverri & Cesar Reyna (EJ Flow Tests) 602.999.7637
Witnessed by: Jim Tunnell (City of Scottsdale) 602.819.7718
City Forces Contacted: City of Scottsdale (Permit Number: C45828)

Flow Test Vicinity Map (No Scale)



SEWER BASIS OF DESIGN

Reserve at Black Mountain

Accepted For:
City of Scottsdale
Water Resources Department
9379 E. San Salvador
Scottsdale, Arizona

By: R. SACKS
Date: 2/16/17

Prepared for:

Pinnacle Land Development, LLC
7440 E. Pinnacle Peak Road
Scottsdale, AZ 85255

Prepared by:

Kimley-Horn and Associates, Inc.
7740 N. 16th Street, Suite 300
Phoenix, Arizona 85020

Kimley»Horn

29101500
February 17

Sewer Basis of Design

RESERVE AT BLACK MOUNTAIN

Registered Professional Engineer (Civil)
CERTIFICATE NO.
49272
ANDREW M.
JUPP
Date Signed 02/08/17
ARIZONA, U.S.A.
Exp. Date 03/31/18

FEBRUARY 8, 2017

Prepared By:

Kimley»Horn

Contents

Tables

Appendices

INTRODUCTION

INTENT

The purpose of this sewer report is to support the sanitary sewer system for the proposed Reserve at Black Mountain residential development located at the northwest comer of Black Mountain and 84th Street in Scottsdale, Arizona. This report presents the basis of design criteria that will be used for the engineering design of the proposed development utilizing current sewer design standards and guidelines set forth by the City of Scottsdale, Arizona.

PROJECT DESCRIPTION

Reserve at Black Mountain is located within Section 1 of Township 5 North, Range 4 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. The site is bound to the South by Black Mountain Road, to the east by 84th Street, to the north by Vista Viento Estates, and to the west by Sandflower subdivision. See **Appendix A: Site Location Map**

Black Mountain is a proposed 32-acre single family residential subdivision, consisting of 31 single family residential units, 2 of which are existing residential homes. According to the Maricopa County Accessor's website existing zoning is R-190, with proposed zoning of the project to be R1-43 ESL.

DISTRIBUTION SYSTEM DESCRIPTION

EXISTING COLLECTION SYSTEM

The site is surrounded by existing single family residential development. Per the City of Scottsdale Quarter Section Map 59-47 there is an existing 8-inch PVC sewer stub located at the southeast corner of the site in 84th Street at Black Mountain Road. This sewer main is too high to service this site. The existing house on Lot 27 (APN 216-34-268) currently utilizes a septic system, which is to be abandoned and serviced with the proposed gravity system with this project

PROPOSED COLLECTION SYSTEM

The proposed Reserve at Black Mountain gravity sewer system will connect to the City of Scottsdale sewer at the cul-de-sac in Sandflower Drive. Multiple sewer outfall locations have been analyzed in order to avoid extensive hard dig that the geotechnical investigation has discovered along the Black Mountain Road alignment. Please see Appendix D: Geotechnical Investigation for more information regarding these subsurface results. This section of Black Mountain Road sewer extension was once stipulated with the development of Sandflower subdivision. However, upon construction, the stipulation was deleted due to very difficult hard dig that was encountered. The final sewer outfall alignment was chosen from several different alternatives and is based on the cooperation of the lot owner and the securement of a 20' wide public sewer easement over the lot. The proposed system will connect through lot 8 in Sandflower to the easternmost manhole located in Sandflower Drive.

The proposed on-site collection system will consist of an 8" PVC gravity sewer line that will collect and convey wastewater flows generated by the site. Lots 26,28, and 29 will be serviced using private on-lot grinder pumps and private individual ejector lines to a private manhole. All on lot private ejector lines will be in private sewer easements. This will then flow into the proposed gravity system utilizing a public gravity service for side of the street. Refer to **Appendix B** for the Proposed Sewer System Layout Exhibit.

BASIS OF DESIGN

DESIGN METHODOLOGY

Average Day Demand design flows are calculated based on design criteria detailed within the City of Scottsdale Design Standards and Polices Manual (DS&PM). Per DS&PM Chapter 7, a design flow of 100 gallons per capita per day (gpcpd) and a residential density of 2.5 persons per dwelling unit shall be used. Per correspondence with Doug Mann, City of Scottsdale Water Services, this development shall be allowed to utilize a peaking factor based on Harmon's Formula per Arizona Administrative Code Title 18 chapter 9 for the purposes of determining downstream capacity within the Sandflower Subdivision that we are tying into. . See **Table 1** below for a summary of sewer demands.

Table 1 OnsiteSewer Demands

Land Use	Dwelling units (du)	Density (persons/du)	Population (persons)	Average Day Demand (gpd)	**Peaking Factor**	Peak Flow (gpd)	Peak Flow (gpm)
<2 du/ac	31	2.5	78	7,800	4	31,200	21.7

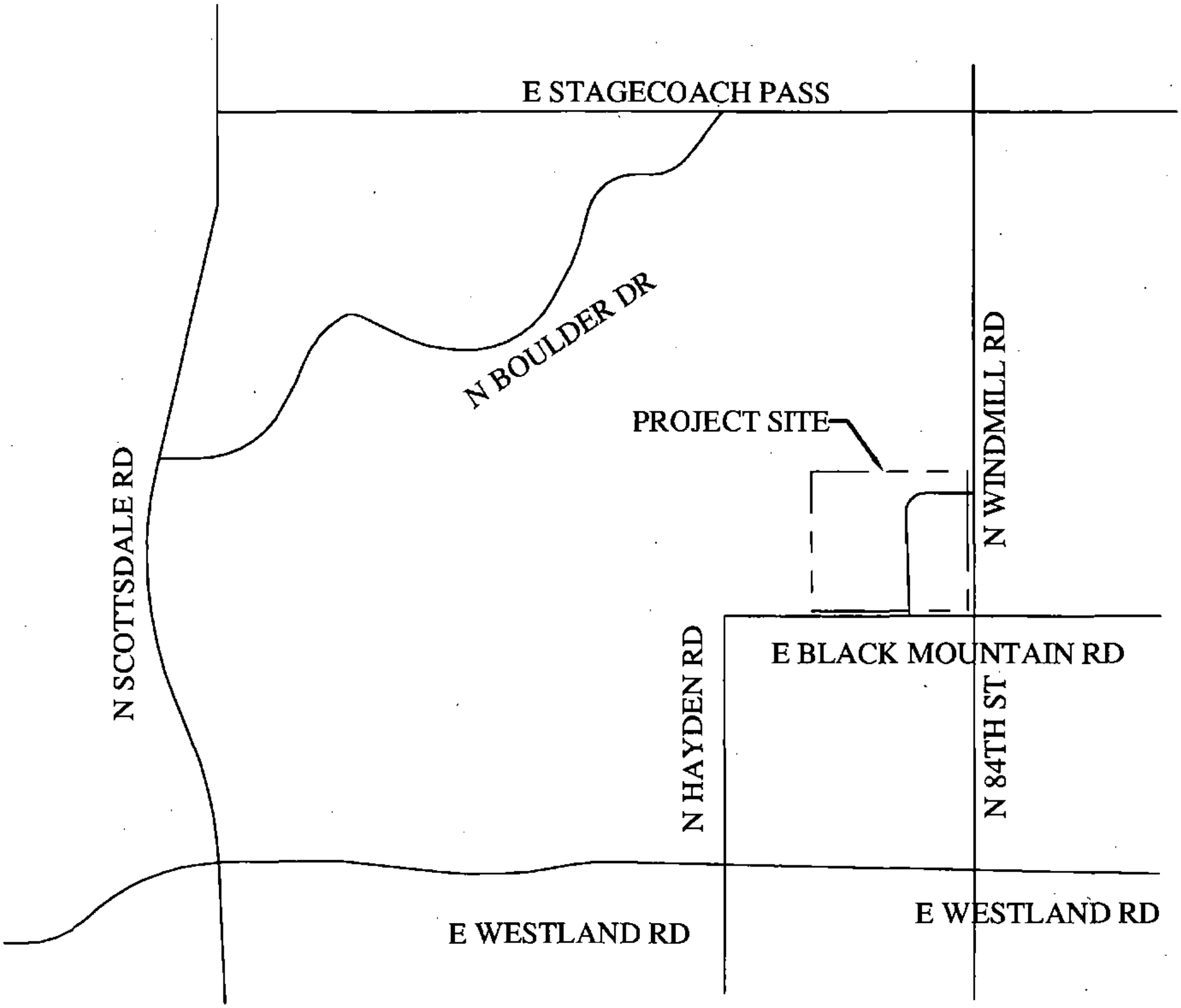
Per the DS&PM, proposed sewer lines within the development were designed to achieve a full flow velocity of between 2.5 and 10 feet per second and maintain a maximum d/D ratio 0.65 when calculated with a Manning's "n" value of 0.013. To satisfy these requirements the proposed public 8-inch sewer will meet the design with a minimum slope of 0.0052 ft/ft (0.52%) and a maximum slope of 0.0833 ft/ft (8.33%). See **Appendix C** for pipe slope calculations.

WASTEWATER SYSTEM ANAYLSIS AND RESULTS

To determine the capacity of the proposed onsite wastewater collection system, the peak design flow was analyzed within the minimum design pipe slope. At the minimum design slope of 0.0052 ft/ft an 8-inch line has the capacity to convey approximately 426,000 gallons per day. An 8-inch line at the minimum design slope can convey the proposed peak design flow of 31,200 gallons per day at a normal depth of 0.84"' or a d/D ratio of 0.10. **See Appendix C – Flowmaster Calculations** for pipe capacity calculations.

Sewer capacities were calculated for the downstream sewer mains located within the Sandflower subdivision. See **Appendix E Sandflower Alternatives Capacity Calculations.** These calculations utilize base sewer flows from the Sandflower report and and proposed based sewer flows from Reserve at Black Mountain subdivision. Harmon's Formula per Arizona Administrative Code Title 18 chapter 9 was utilized to determine an appropriate peaking factor for each of the downstream sewer mains within 81st Street, E. Sandflower Drive and Hayden Road. **See Appendix F for excerpts from the Sandflower Sewer Master Plan**. The Sandflower Sewer Master Plan report does not utilize the current City of Scottsdale peaking factor of 4 or d/D requirement of 0.65, however all pipes have excess actual capacity (d/D<1.0). Flowmaster software was utilized to re-calculate the d/D of the existing 8" and 10" lines downstream of the Reserves at Black Mountain tie-in points and results indicate that new d/D values range from 0.38 to 0.83. Based on this analysis, the existing sewer system has capacity to utilize the tie-in point shown in this report.

Appendix A – Site Location Map

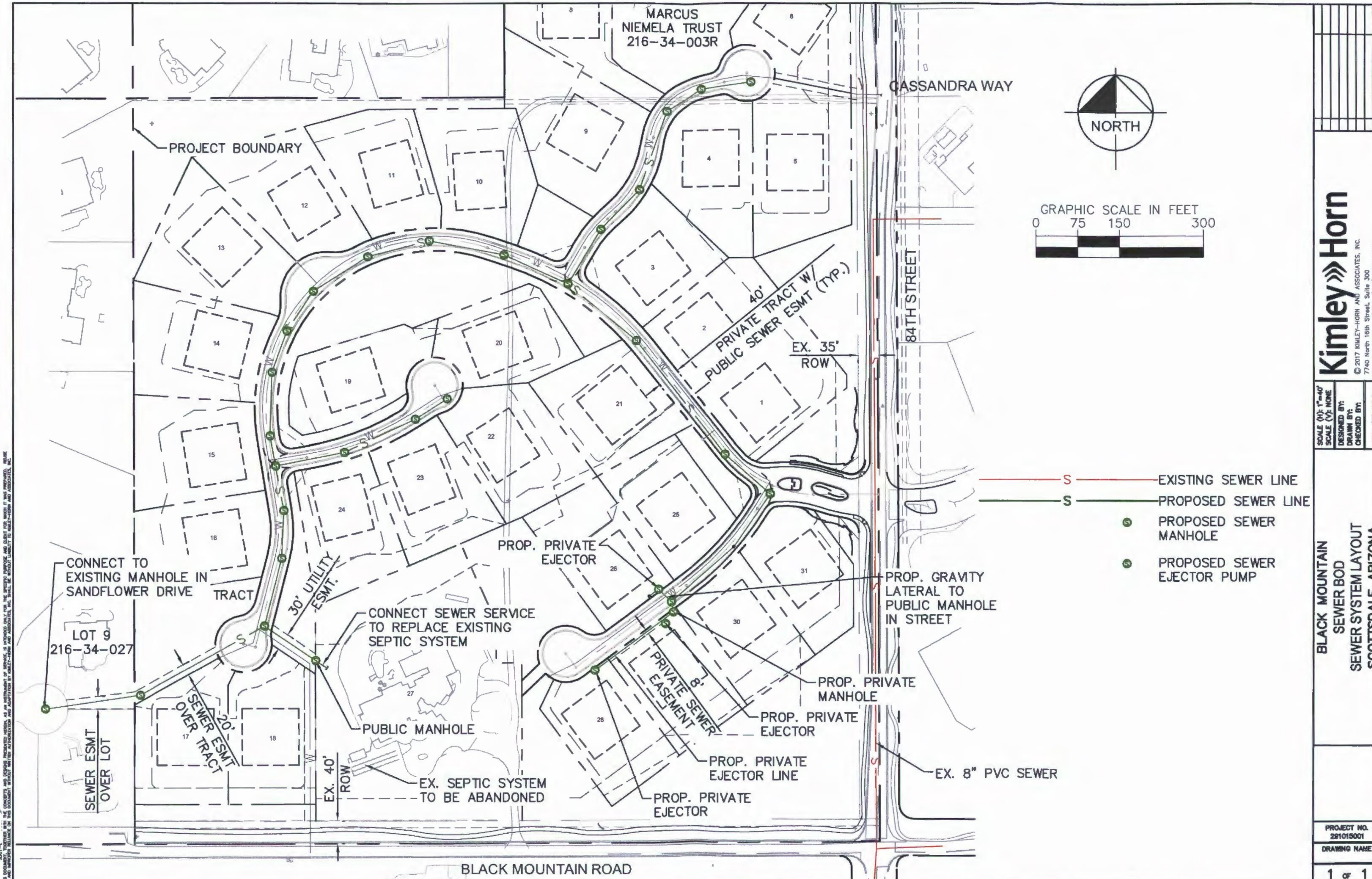


BLACK MOUNTAIN VICINITY MAP

NTS

Kimley»Horn

Appendix B – Proposed Sewer System Layout



MARCUS
NIEMELA TRUST
216-34-003R
CASSANDRA WAY
NORTH
PROJECT BOUNDARY
GRAPHIC SCALE IN FEET
0 75 150 300
40' PRIVATE TRACT W/ PUBLIC SEWER ESMT (TYP.)
EX. 35' ROW
84TH STREET
EXISTING SEWER LINE
PROPOSED SEWER LINE
PROPOSED SEWER MANHOLE
PROPOSED SEWER EJECTOR PUMP
CONNECT TO EXISTING MANHOLE IN SANDFLOWER DRIVE
TRACT
30' UTILITY ESMT.
PROP. PRIVATE EJECTOR
PROP. GRAVITY LATERAL TO PUBLIC MANHOLE IN STREET
LOT 9
216-34-027
CONNECT SEWER SERVICE TO REPLACE EXISTING SEPTIC SYSTEM
PROP. PRIVATE MANHOLE
PROP. PRIVATE EJECTOR
8' PRIVATE SEWER EASEMENT
20' SEWER ESMT OVER TRACT
PUBLIC MANHOLE
PROP. PRIVATE EJECTOR LINE
SEWER ESMT OVER LOT
EX. 40' ROW
EX. SEPTIC SYSTEM TO BE ABANDONED
EX. 8" PVC SEWER
PROP. PRIVATE EJECTOR
BLACK MOUNTAIN ROAD
Kimley»Horn
© 2017 KIMLEY-HORN AND ASSOCIATES, INC.
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500
SCALE (H): 1"=40'
SCALE (V): NONE
DESIGNED BY:
DRAWN BY:
CHECKED BY:
DATE: FEB 2017
BLACK MOUNTAIN
SEWER BOD
SEWER SYSTEM LAYOUT
SCOTTSDALE ARIZONA
PROJECT NO.
291015001
DRAWING NAME
1 OF 1

Appendix C – Flowmaster Calculations

Worksheet for 8-Inch Actual Depth - Minimum Slope

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.28	in
Critical Depth	0.10	ft
Channel Slope	0.00520	ft/ft
Critical Slope	0.00690	ft/ft

Worksheet for 8-Inch d/d=0.65 - Minimum Slope

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00520	ft/ft
Normal Depth	5.20	in
Diameter	8.00	in

Results

Discharge	0.426	mgd
Flow Area	0.24	ft²
Wetted Perimeter	1.25	ft
Hydraulic Radius	2.31	in
Top Width	0.64	ft
Critical Depth	0.38	ft
Percent Full	65.0	%
Critical Slope	0.00757	ft/ft
Velocity	2.74	ft/s
Velocity Head	0.12	ft
Specific Energy	0.55	ft
Froude Number	0.79	
Maximum Discharge	0.94	ft³/s
Discharge Full	0.87	ft³/s
Slope Full	0.00298	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	65.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for 8-Inch d/d=0.65 - Minimum Slope

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	5.20	in
Critical Depth	0.38	ft
Channel Slope	0.00520	ft/ft
Critical Slope	0.00757	ft/ft

Worksheet for 8-Inch Full - Minimum Slope

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00520	ft/ft
Normal Depth	8.00	in
Diameter	8.00	in

Results

Discharge	0.563	mgd
Flow Area	0.35	ft²
Wetted Perimeter	2.09	ft
Hydraulic Radius	2.00	in
Top Width	0.00	ft
Critical Depth	0.44	ft
Percent Full	100.0	%
Critical Slope	0.00857	ft/ft
Velocity	2.50	ft/s
Velocity Head	0.10	ft
Specific Energy	0.76	ft
Froude Number	0.00	
Maximum Discharge	0.94	ft³/s
Discharge Full	0.87	ft³/s
Slope Full	0.00520	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for 8-Inch Full - Minimum Slope

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	8.00	in
Critical Depth	0.44	ft
Channel Slope	0.00520	ft/ft
Critical Slope	0.00857	ft/ft

Worksheet for 8-Inch Full -Maximum Slope

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.08333	ft/ft
Normal Depth	8.00	in
Diameter	8.00	in

Results

Discharge	1.705	mgd
Flow Area	0.35	ft²
Wetted Perimeter	2.09	ft
Hydraulic Radius	2.00	in
Top Width	0.00	ft
Critical Depth	0.65	ft
Percent Full	65.0	%
Critical Slope	0.04252	ft/ft
Velocity	9.99	ft/s
Velocity Head	1.55	ft
Specific Energy	2.22	ft
Froude Number	3.15	
Maximum Discharge	3.75	ft³/s
Discharge Full	3.49	ft³/s
Slope Full	0.04766	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	65.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for 8-Inch Full -Maximum Slope

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	8.00	in
Critical Depth	0.65	ft
Channel Slope	0.08333	ft/ft
Critical Slope	0.04252	ft/ft

Worksheet for Downstream Tie-In

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00700	ft/ft
Diameter	10.00	in
Discharge	0.990	mgd

Results

Normal Depth	6.99	in
Flow Area	0.41	ft²
Wetted Perimeter	1.65	ft
Hydraulic Radius	2.96	in
Top Width	0.76	ft
Critical Depth	0.55	ft
Percent Full	69.9	%
Critical Slope	0.00799	ft/ft
Velocity	3.76	ft/s
Velocity Head	0.22	ft
Specific Energy	0.80	ft
Froude Number	0.91	
Maximum Discharge	1.97	ft³/s
Discharge Full	1.83	ft³/s
Slope Full	0.00489	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	69.91	%
Downstream Velocity	Infinity	ft/s

Worksheet for Downstream Tie-In

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	6.99	in
Critical Depth	0.55	ft
Channel Slope	0.00700	ft/ft
Critical Slope	0.00799	ft/ft

Worksheet for 8-Inch Actual Depth - Minimum Slope

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00520	ft/ft
Diameter	8.00	in
Discharge	0.031	mgd

Results

Normal Depth	1.28	in
Flow Area	0.04	ft²
Wetted Perimeter	0.55	ft
Hydraulic Radius	0.79	in
Top Width	0.49	ft
Critical Depth	0.10	ft
Percent Full	16.0	%
Critical Slope	0.00690	ft/ft
Velocity	1.34	ft/s
Velocity Head	0.03	ft
Specific Energy	0.13	ft
Froude Number	0.87	
Maximum Discharge	0.94	ft³/s
Discharge Full	0.87	ft³/s
Slope Full	0.00002	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	15.98	%
Downstream Velocity	Infinity	ft/s

Appendix D – Geotechnical Investigation

SPEEDIE AND ASSOCIATES
Geotechnical ▪ Environmental ▪ Materials Engineers

www.speedie.net

REPORT ON GEOTECHNICAL INVESTIGATION

Registered Professional Engineer (Civil)
CERTIFICATE NO.
14388
GREGG ALAN CREASER
Date Signed 7/21/16
ARIZONA, U.S.A.
Expires 06/30/17

DESIGNATION: 84th Street Residential

LOCATION: NWC 84th Street & Black Mountain Road
Scottsdale, Arizona

CLIENT: Pinnacle Land Development, LLC

PROJECT NO: 161008SA

DATE: July 21, 2016

3331 East Wood Street • Phoenix, AZ 85040 • Phone (602) 997-6391 • Fax (602) 943-5508
4025 East Huntington Drive, Suite 140 • Flagstaff, AZ 86004 • Phone (928) 526-6681 • Fax (928) 526-6685
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SPEEDIE AND ASSOCIATES
Geotechnical ■ Environmental ■ Materials Engineers

TABLE OF CONTENTS

Registered Professional Engineer (Civil)
CERTIFICATE NO.
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GREGG ALAN
CREASER
Date Signed 7/21/16
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1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of the proposed residential development to be constructed at the northwest corner of 84th Street and Black Mountain Road, in Scottsdale, Arizona.

We understand that the development will consist of 23 custom home lots on approximately 34.7 acres. The homes will be one or two stories with slab on grade (no basements) and masonry or wood frame walls. Due to the terrain, retaining walls and culverts may be required. Structural loads are expected to be light to moderate and no special considerations regarding settlement tolerances are known at this time. The lot will be paved to support light to moderate passenger vehicle traffic. Adjacent areas will be landscaped and utilized for storm water retention and disposal. Half street improvements to Black Mountain Road may also be required.

Due to the conceptual nature of the project at this time, this report is limited to providing geotechnical **recommendations for the infrastructure improvements only** and presents only preliminary recommendations for any of the proposed building lots or structures. Final recommendations will depend on the grading plans for each residential lot and inclusion of any basement levels, retaining walls, pools etc. **It is highly recommended that supplementary individual site investigations be conducted at each lot as the development plans become available.**

2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

The site is bounded on the north and west by single family residential, on the east by 84th Street and on the south by Black Mountain Road. There is an existing residential lot on the south central portion that the property to be developed wraps around. The site is currently native desert land with rolling terrain with high ridge lines and rock outcropping throughout the site. There are a few significant natural drainage washes that traverse the site in a general northeast to southwest direction. Remnants of an old dirt road (83rd street) through the center of the site are still present. Please refer to the attached seismic refraction survey and the following figures for additional site features:

Figure 2.1.1 Dated 1996

Figure 2.1.2 Dated 2016

Figure 2.1.3 Photo 83rd Street Looking South

Figure 2.1.3 Typical Rock Out Cropping

2.1 Geologic Conditions

The site is located outside any area that has undergone considerable subsidence due to groundwater removal. Areas of subsidence are known to produce earth fissuring, which has affected areas within several miles of the site. No evidence of earth fissures was observed on the site. Although it is unlikely, it is possible that earth fissures exist at depth and are not visible due to surface disruption on the site. Fissure gullies form over subsurface irregularities such as bedrock highs, which cause tensional stresses and differential subsidence. Where such anomalies are not present, subsidence tends to be uniform over a wide area, this having minimal effect on surficial structures. The closest known earth fissures are located about 15 miles south from this site. Based on local experience, subsidence and earth fissures historically have **not** been a problem in this immediate area.

2.2 Seismic Design Parameters

The project area is located in a seismic zone that is considered to have low historical seismicity. The seismicity of the Phoenix area has had only three magnitude 3.0 events in over 100 years. Liquefaction is not considered a concern as groundwater exceeds 15 meters below ground surface.

Although test pits were not advanced to 100 feet, based on the nature of the subsoils encountered in the test pits and geology in the area, Site Class Definition, Class C (Table 1613.5.2, 2006 IBC), or Residential Seismic Design Category B (Table R301.2.2.1.1, 2006 IRC) may be used for design of the structure.

2.3 General Subsurface Conditions

A total of 8 test pits were excavated across the site to determine the soil properties. Subsurface conditions at the site are typical for the area and consist generally of a 2-5 feet thick or less surface layer of clayey sand and silty sand underlain by well-graded sand and gravel with varying amounts of silt and clay, locally referred to as decomposed granite (DG). The DG transitions into weathered to competent granitic bedrock at the termination depths of the test pits. Very hard dense caliche layers along with rock out cropping's and core stones where noted throughout the site. The soil density generally increases with depth as evidenced by resistance to excavation. Accordingly competent granitic bedrock will likely be encountered by excavations for the proposed sewer & water line, and/or if deeper excavations are needed to grade the street to finished elevations. No groundwater was encountered during this investigation. Based on visual and tactile observation, the soils were in a 'dry' state at the time of investigation.

In addition to the test pits, nine seismic refraction survey lines were conducted, 6 along Black Mountain Road for the proposed sewer line, and 3 along the proposed access road alignment that will likely include utilities. Based on the survey the decomposed granite and caliche will be marginally rippable and excavations will likely encounter granite bedrock requiring specialized rock breaking equipment or blasting. Please refer to the Seismic Refraction report in the Appendix for more detail.

Laboratory testing indicates liquid limits are on the order of 31 to 41 with plasticity indices on the order of 6 to 19. The upper clayey soils exhibit volume increase (swell) due to wetting ranging from zero to 1.9 percent when re-compacted to moisture and density levels normally expected during construction. This is considered to be low. Due to the dry, granular nature of the native soils, undisturbed samples suitable for testing could not be obtained to evaluate the soil's in-place dry density or consolidation potential. The material generated from the test pit excavations was typically well-graded angular sand with gravel-sized and occasional cobble-sized rock fragments, and containing a low amount of fines.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Analysis of the field and laboratory data indicates that subsoils at the site are generally favorable for the support of the proposed access drive, infrastructure, and future homes on shallow foundations and slab-on-grade subject to remedial earthworks.

It appears that major grading will be required. Cuts and/or fills on the order of 5 feet ± are anticipated. Depending on grading scheme, it is possible that the structure may be partially supported on the residual soil (native soil or bedrock, and/or fill). Structural damage could occur due to differential movement along interfaces with the different bearing media. **In order to avoid this, a structure should be supported entirely on one bearing medium**, especially in the area of interfaces with fill material and bedrock. Depending on the grading plans, it is highly recommended to place all foundation elements entirely on weathered to competent bedrock or a minimum of 2 feet of engineered fill. Depending on the grading plan this may require slightly deeper than normal footings along portions of the buildings. This could be accomplished by over-excavating the planned footing width to expose the bedrock and backfilling with a lean (500 psi) grout to the proposed bottom of footing elevation. This potential for differential settlement is even greater for footings bearing on rock versus fill. **That combination should be avoided if at all possible** or differential settlement should be taken into account in the design.

Groundwater is not expected to be a factor in the design or construction of shallow foundations and underground utilities. **However it is possible to encounter perched water flows in the unconsolidated soils overlying the weathered bedrock surfaces. There also appears to be a drainage easement along the east side of the property which may receive significant flows. Strong consideration should be given to installing "french drain" interceptors on the uphill side of the lots to collect perched water flows at the bedrock interface to be discharged downhill or into the drainage easements.**

Attention must be paid to provide proper drainage to limit the potential for water infiltration under the homes. Poor drainage will increase the potential for creating perched water on the soil-rock interface causing moisture problems inside the house. A minimum slope of at least 5 percent for a distance of 10 feet away from the structure is recommended in accordance with the Residential Code requirements for unpaved landscaped areas. If this slope cannot be provided, other conveyances are recommended such as roof drains and gutter systems and/or yard drains to direct water away from the structure. Roof drains should not be allowed to discharge into planters adjacent to the structure and allowed to pond. Irrigated planters adjacent to the structures should be kept at a minimum and/or the use of low water use plants (xeriscape).

The presence of shallow bedrock, cobbles, and boulders may make site preparation, foundation excavation, and utility installations difficult. Weathered rock material may interfere with 'neat' foundation excavations and result in soil disturbance. This may result in concrete overages for foundation pours and/or the need to re-compact soils in the areas disturbed. **Excavation difficulties may be encountered in areas where bedrock is highly competent, and possible within any swimming pool excavation depending on depth.** Rock removal techniques may be required. This may include blasting and/or pneumatic rock hammering.

For exterior slabs-on-grade, frequent jointing is recommended to control cracking and reduce tripping hazards should differential movement occur. It is also recommended to pin the landing slab to the building floor/stem wall. This will reduce the potential for the exterior slab lifting and blocking the operation of out-swinging doors. Pinning typically consists of 24-inch long No. 4 reinforcing steel dowels placed at 12-inch centers.

3.2 Site Preparation

The entire area to be occupied by the proposed construction should be stripped of all vegetation, debris, rubble, and obviously loose surface soils. Special attention must be paid to areas where depressions from natural stream channels (washes), or drainage courses are evident. In areas where loose channel deposits occur, the loose material should be removed, generally to a depth of 1 to 2 feet, be re-placed and compacted.

If the engineered fill option is selected, subsoils should be further over-excavated **at least 2 feet** below proposed footing bottom elevation, or existing grade, **whichever is deeper**, extending at least 5 feet beyond the footing edges within all footing areas. The entire building pad does not require over-excavation provided footing lines can be accurately located during grading operations. It may be more feasible to over-excavate the entire building pad since the building footprint is relatively small.

A representative of the Geotechnical Engineer should examine the subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials. Fill placement and quality should be as defined in the "Fill and Backfill" section of this report.

All excavations must comply with current governmental regulations including the current OSHA Excavation and Trench Safety Standards. Side slopes for open-cut excavation should be cut back at

1:1 (horizontal:vertical). Steeper slopes may be possible when examined by a responsible party that is capable of evaluating soil classifications for slope stability and the effects of traffic vibration. The slopes should be protected from erosion due to run-off or long-term surcharge at the slope crest. Construction equipment, building materials, excavated soil and vehicular traffic should not be allowed within 10 feet or one-third the slope height, whichever is greater, from the top of slope. The Geotechnical Engineer and/or the contractor's responsible party should observe all cut slopes during excavation. Adjustments to the recommended slopes may be necessary due to wet zones, loose strata and other conditions not observed in the test pits. Localized shoring may also be required. Shotcrete or soil stabilizer on the slope face may be useful in preventing erosion due to run-off and/or drying of the slope. Depending on proximity, existing elements may require shoring, bracing or underpinning to provide structural stability and protect personnel working in the excavation.

Prior to placing engineered fill below footing bottom elevation, the exposed grade should be scarified to a depth of 8 inches, moisture-conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698. Pavement areas should be scarified, moisture-conditioned and compacted in a similar manner.

All cut areas and areas above footing bottom elevation that are to receive floor slab only fill should be scarified 8 inches, moisture conditioned to at least optimum to 3 percent above optimum and lightly but uniformly compacted to 90 but not more than 95 percent of maximum dry density as determined by ASTM D-698.

3.3 Foundation Design

The following bearing capacities can be utilized for design of site walls and preliminary design only for houses:

Table 3.3.1 Foundation Bearing Capacities

Structure	Foundation Type	Foundation Depth	Bearing Medium	Bearing Capacity	Comments
Minor Structures	Spread	1.5 ft.	Native Soils	1,500 psf	1,3
Main Structure & Retaining Walls	Spread/Strip	2.0 ft.	Dense Native to Weathered Bedrock	4,000 psf	2,3
	Spread/Strip	1.5 ft.	Engineered Fill	2,500 psf	4,3

Comments:

1. For minor structures such as screen walls, planter walls, box culverts, etc. not connected to any main structure.
2. Shallow spread footings bearing on dense native or weathered bedrock at a minimum depth of 2 feet below existing grade or lowest adjacent finished grade within 5 feet, whichever is greater. If conditions dictate (such as deeper fill zones), the footings may be over-excavated the planned footing width, through any engineered fill, to contact dense native/weathered bedrock, and backfilled with a lean (500 psi) concrete grout back up to the proposed bottom of footing elevation.
3. A scour analysis should be performed to determine the scour depth. Foundation placed adjacent to washes should be deepened at least 2 feet below scour depth unless competent bedrock in encountered. In cases where competent bedrock is encountered foundation depths can be reduced to a nominal 12 inches provided they are doweled into the rock.
4. For building pads that will require mostly fill it is recommended to provide at a minimum of 2 feet of engineered fill below the bottom of foundation throughout the entire structure. This will require some over-excavation on the cut side of the lot.

These bearing capacities refer to the total of all loads, dead and live, and are net pressures. They may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials. Positive drainage away from the proposed buildings **must** be maintained at all times.

Continuous masonry wall footings and isolated rectangular footings should be designed with minimum widths of 16 and 24 inches respectively, regardless of the resultant bearing pressure. Lightly loaded interior partitions (less than 800 plf) may be supported on reinforced thickened slab sections (minimum 12 inches of bearing width and 12 inches deep).

Estimated settlements under design loads are on the order of ½ to ¾ inch, (nil on bedrock) virtually all of which will occur during construction. Post-construction differential settlements will be on the order of one-half the total, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content. **Positive drainage away from structures and controlled routing of roof runoff must be provided and maintained to prevent ponding adjacent to perimeter walls.** Planters requiring heavy watering should **not** be placed adjacent to or within 5 feet of the building. Care should be taken in design and construction to insure that domestic and interior storm drain water is contained to prevent seepage. Roof drainage should be directed to paved areas or storm drains. They should not discharge into planters adjacent to the structures.

Continuous footings and stem walls should be reinforced to distribute stresses arising from small differential movements, and long walls should be provided with control joints to accommodate these movements. **Slab reinforcement and frequent control joints are suggested to allow slight movement and prevent minor floor slab cracking especially in floor areas to be covered with hard tile.**

3.4 Lateral Pressures

The following lateral pressure values may be utilized for the proposed construction:

Active Pressures	
Unrestrained Walls	35 pcf
Restrained Walls	60 pcf
Passive Pressures	
Continuous Footings	350 pcf
Spread Footings or Drilled Piers	400 pcf
Coefficient of Friction (w/ passive pressure)	0.35
Coefficient of Friction (w/out passive pressure)	0.45
Coefficient of Friction (on Bedrock)	0.70

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain. Expansive soils should not be used as retaining wall backfill, except as a surface seal to limit infiltration of storm/irrigation water. The expansive pressures could greatly increase active pressures.

3.5 Fill and Backfill

Native soils, after removal of rock larger than 6 inches (3 inches preferred) are considered suitable for use in general grading fills and pad fills. The sandy silty soils may be sensitive to excessive moisture content and will become unstable at elevated moisture content. Accordingly, it may be necessary to compact soils on the dry side of optimum. The reduced moisture content under slabs-on-grade should only be used upon approval of the engineer in the field.

Successful backfill of below-grade walls (such as the anticipated retaining walls) can be difficult to achieve given the sometimes tight access. A well-graded granular import should be specified for backfill of below grade walls. Placement and compaction must be carefully controlled in order to minimize the potential for post construction settlement should the backfill zone be subjected to water infiltration. Even the most well controlled fills could experience additional settlement on the order of 1 inch if subjected to significant moisture increases. Accordingly, consideration should be given to constructing a structural slab over the backfill zone in the most critical areas such as interior slabs or reinforce and pin the landing/entry slabs to the building stem wall to span over the backfill zone. This will reduce the potential for the exterior slab dropping and creating a tripping hazard. Critical areas can be considered to include not only concrete walkways and slabs, but also concrete and asphaltic concrete paving. Paving over wall backfill zones should be detailed to minimize the effects of backfill settlement. Utility lines (especially gravity sewer lines), except for building service connections, should be avoided in this zone.

If imported common fill for use in site grading is required, it should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. In general, the fill should have 100 percent passing the 3-inch sieve and no more than 60 percent passing the 200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Fill should be placed on subgrade, which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±2 percent (***optimum to +3 percent for under-slab fill***). Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows:

A.	Building Areas		
	1.	Below footing level Fill less than 4 feet thick	95 or 500 psi slurry
	2.	Below footing level Fill greater than 4 feet thick	98
	3.	Below slabs-on-grade (non-expansive soils)	95
B.	Roadway Pavement Subgrade or Fill		
	1.	Fill less than 4 feet thick	95
	2.	Fill greater than 4 feet thick	98
C.	Utility Trench Backfill		95
D.	Aggregate Base Course		
	1.	Below floor slabs	95
	2.	Below asphalt paving	100
E.	Landscape Areas		90

3.6 Utilities Installation

Shallow trench excavations can be accomplished by conventional trenching equipment. Deeper excavations encountering weathered granite will be more difficult and may require rock removal techniques. The fact that a test pit was excavated to a certain depth does not mean that the soils may be excavated by normal means. The excavating contractor must make his/her own assessment as to excavatability. Trench walls should stand near-vertical for the short periods of time required to install shallow utilities **although some sloughing may occur in looser and/or sandier soils** requiring laying back of side slopes and/or temporary shoring. Adequate precautions must be taken to protect workmen in accordance with all current governmental regulations.

Backfill of trenches above bedding zones may be carried out with native excavated material provided over-sized material (>3 inches) is first removed. This material should be moisture-conditioned, placed in 8-inch lifts and mechanically compacted. Water settling is **not** recommended. Compaction requirements are summarized in the "Fill and Backfill" section of this report.

3.7 Conventional Slabs-on-Grade

To facilitate fine grading operations and aid in concrete curing, a 4-inch thick layer of granular material conforming to the gradation for aggregate base (A.B.) as per M.A.G. Specification Section 702 should be utilized beneath the slab. Dried subgrade soils **must** be re-moistened prior to placing the aggregate base if allowed to dry out, especially if fine-grained soils are used in the top 12-inches of the pad.

The native soils are capable of storing a significant amount of moisture and there is a potential for perched groundwater, which could greatly increase the natural vapor drive through the slab. Accordingly, if moisture sensitive flooring and/or adhesive are planned, the use of a vapor barrier or low permeability concrete should be considered. Vapor barriers should be a minimum 15-mil thick polyolefin (or equivalent), which meets ASTM E 1745 Class A specifications. Vapor barriers do increase the potential for slab curling and water entrapment under the slab. Accordingly, if a vapor barrier is used, additional precautions such as low slump concrete, frequent jointing and proper curing will be required to reduce curling potential and detailed to prevent the entrapment of outside water sources.

3.8 Corrosion

Laboratory testing for sulfate contents indicates 3 to 6 ppm. This value represents a negligible potential for sulfate attack on concrete. Subsurface concrete should use Type I or II cement, which is readily available and used in the area with cement content meeting or exceeding residential code requirements. There have been some issues with alkali silica reaction (ASR) in local supplier aggregate sources. Flyash should be allowed/required in the mix to help mitigate ASR.

Chloride concentrations were on the order of 24 to 32 ppm. These results indicate a low to moderate degree of corrosivity to direct buried metal. Chloride concentrations of 500 ppm or greater are considered severely corrosive. Soil pH of 7.6 to 7.7 was measured along with resistivities of 1350 to 2490 Ohm-cm. Accordingly, suitable pipe wall thickness and corrosion protection should be selected per the lifetime requirements of the project.

3.9 Asphalt/Concrete Pavement

If earthwork in paved areas is carried out to finish subgrade elevation as set forth herein, the subgrade will provide adequate support for pavements. The following table presents some options for various section and capacities for **private residential roadways**. The location designation is for reference only. The designer/owner should choose the appropriate sections to meet the anticipated traffic volume and life expectancy. The section capacity is reported as daily ESALs, Equivalent 18 kip Single Axle Loads. Typical heavy trucks impart 1.0 to 2.5 ESALs per truck depending on load. It takes approximately 1,200 passenger cars to impart 1 ESAL.

Table 3.9.1 Pavement Sections

Area of Placement	Flexible (AC Pavement)			Rigid (PCC Pavement)	
	Thickness AC (0.39)	Thickness ABC (0.12)	Daily 18-kip ESALs	Thickness PCCP	Daily 18-kip ESALs
Driveways and Parking	2.0"	4.0"	4	5.0"	9
Roadways(3)	3.0"	4.0"	17	6.0"	23
	3.0"	7.0"(4)	55	7.0"	50

Notes:

1. Designs are based on AASHTO design equations and ADOT correlated R-Values.
2. The PCCP thickness is increased to provide better load transfer, and reduce potential for joint & edge failures. Design PCCP per ACI 330R-87.
3. Full depth asphalt or increased asphalt thickness can be increased by adding 1.0-inch asphalt for each 3 inches of base course replaced.
4. A pavement section of 3 inches of asphalt on 7 inches of aggregate base course is required to meet the City of Scottsdale minimum guidelines for local public streets.

Pavement Design Parameters:

Assume:	One 18 kip Equivalent Single Axle Load(ESAL)/Truck
Life:	20 years
Subgrade Soil Profile:	
% Passing #200 sieve:	20%
Plasticity Index:	19
k:	150 pci (assumed)
R value:	36 (per ADOT tables)
M_R:	21,700 (per AASHTO design)

These designs assume that all subgrades are prepared in accordance with the recommendations contained in the "Site Preparation" and "Fill and Backfill" sections of this report, and paving operations carried out in a proper manner. If pavement subgrade preparation is not carried out immediately prior to paving, the entire area should be proof-rolled at that time with a heavy pneumatic-tired roller to identify locally unstable areas for repair.

Pavement base course material should be aggregate base per M.A.G. Section 702 Specifications. Asphalt concrete materials and mix design should conform to M.A.G. 710 and meet the City of Scottsdale requirements for public streets. It is recommended that a ½ inch or ¾ inch mix designation be used for the pavements. While a ¾ inch mix may have a somewhat rougher texture, it offers more stability and resistance to scuffing, particularly in truck turning areas. Pavement installation should be carried out under applicable portions of M.A.G. Section 321 and municipality standards. The asphalt supplier should be informed of the pavement use and required to provide a mix that will provide stability and be aesthetically acceptable. Some of the newer M.A.G. mixes are very coarse and could cause placing and finish problems. A mix design should be submitted for review to determine if it will be acceptable for the intended use.

For sidewalks and other areas not subjective to vehicular traffic a 4-inch section of concrete will be sufficient. For trash and dumpster enclosures a thicker section of 6 inches of concrete is recommended.

Portland Cement Concrete Pavement must have a minimum 28-day flexural strength 550 psi (compressive strength of approximately 3,700 psi). It may be cast directly on the prepared subgrade with proper compaction (reduced) and the elevated moisture content as recommended in the report. Lacking an aggregate base course, attention must be paid to using low slump concrete and proper curing, especially on the thinner sections. No reinforcing is necessary. Joint design and spacing should be in accordance with ACI recommendations. Construction joints should contain dowels or be tongue and grooved to provide load transfer. Tie bars are recommended on the joints adjacent to unsupported edges. Maximum joint spacing in feet should not exceed 2 to 3 times the thickness in inches. Joint sealing with a quality silicone sealer is recommended to prevent water from entering the subgrade allowing pumping and loss of support.

Proper subgrade preparation and joint sealing will reduce (but not eliminate) the potential for slab movements (thus cracking) on the expansive native soils. Frequent jointing will reduce uncontrolled cracking and increase the efficiency of aggregate interlock joint transfer.

4.0 GENERAL

The scope of this investigation and report does not include regional considerations such as seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, or any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Geotechnical Engineer observe and test the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE & ASSOCIATES, INC.

Registered Professional Engineer (Civil) CERTIFICATE NO. 37292 KEITH R. GRAVEL Date Signed 7/21/16 ARIZONA, U.S.A. Expires 03/31/17

Keith R. Gravel, P.E.

Registered Professional Engineer (Civil) CERTIFICATE NO. 14388 GREGG ALAN CREASER Date Signed 7/21/16 ARIZONA, U.S.A. Expires 06/30/17

Gregg A. Creaser, P.E.

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL TEST PIT LOCATION PLAN

SOIL LEGEND

LOG OF TEST PITS

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MOISTURE-DENSITY RELATIONS

SWELL TEST DATA

CORROSIVE TEST DATA

SEISMIC REFRACTION REPORT

FIELD AND LABORATORY INVESTIGATION

On June 2, 2016, test pits were excavated at the approximate location shown on the attached Soil Test Pit Location Plan. All exploration work was carried out under the full-time supervision of our staff engineer, who recorded subsurface conditions and obtained samples for laboratory testing. The soil test pits were advanced with a standard backhoe with an 18 inch bucket. Detailed information regarding the test pits and samples obtained can be found on an individual Log of Test Pit prepared for each location.

Laboratory testing consisted of grain-size distribution and plasticity (Atterberg Limits) tests for classification. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. All field and laboratory data is presented in this appendix.

- APPROXIMATE TEST PIT LOCATIONS
- APPROXIMATE SEISMIC LINE LOCATIONS

N

TEST PIT / SEISMIC LINE LOCATION PLAN

DR: TSW | REV: | CHK: | DATE: 07/20/16 | PROJECT NO. 1610088A

84TH STREET RESIDENTIAL
NWC 84TH STREET & BLACK MOUNTAIN ROAD
SCOTTSDALE, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS

SOIL LEGEND

SAMPLE DESIGNATION		DESCRIPTION	
	AS	**Auger Sample**	A grab sample taken directly from auger flights.
	BS	**Large Bulk Sample**	A grab sample taken from auger spoils or from bucket of backhoe.
	S	**Spoon Sample**	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.
	RS	**Ring Sample**	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
	LS	**Liner Sample**	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
	ST	**Shelby Tube**	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
	--	**Continuous Penetration Resistance**	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.

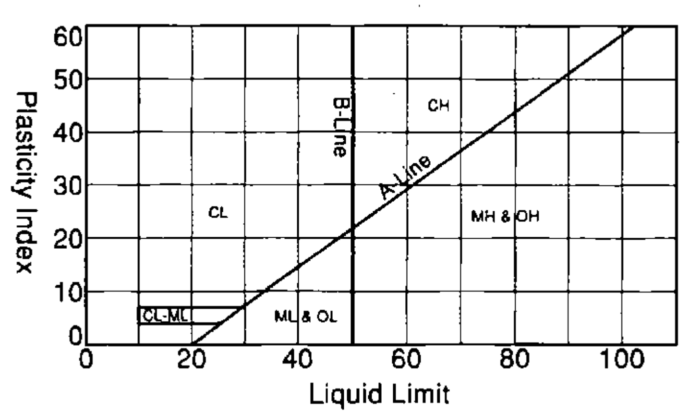
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICAL PRESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size •	mm	Sieve Size •
SANDS				
Fine	0.075	#200	0.42	#40
Medium	0.420	#40	2.00	#10
Coarse	2.000	#10	4.75	#4
GRAVELS				
Fine	4.75	#4	19	0.75" ✖
Coarse	19	0.75" ✖	75	3" ✖
COBBLES	75	3" ✖	300	12" ✖
BOULDERS	300	12" ✖	900	36" ✖

•U.S. Standard ✖Clear Square Openings



Depth (feet)	Graphic Log	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Reddish Brown CLAYEY SAND (SC-Dry) with Little Gravel — 2.0	BS-1	2.0	NT	NT	
		Light Brown SILTY SAND (SM-Dry) with Some Gravel, Weak to Moderate Calcareous Cementation — 4.0					
5		Light Brown WELL GRADED GRAVEL with SILT and SAND (GW/GM-Dry) — 8.0					
		Test Pit Refusal on Bedrock					
10							

Equipment Type: Cat-416B Backhoe

Surface Elevation: N/A

Excavation Date: 6-2-16

Field Engineer/Technician: K. Gravel

Excavator: E. Crain

Contractor: Geomechanics SW

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: TP-1

84th Street Residential

NWC 84th Street & Black Mountain Road

Scottsdale, Arizona

Project No.: 161008SA

Depth (feet)	Graphic Log	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Light Brown SILTY SAND (SM-Dry) with Little Gravel					
1.5		Light Brown WELL GRADED SAND with SILT (SW/SM-Dry) with Gravel	AS-1	3.0	NT	NT	
4.5		Test Pit Refusal on Bedrock					
5							
10							

Equipment Type: **Cat-416B Backhoe**

Surface Elevation: **N/A**

Excavation Date: **6-2-16**

Field Engineer/Technician: **K. Gravel**

Excavator: **E. Crain**

Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-2**

84th Street Residential

NWC 84th Street & Black Mountain Road

Scottsdale, Arizona

Project No.: **161008SA**

TEST PIT 161008SA.GPJ GENGEO.GDT 6/27/16

Depth (feet)	Graphic Log	Equipment Type: Cat-416B Backhoe Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Light Brown <u>CLAYEY SAND</u> (SC-Dry) with Trace to Little Gravel					
3.0		Light Brown <u>WELL GRADED SAND with SILT</u> (SW/SM-Dry) with Gravel					
5							
7.0		Test Pit Refusal on Bedrock					
10							

Excavation Date: 6-2-16
Field Engineer/Technician: K. Gravel
Excavator: E. Crain
Contractor: Geomechanics SW

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: TP-3

84th Street Residential

NWC 84th Street & Black Mountain Road

Scottsdale, Arizona

Project No.: 161008SA

TEST PIT 161008SA.GPJ GENGEO.GDT 6/27/16

Depth (feet)	Graphic Log	Equipment Type: Cat-416B Backhoe Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Light Brown CLAYEY SAND (SC-Dry) with Little Gravel						
			2.0					
		Light Brown WELL GRADED SAND with SILT (SW/SM-Dry) with Some Gravel						
5								
				BS-1	6.0	NT	NT	
			7.0					
		Test Pit Refusal on Bedrock						
10								

Excavation Date: 6-2-16
Field Engineer/Technician: K. Gravel
Excavator: E. Crain
Contractor: Geomechanics SW

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: TP-4

84th Street Residential

NWC 84th Street & Black Mountain Road

Scottsdale, Arizona

Project No.: 161008SA

TEST PIT 161008SA.GPJ GENGEO.GDT 6/27/16

Depth (feet)	Graphic Log	Equipment Type: Cat-416B Backhoe Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Light Brown CLAYEY SAND (SC-Dry) with Strong Calcareous Cementaiton					
2.3		Test Pit Refusal on Bedrock					
5							
10							

Excavation Date: **6-2-16**
Field Engineer/Technician: **K. Gravel**
Excavator: **E. Crain**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-5**

84th Street Residential

NWC 84th Street & Black Mountain Road

Scottsdale, Arizona

Project No.: **161008SA**

TEST PIT 161008SA.GPJ GENGEO.GDT 6/27/16

Depth (feet)	Graphic Log	Equipment Type: Cat-416B Backhoe Surface Elevation: N/A Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Light Brown CLAYEY SAND (SC-Dry) with Weak to Moderate Calcareous Cementation	2.0	AS-1	2.0	NT	NT	
		Light Brown SILTY SAND (SM-Dry) with Little Gravel						
5			6.0					
		Test Pit Refusal on Bedrock						
10								

Excavation Date: 6-2-16
Field Engineer/Technician: K. Gravel
Excavator: E. Crain
Contractor: Geomechanics SW

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-6**

84th Street Residential

NWC 84th Street & Black Mountain Road

Scottsdale, Arizona

Project No.: **161008SA**

Depth (feet)	Graphic Log	Equipment Type: Cat-416B Backhoe Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 25 50)
0		Brown SILTY SAND (SM-Dry) with Trace Gravel, Trace Roots	BS-1	3.0	NT	NT	
5		5.0 Brown CLAYEY SAND (SC-Dry) with Little Gravel, Moderate Calcareous Cementation					
		7.0 Test Pit Refusal on Bedrock					
10							

Excavation Date: 6-2-16
Field Engineer/Technician: K. Gravel
Excavator: E. Crain
Contractor: Geomechanics SW

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: TP-7

84th Street Residential

NWC 84th Street & Black Mountain Road

Scottsdale, Arizona

Project No.: 161008SA

TEST PIT 161008SA.GPJ GENGEO.GDT 6/27/16

Depth (feet)	Graphic Log	Equipment Type: Cat-416B Backhoe Surface Elevation: N/A Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0		Light Brown CLAYEY SAND (SC-Dry) with Little Gravel, Moderate Calcareous Cementation, 1-10% Cobble, Occasional Boulders					
3.0		Light Brown WELL GRADED GRAVEL with SILT and SAND (GW-Dry)					
5							
5.5		Test Pit Refusal on Bedrock					
10							

Excavation Date: 6-2-16
Field Engineer/Technician: K. Gravel
Excavator: E. Crain
Contractor: Geomechanics SW

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Pit Number: **TP-8**

84th Street Residential

NWC 84th Street & Black Mountain Road

Scottsdale, Arizona

Project No.: **161008SA**

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
TP-1	BS-1	BULK	0.0 - 2.0	NT	NT	19.2	31	50	78	NT	41	22	19	SC	CLAYEY SAND with GRAVEL
TP-4	BS-1	BULK	2.0 - 6.0	NT	NT	5.9	19	53	76	100	34	27	7	SW-SM	WELL-GRADED SAND with SILT and GRAVEL
TP-7	BS-1	BULK	0.0 - 3.0	NT	NT	20.5	36	62	83	100	31	25	6	SM	SILTY SAND with GRAVEL

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested

Sheet 1 of 1

84th Street Residential
NWC 84th Street & Black Mountain Road
Scottsdale, Arizona
Project No. 161008SA

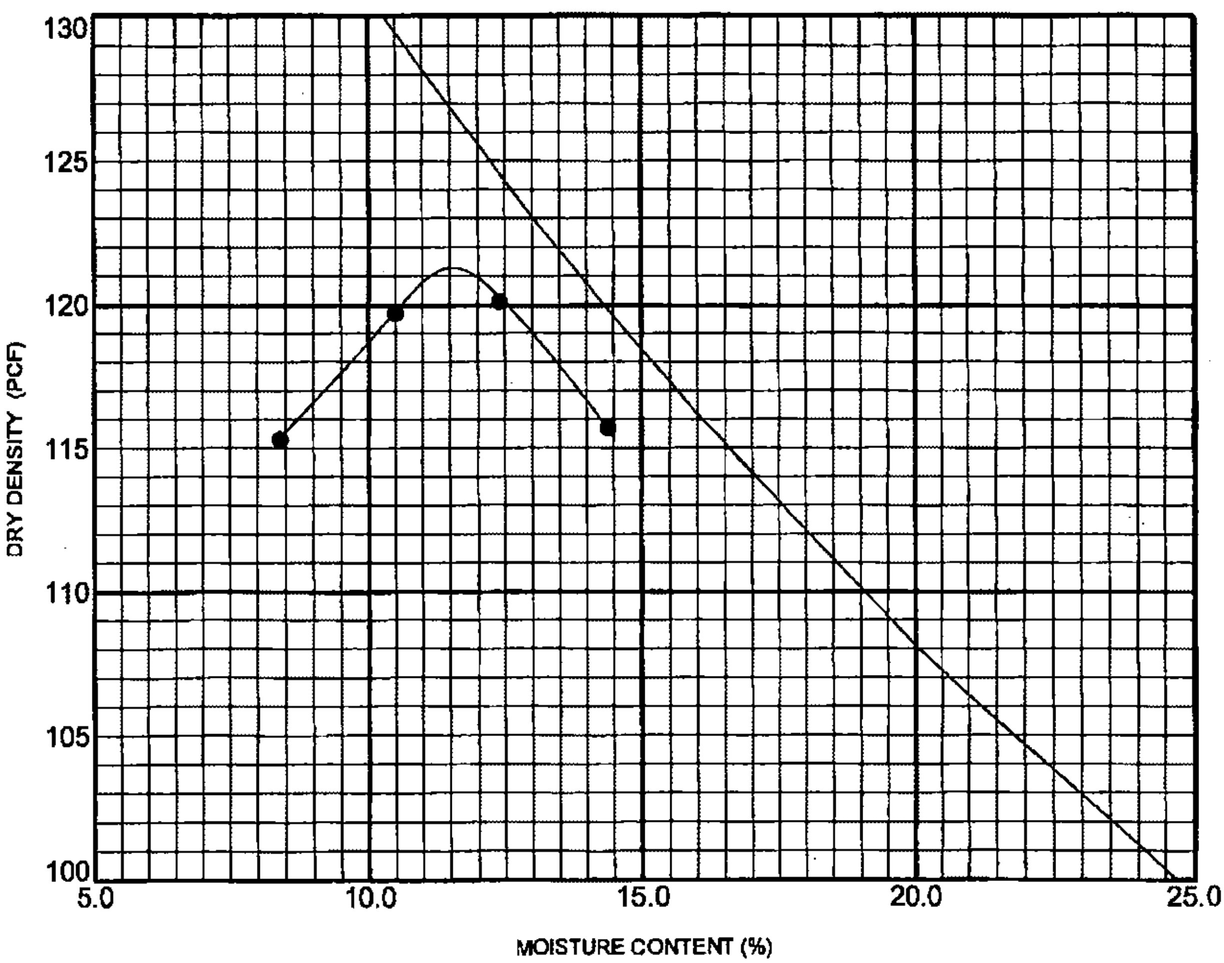
SPEEDIE AND ASSOCIATES

TABULATION OF TEST DATA 161008SA.GPJ GENGEO.GDT 6/27/16

MOISTURE-DENSITY RELATIONS

PROJECT: 84th Street Residential | PROJECT NO.: 161008SA
LOCATION: NWC 84th Street & Black Mountain Road | DATE: 6/2/16
BORING NO.: TP-1 SAMPLE NO.: BS-1 SAMPLE DEPTH: 0 to 2 | LABORATORY NO.:
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 41 PLASTIC LIMIT: 22 PLASTICITY INDEX: 19
CLASSIFICATION: SC ASTM SOIL DESCRIPTION: CLAYEY SAND with GRAVEL

MAXIMUM DRY DENSITY: 121.1 PCF OPTIMUM MOISTURE CONTENT: 11.6%



SPEEDIE AND ASSOCIATES

GEOTECH PROCTOR 161008SA.GPJ 6/27/16

MOISTURE-DENSITY RELATIONS

PROJECT: 84th Street Residential PROJECT NO.: 161008SA

LOCATION: NWC 84th Street & Black Mountain Road DATE: 6/2/16

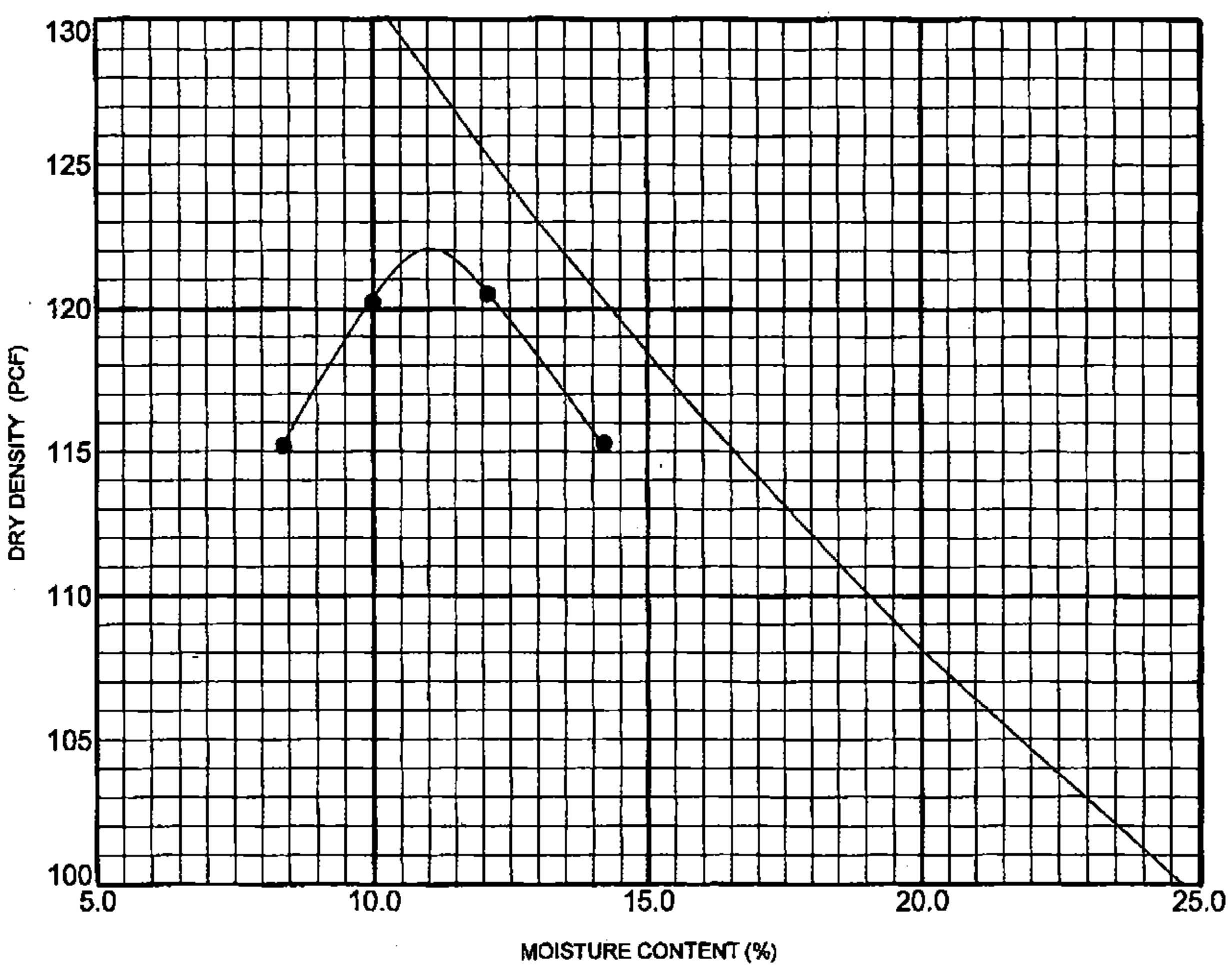
BORING NO.: TP-4 SAMPLE NO.: BS-1 SAMPLE DEPTH: 2 to 6 LABORATORY NO.:

METHOD OF COMPACTION: D698A

LIQUID LIMIT: 34 PLASTIC LIMIT: 27 PLASTICITY INDEX: 7

CLASSIFICATION: SW-SM ASTM SOIL DESCRIPTION: WELL-GRADED SAND with SILT and GRAVEL

MAXIMUM DRY DENSITY: 122.0 PCF OPTIMUM MOISTURE CONTENT: 11.0%



SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, ft	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	REMOLDED DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	PERCENT COMPACTION	FINAL MOISTURE CONTENT (%)	CONFINING LOAD (psf)	TOTAL SWELL (%)
TP-1, BS-1	2.0	121.1	11.6	115.0	9.9	94.9	14.5	100	1.9
TP-4, BS-1	6.0	122.0	11.0	116.0	9.1	95.1	14.2	100	0.1

84th Street Residential
NWC 84th Street & Black Mountain Road
Scottsdale, Arizona
Project No. 161008SA

SPEEDIE AND ASSOCIATES

CORROSIVE TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	PERCENT FINER #200 SIEVE	pH	RESISTIVITY (Ohm-Centimeters)	SULFATE (SO4) (ppm)	CHLORIDE (CL) (ppm)	SULFIDE (+ or -)	REDOX (millivolts)	UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
TP-1	BS-1	BULK	0.0 - 2.0	19.2	7.6	1350	6	32	NT	NT	SC	CLAYEY SAND with GRAVEL
TP-4	BS-1	BULK	2.0 - 6.0	5.9	7.7	2490	3	24	NT	NT	SW-SM	WELL-GRADED SAND with SILT and GRAVEL

84th Street Residential
NWC 84th Street & Black Mountain Road
Scottsdale, Arizona
Project No. 161008SA

SPEEDIE AND ASSOCIATES

GEOLOGICAL CONSULTANTS INC

KENNETH M. EUGE, R.G.

Report Prepared for:

Speedie & Associates
3331 East Wood Drive
Phoenix, AZ 85040

Prepared for: Mr. Kenny Euge
Project Coordinator

Speedie Project No. 161008SA

Report Prepared by:

Geological Consultants Inc.
2333 West Northern Avenue, Suite 1A
Phoenix, Arizona 85021

Prepared by: Martina G Velasquez

Ms. Martina G. Velasquez
Geologist

Reviewed by:

REGISTERED GEOLOGIST CERTIFICATE NO 10338 KENNETH M. EUGE DATE SIGNED 07/13/16 ARIZONA U.S.A. EXP 09-30-2017

Mr. Kenneth M. Euge, R.G.
Principal Geologist

SEISMIC REFRACTION SURVEY
84TH STREET RESIDENTIAL
NWC 84TH STREET & BLACK MOUNTAIN ROAD
SCOTTSDALE, ARIZONA

GCI Project No. 2016-120

July 13, 2016

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APPENDIX B - EXCAVATEABILITY AND RIPPABILITY CHARTS

REGISTERED GEOLOGIST
CERTIFICATE NO.
10338
KENNETH M.
EUGE
DATE SIGNED 07/13/16
ARIZONA U.S.A.
EXP 09-30-2017

SEISMIC REFRACTION SURVEY
84TH STREET RESIDENTIAL
NWC 84TH STREET & BLACK MOUNTAIN ROAD
SCOTTSDALE, ARIZONA

1.0 INTRODUCTION

This report presents results of a seismic refraction geophysical field investigation and analysis to assess general subsurface conditions at the 84th Street Residential Project, located on the northwest corner of 84th Street and Black Mountain Road, in Scottsdale, Arizona (Figure 1). Nine seismic refraction survey lines were to be laid out along a proposed roadway to assess the subsurface condition within the alignment (Figures 2a and 2b). The seismic refraction survey lines BM-S1, BM-S2, BM-S3, BM-S4, BM-S5, and BM-S6 were directed toward the east, along Black Mountain Road. Seismic surveys BM-S7, BM-S8, and BM-S9 were approximately located along a proposed roadway alighnemt within the proposed development area. GM-S7 is located along the north-south roadway alignment in the east portion of the parcel. BM-S8 is located along an east-west segment of the proposed alignment in the north portion of the parcel. BM-S9 is located along a north-south roadway alignment that bisects the west portion of the parcel. The specific seismic survey line locations were selected following a joint reconnaissance of the lot area and discussion between Mr. Kenny Euge, II, Project Coordinator of Speedie & Associates and Mr. Kenneth M. Euge, Sr., R.G. of Geological Consultants Inc. This report is provided to supplement the geotechnical investigation being conducted by Speedie & Associates.

The seismic refraction survey line is underlain by a relatively thin veneer of naturally deposited and reworked alluvial soils derived from a decomposed granite bedrock (Pinnacle Peak Granite) which underlies the project area (Skotnicki, Steven J., et al, 1997). The alluvial soils are loose to dense and unconsolidated to poorly consolidated alluvium that consists of medium to dark reddish orange brown, angular to subangular silty sand with gravel, cemented with caliche at depth. Sheet flow-deposited, angular to subrounded, coarse gravel, pebbles, and cobble-size rock fragments and caliche fragments are locally scattered on top of the alluvial soil surface. The porphyritic granite bedrock pediment is locally exposed and capped with caliche. Based on our interpretation of the seismic survey results, weakly to moderately cemented alluvium and/or moderately to slightly decomposed granite bedrock could be encountered approximately four to thirty-five feet below the existing ground surface, where seismic surveys were conducted. Underlying, slightly weathered to unweathered granite bedrock, may be as little as five feet below the ground surface.

Seismic survey line data are used to develop reasonable interpretations of subsurface conditions within specified areas of the project site. The objectives of the seismic refraction geophysical surveys are to provide for, by indirect means, a higher level of confidence to:

- Indirectly characterize earth fill, natural soil, bedrock, or bedrock-like materials that may be present within and adjacent to the proposed roadway alignment.

- Evaluate the thicknesses of existing soil overburden alluvium and depth to underlying cemented or very dense alluvium, and moderately to slightly weathered and decomposed granitic bedrock.

The general requirements for this project were defined by Mr. Kenny Euge, II, Project Coordinator, of Speedie & Associates. Seismic survey field work for the seismic refraction survey lines was completed on June 14, 2016 (BM-S1, BM-S2, and BM-S3) and June 21, 2016 (BM-S4 through BM-S9).

The Scope of Work performed to accomplish the objectives of this study included:

- Mobilizing and demobilizing personnel and equipment to and from the job site.

- Completion of nine shallow seismic refraction surveys and preliminary field analysis of survey results. Figure 2 depicts the locations of the seismic refraction survey lines.

- A rough position survey using a hand-held GPS receiver to locate the seismic line relative to the site topography and cultural features observed at the site.

- A cursory examination of the residual soil and alluvial deposits exposed within and adjacent to the proposed roadway alignment.

- Computer analysis of field data and interpretation of results was performed to complete the assessment of the materials present, their relative quality and their excavateability.

- Preparation of this report to document the seismic refraction survey, its findings, interpretations, conclusions, and recommendations.

The seismic survey was designed to investigate representative areas along the proposed roadway alignment to address concerns relative to the site soil conditions and to determine the depth of bedrock (if present) that may be encountered at and in the vicinity of excavations proposed at this site, and qualitatively assess the relative ease of excavation of the soils, and bedrock that may be encountered. The effective penetration depth for the seismic refraction survey is estimated to be at least 30 feet below the ground surface. Velocity, thickness, and depth computations of different horizons, or zones, are provided to generally characterize site materials within the depth of interest expected at the project site. No direct subsurface explorations, such as test pits, were made by Geological Consultants Inc. as part of this seismic refraction survey. However, test pit explorations were conducted by Speedie & Associates as part of their geotechnical investigation.

2.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the cursory site reconnaissance, seismic surveys, and the data interpretations, the following conclusions and recommendations are provided:

2.1 Site Geology: The 84th Street Residential project area is underlain by soil and bedrock. The naturally deposited and reworked alluvial sediments are medium to dark reddish orange brown, loose to dense, and unconsolidated to poorly consolidated alluvium consisting of silty sand with gravel that is locally overlain with scattered accumulations of coarse gravel, pebbles, and cobble-size, angular to subrounded rock fragments and scattered caliche fragments.

Based on our interpretation of the seismic survey results, the subsurface material can be subdivided into three velocity layers. The top, low velocity layer consists of loose to slightly dense, uncemented to weakly cemented alluvium. The thickness of this layer ranges from zero to approximately 3.8'. The thickness of the middle layer ranges from approximately 4.1' to 35.2', and likely consists of moderately to slightly decomposed granite which may contain very hard granite core stones of variable diameter. The alluvial sediments are underlain by a relatively high velocity layer consisting of hard to very hard porphyritic granite bedrock. This bedrock, an exhumed pediment, is exposed in several areas across the project site where it appears to be caliche capped (Figures 21, 22, and 23).

Excavation of the alluvial soils and moderately to slightly decomposed granite bedrock, if encountered, is expected to be relatively easy to slightly difficult depending on the density and degree of cementation or decomposition of these underlying geologic units. Excavation of the high velocity, slightly weathered to unweathered granite bedrock will be very difficult and may necessitate use of specialized rock breaking equipment or blasting.

2.2 Seismic Survey Results: Interpreted stratigraphy derived from the seismic survey data are depicted in Figures 3, 5, 7, 9, 11, 13, 15, 17, and 19. These figures include the average seismic velocities of the materials encountered along the seismic line, a thickness profile of the different velocity zones, and the calculated velocity zone boundaries. Our interpretations of the geologic materials represented by the measured seismic velocities are summarized in Table 1.

Based on our interpretations of the seismic data, the conclusions presented regarding the depth to various velocity zones are believed to be reasonable at the location of the seismic survey line. The conditions characterized by indirect seismic methods along the seismic survey line probably represent subsurface conditions that could be found within the project site. The calculated depth/velocity ranges are summarized in Table 1.

Table 1
Seismic Survey Line Calculated Depth/Velocity Ranges
84th Street Residential Project
NEC Lone Mountain Road & Via Cortana Road
Scottsdale Arizona

Survey Line No.	Depth Range at Shot Point (ft)			Average Seismic Velocity (ft/sec)	Interpreted Geologic Description	Qualitative Rippability
	A	B	C			
BM-S1	0 - 2.9	0 - 2.4	0 - 1.1	1,619	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	2.9 - 21.0	2.4 - 17.0	1.1 - 5.2	5,347	Moderately to Strongly Caliche Cemented Alluvium and/or Moderately to Slightly Decomposed Granite Bedrock	Moderate
	21.0±	17.0±	5.2±	9,782	Slightly Weathered to Unweathered Granite Bedrock	Severe
BM-S2	0 - 1.3	0 - 0.9	0 - 0.9	1,000	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	1.3 - 10.5	0.9 - 12.0	0.9 - 13.7	3,793	Moderately to Strongly Caliche Cemented Alluvium and/or Moderately to Slightly Decomposed Granite Bedrock	Moderate
	10.5±	12.0±	13.7±	13,064	Slightly Weathered to Unweathered Granite Bedrock	Severe
BM-S3	0 - 1.4	0 - 3.0	0 - 1.9	1,043	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	1.4 - 14.7	3.0 - 16.2	1.9 - 11.2	2,897	Moderately to Strongly Caliche Cemented Alluvium and/or Moderately to Slightly Decomposed Granite Bedrock	Slight to Moderate
	14.7±	16.2±	11.2±	7,618	Slightly Weathered to Unweathered Granite Bedrock	Severe
BM-S4	0 - 3.1	0 - 4.0	0 - 2.6	1,452	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	3.1 - 26.6	4.0 - 30.7	2.6 - 26.9	3,289	Moderately to Strongly Caliche Cemented Alluvium and/or Moderately to Slightly Decomposed Granite Bedrock	Moderate
	26.6±	30.7±	26.9±	6,006	Slightly Weathered to Unweathered Granite Bedrock	Severe

Survey Line No.	Depth Range at Shot Point (ft)			Average Seismic Velocity (ft/sec)	Interpreted Geologic Description	Qualitative Rippability
	A	B	C			
BM-S5	0 - 0.9	0 - 3.8	Nil	1,481	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	0.9 - 11.3	3.8 - 13.3	0 - 10.5	2,056	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	11.3±	13.3±	10.5±	10,806	Slightly Weathered to Unweathered Granite Bedrock	Severe
BM-S6	0 - 2.8	0 - 2.5	0 - 2.0	1,133	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	2.8 - 16.9	2.5 - 23.6	2.0 - 25.7	4,699	Moderately to Strongly Caliche Cemented Alluvium and/or Moderately to Slightly Decomposed Granite Bedrock	Moderate
	16.9±	23.6±	25.7±	13,063	Slightly Weathered to Unweathered Granite Bedrock	Severe
BM-S7	Nil	0 - 3.0	0 - 2.7	1,757	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	0 - 35.2	3.0 - 29.0	2.7 - 24.5	3,576	Moderately to Strongly Caliche Cemented Alluvium and/or Moderately to Slightly Decomposed Granite Bedrock	Moderate
	35.2±	29.0±	24.5±	8,698	Slightly Weathered to Unweathered Granite Bedrock	Severe
BM-S8	0 - 1.8	0 - 1.1	0 - 1.0	1,000	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	1.8 - 16.0	1.1 - 9.0	1.0 - 13.4	3,981	Moderately to Strongly Caliche Cemented Alluvium and/or Moderately to Slightly Decomposed Granite Bedrock	Moderate
	16.0±	9.0±	13.4±	7,353	Slightly Weathered to Unweathered Granite Bedrock	Severe
BM-S9	0 - 1.0	0 - 1.5	0 - 1.3	1,000	Loose to Slightly Dense, Non-Cemented to Weakly Caliche Cemented Alluvium	Slight
	1.0 - 8.3	1.5 - 12.7	1.3 - 18.8	3,727	Moderately to Strongly Caliche Cemented Alluvium and/or Moderately to Slightly Decomposed Granite Bedrock	Moderate
	8.3±	12.7±	18.81±	5,886	Moderately to Strongly Caliche Cemented Alluvium and/or Moderately to Slightly Decomposed Granite Bedrock	Moderate to Severe

2.3 **Estimated Rock Strength:** If decomposed bedrock is encountered, this decomposed to moderately weathered granite could be described as "Very Soft Rock" with an estimated unconfined compressive strength between 246 and 435 pounds per square inch (psi) in the low velocity zone (Table B-1). According to the Unified Rock Classification System, the estimated unconfined compressive strength for the decomposed granite that retains the fabric of intact rock is probably less than 1,000 psi. Slightly weathered and decomposed granite bedrock with velocities ranging between 3,935 to 4,920 feet per second could have an unconfined compressive strength ranging from 435 to 1,450 psi. Where encountered, moderately to slightly weathered granite core stones, and the slightly weathered to unweathered granite bedrock could be considered hard to extremely hard rock with high compressive strengths ranging from 1,450 psi at the lower velocities to greater than 10,150 psi at the higher velocities (see Table B-1)

2.4 **Qualitative Rippability / Excavateability**: The estimated qualitative rippability/ excavateability summarized in Table 2 is based on the interpretations of the seismic survey data, understanding of the site geological conditions, and professional experience. There is no guarantee that the seismic refraction survey results or the qualitative rippability/excavateability can be duplicated by others. We recommend this information be used with caution and only as guidelines.

Because the seismic velocities used to determine qualitative rippability/excavateability may vary from 10 to 20 percent, and due to the variability of the subsurface material, qualitative rippability/excavateability constraint categories listed in Table 2 may overlap at the transition from one constraint category to the next.

2.5 **Excavation Constraints**: The excavation constraints described in this report (Tables 1 and 2) are, in our opinion, reasonable for the locations where the seismic refraction surveys were conducted. The ultimate excavateability is dependent on many factors (variably cemented soils, cemented gravel to boulder soil zones, presence of large boulder and core stones, bedrock and soil physical properties, excavation methods, size and age of excavation equipment, level of effort applied by the contractor, etc.) and it may not be possible to correlate these factors with the results of the seismic refraction survey conducted for this investigation. The excavation contractor must exercise caution, and assume associated risks, when attempting to extrapolate these data to other areas where seismic surveys have not been conducted. There is no guarantee that the seismic refraction survey results (Table 1) or the qualitative rippability/excavateability (Table 2) can be duplicated by others. We recommend this information be used with caution and only as guidelines.

Prospective contractors or others involved with excavation at this site should review this report along with the excavateability performance charts and tables provided by manufacturers of rock and soil excavating equipment. This information can be used as part of their evaluation criteria for selecting equipment that may be used to excavate or fragment moderately to slightly weathered and unweathered bedrock expected to be encountered at this site. However, the contractors using these data or making interpretation of this information, for any reason, do so at their sole risk.

The qualitative excavateability summarized in Table 2, along with our interpretation of the subsurface materials (Table 1) are provided so that a prospective contractor can relate seismic velocities to the subsurface materials they can expect to encounter where excavations may be proposed. Although a backhoe may be able to excavate low velocity material and a heavy, hydraulic impact rock breaker attached to a large track-mounted excavator might be able to fragment moderate to high velocity bedrock, strongly cemented zones, or fractured and jointed bedrock material, there are no guarantees due to the wide range of variables summarized herein that effect equipment suitability and material excavateability. Also, the progress of excavation in soils, cemented with caliche to a rock-like consistency and/or bedrock, where encountered, should be expected to be slow. Appendix B contains tables and charts, from various sources, on the rippability/excavateability of various materials.

Table 2

Qualitative Excavateability Relative to Soil/Bedrock Type & P-Wave Velocity
84th Street Residential Project, Scottsdale, Arizona

Unit	Average Velocity (feet per second)	Excavateability Constraints
Fill/Medium to Coarse Grained, Uncemented to Weakly Cemented Residual and Alluvial Soil & Strongly Decomposed Granite Bedrock	< 3,000	**Slight**- Should be excavateable using conventional earthmoving equipment. Gravel- to large cobble-size rock fragments could be encountered where the residual soil and alluvium is excavated. If large core stones or boulders are encountered, secondary fragmentation could be necessary. Marginal excavation conditions could be experienced where caliche-cemented alluvium is encountered.
Moderately to Strongly Caliche Cemented Alluvium or Moderately to Slightly Decomposed Granite Bedrock	3,000 to 6,000	**Marginal**- Potentially difficult to excavate with low horsepower-low torque conventional equipment where moderately to strongly caliche cemented soils and variably weathered granitic bedrock is encountered. Large, blocky, cobble to boulder-size corestones could be generated and could be difficult to excavate. Large rock fragments (boulders, etc.) could require special fragmentation methods such as heavy, high impact energy hydraulic hammers mounted on large track-hoes. Fragmentation could be difficult. Moderate to high horsepower excavation equipment and rippers could improve production where the bedrock is strongly broken; however, production could be slow.

Slightly Weathered to Unweathered Bedrock	> 6,000	**Severe**- Conventional, low horsepower/torque excavation equipment will likely experience refusal. Where allowed, blasting could be used for effective fragmentation. Very hard, massive or granite bedrock will be very difficult to excavate. Bedrock may be locally rippable using a large tractor such as a D-9, D10, or equivalent, with a single-shank ripper or heavy backhoe/trackhoe with heavy hydraulic impact hammers used along joint and fracture planes. Large boulder-size rock fragments could be generated that could require secondary fragmentation. Production expected to be very slow.

No site-specific testing has been conducted at this site by Geological Consultants Inc. to verify the qualitative rippability/excavateability categories (Table 2) nor has any equipment performance evaluations been conducted relative to ripping or excavating site materials or to determine equipment suitability for this site. Therefore, the contractor must exercise caution and assume associated risks if the information provided herein is used by the contractor to assist with the determination of equipment suitability for fragmentation or excavation. For an indicator of the rippability and excavateability of the near surface soils and decomposed granite, refer to test pit logs provided in the Speedie & Associates geotechnical report.

2.6 **Construction Vibration Considerations**: Blasting is not expected to be required at this site to assist with excavation except where high velocity (6,000 feet per second±) slightly weathered to unweathered granite bedrock is encountered. However, if heavy, vibration-producing equipment or blasting is used to assist with the excavations made at this site, the contractor should be required to keep ground vibrations from any construction source within applicable safe limits for surrounding structures including residential buildings and utilities.

We suggest that preconstruction surveys should be considered for all existing structures located within 300 to 500 feet of the proposed excavation areas where heavy construction equipment, such as vibratory compactors, high-energy impact hammers, or blasting, may be used. Likewise, we suggest construction equipment operations be monitored periodically during construction to assure the ground vibrations are within safe limits for the existing structures and utilities. However, we recommend the construction vibration intensities be limited to less than one inch per second for residential areas and for sensitive structures or components such as buried gas and water lines unless more restrictive allowable vibration limits are specified by other regulatory authorities. The purpose of the preconstruction surveys and construction vibration monitoring is to limit liability for property owners, the contractor, and other involved parties. If blasting is used, we recommend the blasting be conducted by a firm with personnel experienced with blasting in similar geological material and site conditions in close proximity to structures.

2.7 **Safety**: We recommend adequate "safety zones" be established and maintained around the proposed excavations during construction.

2.8 **Slope Stability Considerations**: If the vertical height of any permanent or temporary slopes excavated in close proximity or adjacent to existing structures exceed 5 feet and where the finish slope gradients are steeper than 2:1 (horizontal to vertical) or are steeper than current building and grading code requirements, the contractor must be required to provide shoring or a slope reinforcement/stabilization system, design by registered civil engineer or engineering geologist according to the local or County building code standards and according to the design recommendations provided by a registered civil (geotechnical) engineer or geologist. The purpose of the shoring / stabilization system is to provide permanent and temporary cut slopes or trench slopes will have an adequate factor of safety against failure and to mitigate potential damage to nearby structures.

3.0 GEOPHYSICAL SITE INVESTIGATION

The seismic refraction survey was conducted to indirectly investigate subsurface conditions and to develop reasonable interpretations of subsurface conditions.

3.1 Site Specific Seismic Survey

Following the completion of a site reconnaissance to identify the seismic survey locations, seismic refraction surveys (BM-S1, BM-S2, BM-S3, BM-S4, BM-S5, BM-S6, BM-S7, BM-S8, and BM-S9) were made at the locations depicted in Figures 2. The seismic surveys were conducted to evaluate the soil overburden thickness and where possible, identify and characterize fill soil and decomposed granitic bedrock that may be present below existing grades along a proposed roadway alignment, and to characterize the qualitative excavateability of the soil and bedrock, if encountered.

Three shot points were used along the seismic survey line to evaluate possible non-horizontal subsurface boundary conditions (buried sloping surfaces, cementation zones, soil-change boundaries, etc.) that could be expected in this type of geological terrain (Figures 4, 6,8, 10, 12, 14, 16, 18, and 20), and to improve the accuracy of the seismic wave velocity determinations. The seismic refraction surveys BM-S1 through BM-S9 were run over a total length (120-feet, including shot point offsets) sufficient to achieve adequate depth penetration (of at least 30 feet). The geometry of the seismic survey lines was set up to identify the subsurface layers or zones that could influence excavation proposed at the site.

As with any type of geophysical investigation method, there are limitations to its usefulness and application. Refer to Appendix A for additional information regarding seismic refraction surveys and their limitations.

3.2 Equipment

Travel-time data for the seismic survey was obtained using Geometrics Inc. Model S12 SmartSeis™ 12-Channel Exploration Seismograph. Seismic wave arrivals are detected with digital grade vertical geophones with a dual hum-bucking coil and a frequency response above 14 Hz natural frequency. Geophones were placed beginning at Station 0 and at 10-foot intervals thereafter to the end of the seismic survey line. The seismic shock waves are produced by repeated impacts of a 16-pound sledge hammer onto a soft steel striking plate. Hammer impacts (shots) were made at five-foot offsets from each end of the seismic line traverse and at a shot point located at the center of the survey line spread. The distance from the impact locations (shot points) to the geophones and the travel time recorded for each station is stored in the seismographs onboard computer. If the field seismic data plots indicated the possible presence of anomalous subsurface conditions or spurious noise coincident with the hammer impacts, repeated impacts are used to verify the initial data reading or to correct the data. Topographic features,

4.0 GENERAL LIMITATIONS

The geologic observations, findings, conclusions, and recommendations presented in this report are based on (1) cursory observations of surface conditions and geologic materials where exposed and (2) analysis of the seismic refraction data gathered at the site. The services provided by Geological Consultants Inc. were performed in accordance with generally accepted geological principals and standard practices used by members of the geological profession in this locale at the time of this study.

It must be recognized that subsurface geologic conditions may vary from place to place and from those found at locations where measurements or surveys are made by the investigator. Generalized geological and rippability/excavateability recommendations presented in this report are based on the interpretations of the results of this investigation and it may not be possible for others to accurately correlate the geology and excavateability results to test explorations or investigations conducted by others. No warranty or representation, either expressed or implied, is or should be construed regarding geological conditions at locations other than those evaluated as part of this study.

The professional opinions, conclusions and recommendations presented in this report relate only to the project and locations specified in this report. If any changes are made in the project, the conclusions and/or recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations of this study are modified and approved in writing by Geological Consultants Inc.

5.0 BIBLIOGRAPHY

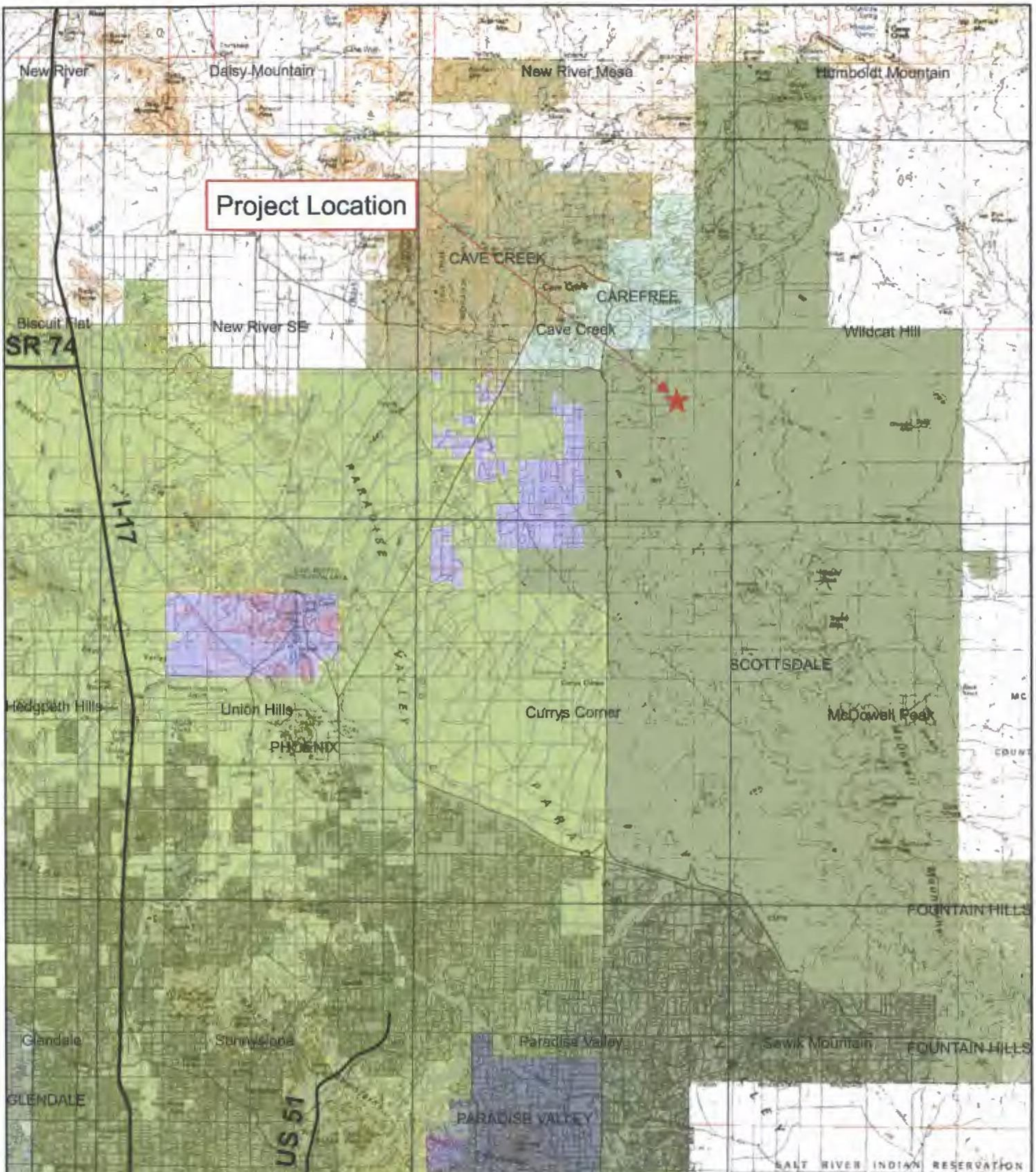
AMEC; 2005; consultants report prepared for City of Phoenix entitled "Refraction Seismic Evaluation, Deer Valley Road-7th Street to Cave Creek Road"; COP Project No. ST85100044, AMEC Job No. 5-119-000199, Report No. 2; 2 September 2005.

Caterpillar, Inc.; 2013; Caterpillar Performance Handbook, Edition 43; Section 18, Rippers, Seismic Wave Velocity Charts; pp. 18-75 to 18-80.

Weaver, J.M.; 1975; Geological Factors Significant in the Assessment of Rippability; The Civil Engineer in South Africa (Die siviele ilngenieur in Suid-Afrika); Volume 17, Issue 12, December 1975; pp. 313-316.

Williamson, D.A.; 1984; Unified Rock Classification System; Bulletin of the Association of Engineering Geologists, Vol. XXI, No. 3, 1984; pp. 345-354.

FIGURES



Basemap from USGS 30'x60' Phoenix North and Theodore Roosevelt Lake Quadrangle Maps.

Seismic Refraction Survey
84th Street Residential
NWC 84th Street & Black Mountain Road
Scottsdale, Arizona
General Project Location Map
Figure 1

GEOLOGICAL CONSULTANTS INC.
2333 West Northern Ave, Suite 1A
Phoenix, AZ 85021
phone 602-864-1888
fax 602-864-1899

Explanation:

BP-S1 Seismic Survey Line Location (approximate)

N

NOT TO SCALE

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Refraction Survey Line
Location Map - West
Figure 2a

Geological Consultants

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Phoenix, Arizona 85021
Phone 602-864-1888
Fax 602-864-1899

Explanation:

BP-S1 Seismic Survey Line Location (approximate)

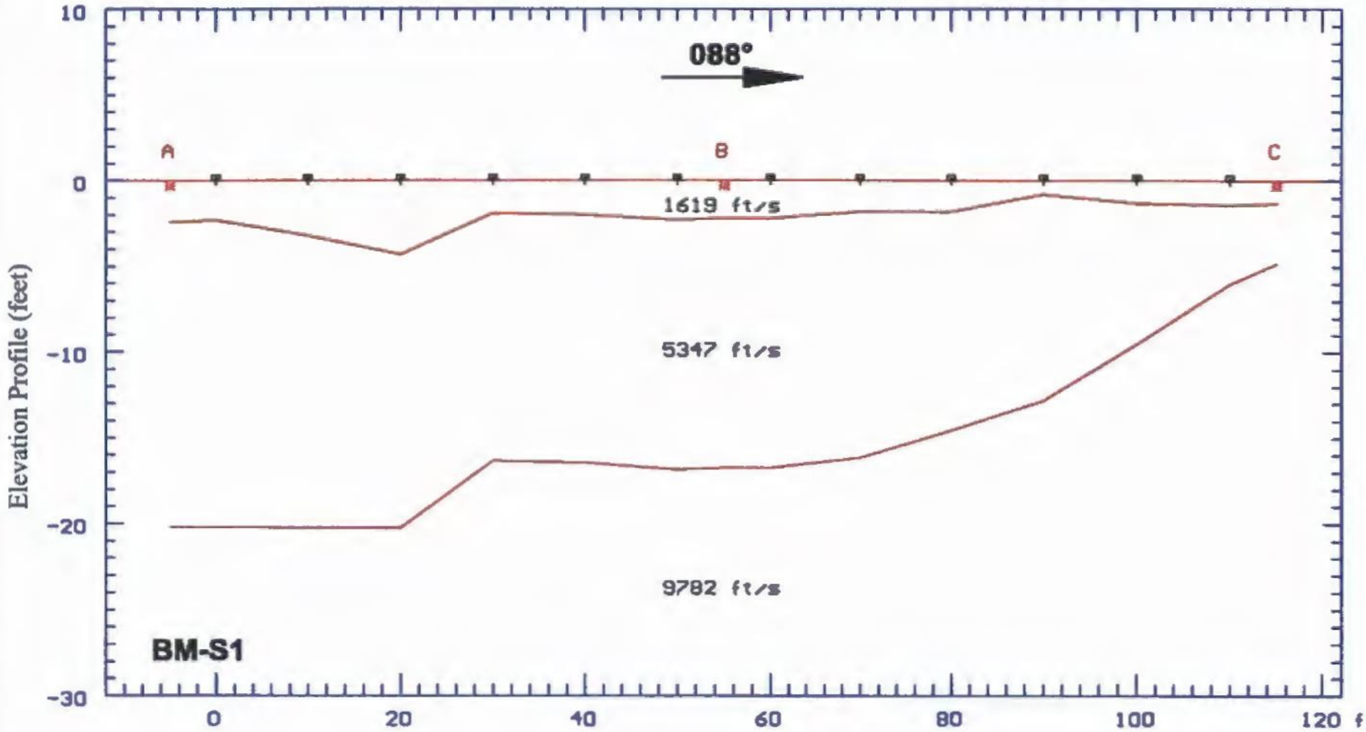
N

NOT TO SCALE

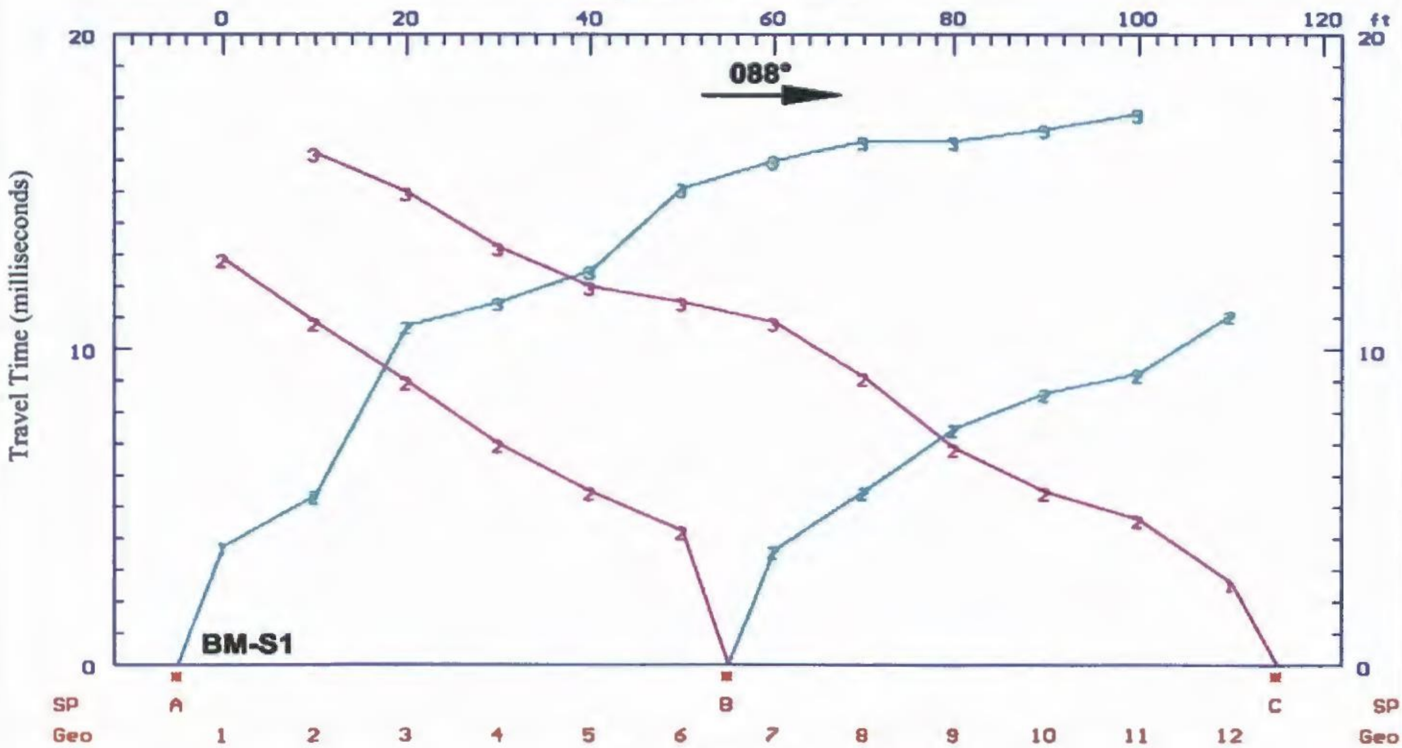
84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Refraction Survey Line
Location Map - East
Figure 2b

Geo-

2333 West Northern Ave. Ste 1A
Phoenix, Arizona 85021
Phone 602-864-1888



Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 4 for photographs of the seismic survey line layout.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S2
Velocity Profile & Time-Distance Plot
Figure 3

Geological Consultants

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Figure 4; Photo 1: Seismic Survey Line BM-S1 view looking toward the east from Shot Point A toward Shot Point C.

Figure 4; Photo 2: Seismic Survey Line BM-S1 view looking toward the west from Shot Point C toward Shot Point A.

Photographs of seismic survey line CS-S1 taken June 14, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

Explanation:

Line BM-S1

A C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 3 for interpreted seismic line profiles and travel time-distance plot.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S1 Photographs
Figure 4

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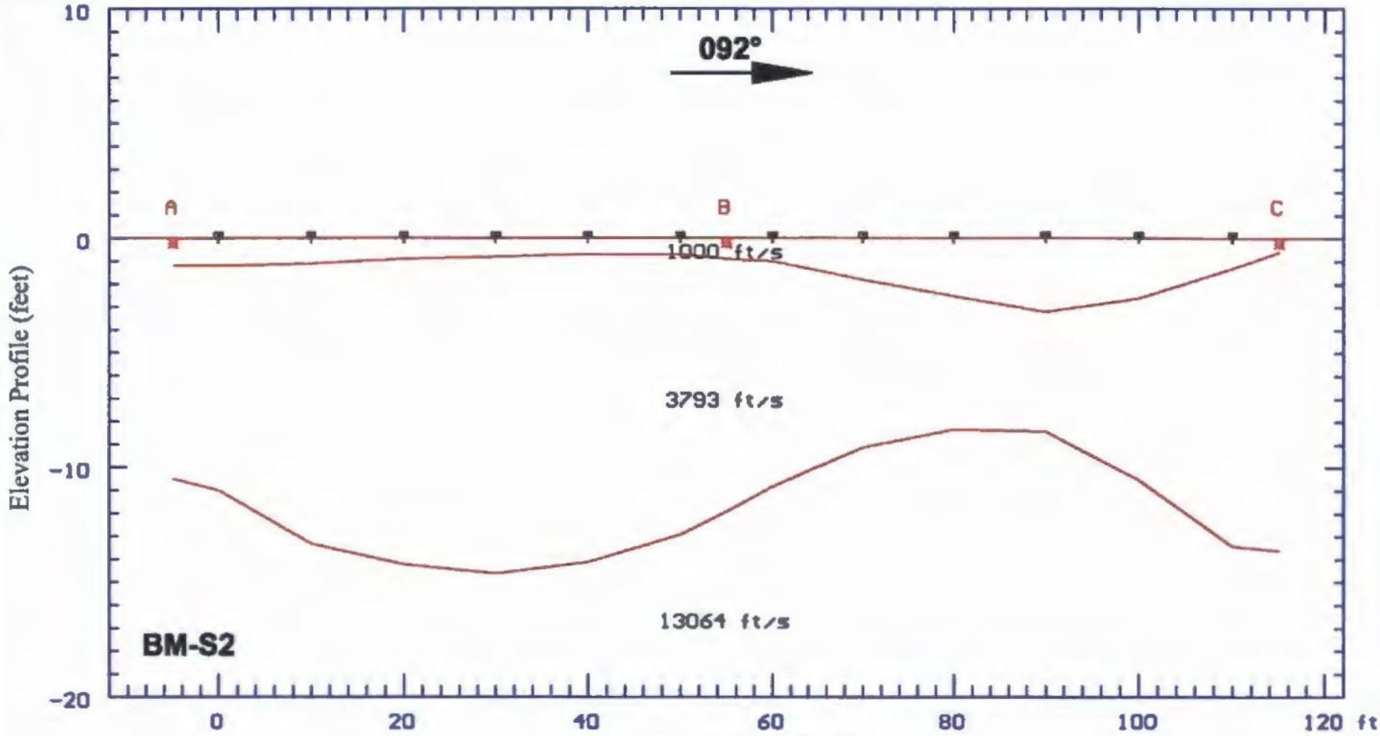
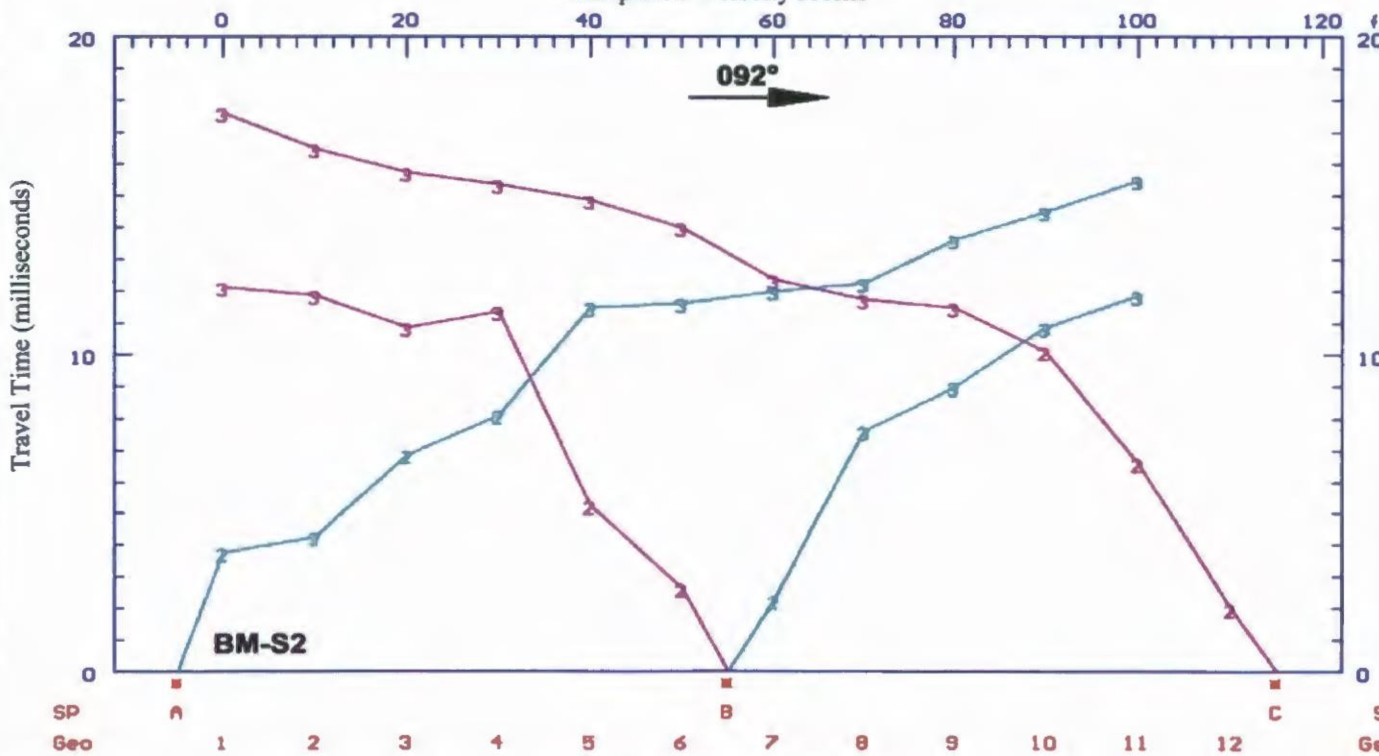


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 6 for photographs of the seismic survey line layout.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S2
Velocity Profile & Time-Distance Plot
Figure 5

Geological Consultants

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Ste 1A
Phoenix, Arizona 85021
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Figure 6; Photo 1: Seismic Survey Line BM-S2 view looking toward the east from Shot Point A toward Shot Point C.

Figure 6; Photo 2: Seismic Survey Line BM-S2 view looking toward the west from Shot Point C toward Shot Point A.

Photographs of seismic survey line BM-S2 taken June 14, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

Explanation:

Line BM-S2

A **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 5 for interpreted seismic line profiles and travel time-distance plot.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S2 Photographs
Figure 6

Geological Consultants Inc.

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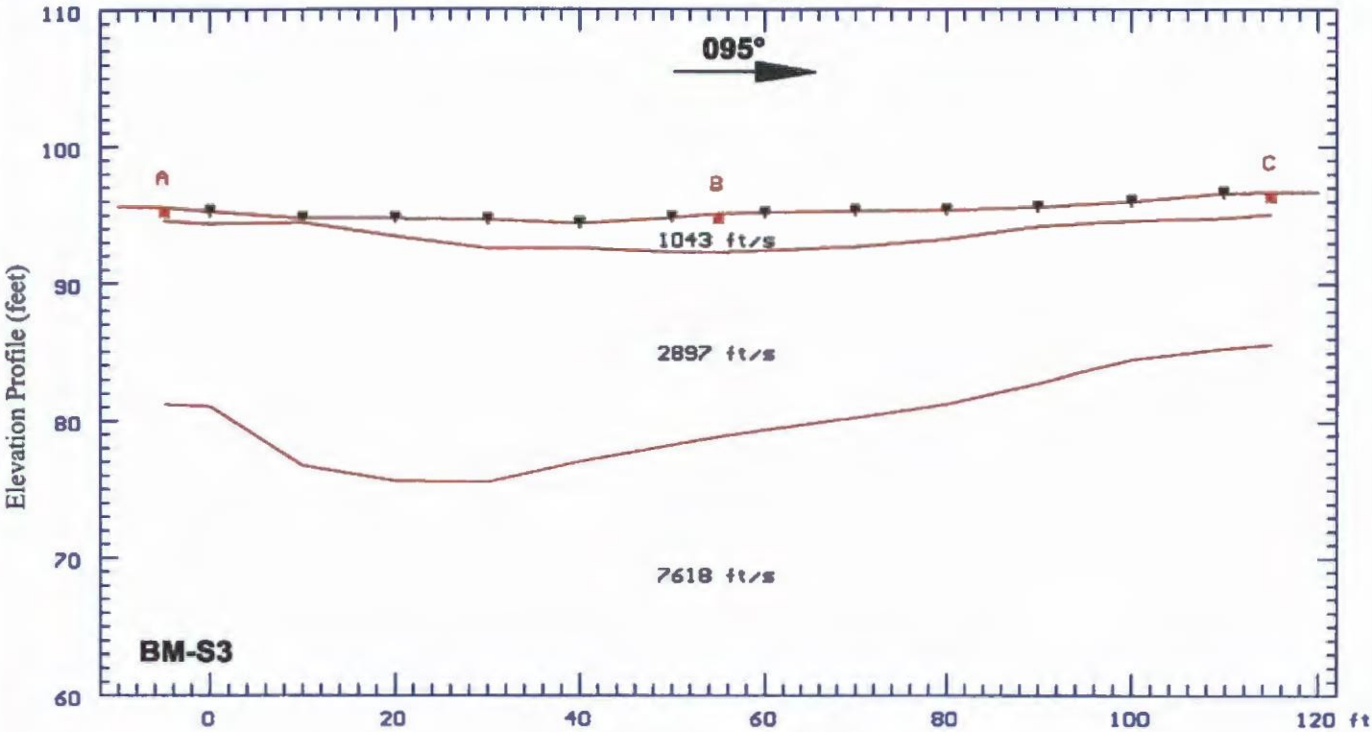
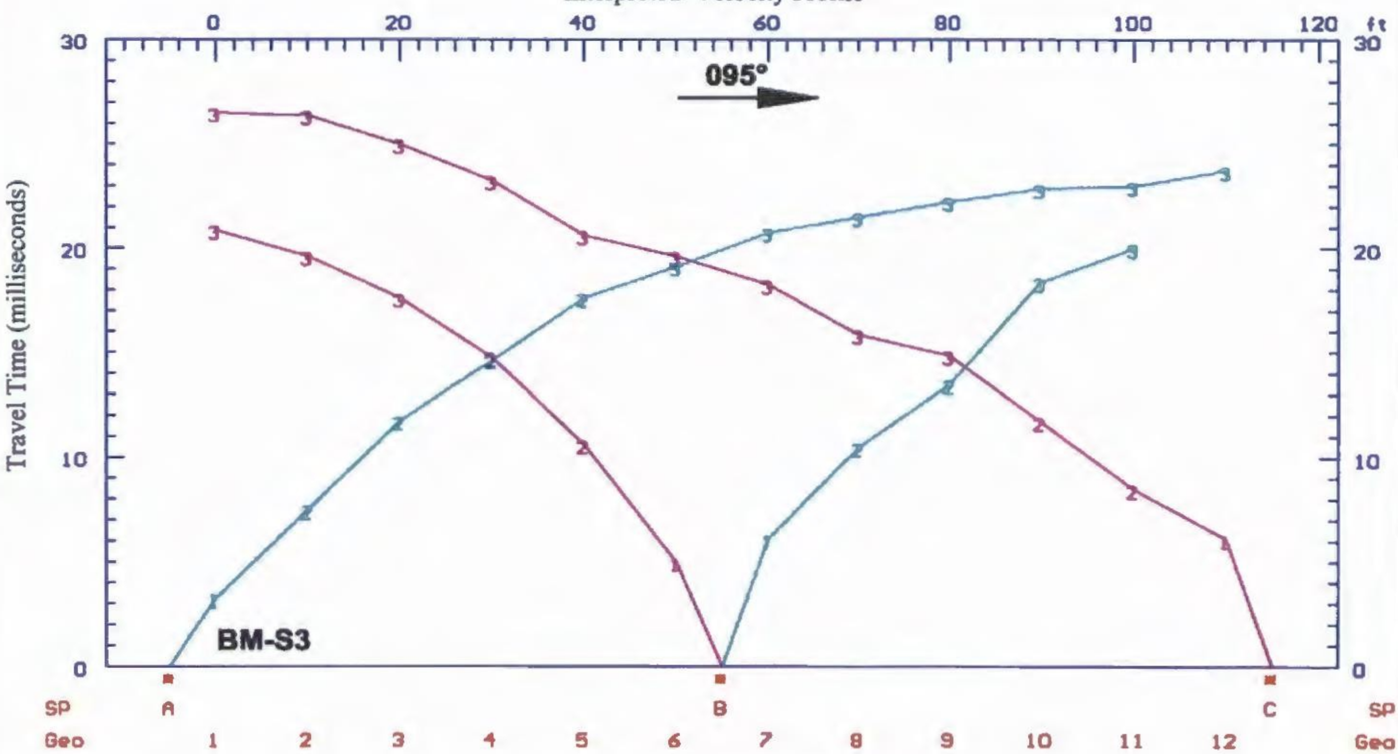


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 8 for photographs of the seismic survey line layout.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S3
Velocity Profile & Time-Distance Plot
Figure 7

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Figure 8; Photo 1: Seismic Survey Line BM-S3 view looking toward the east from Shot Point A toward Shot Point C.

Figure 8; Photo 2: Seismic Survey Line BM-S3 view looking toward the west from Shot Point C toward Shot Point A.

Photographs of seismic survey line BM-S3 taken June 14, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

Explanation:

Line BM-S3

A C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 7 for interpreted seismic line profiles and travel time-distance plot.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S3 Photographs
Figure 8

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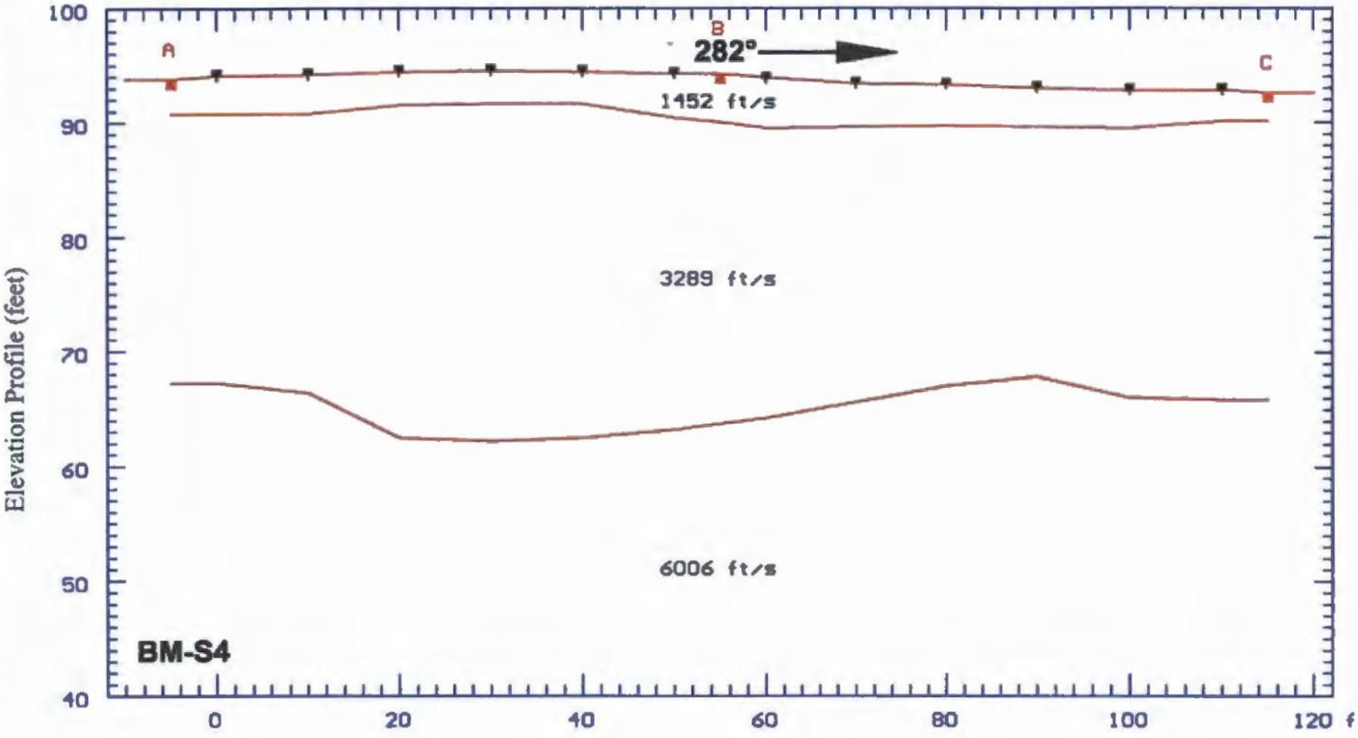
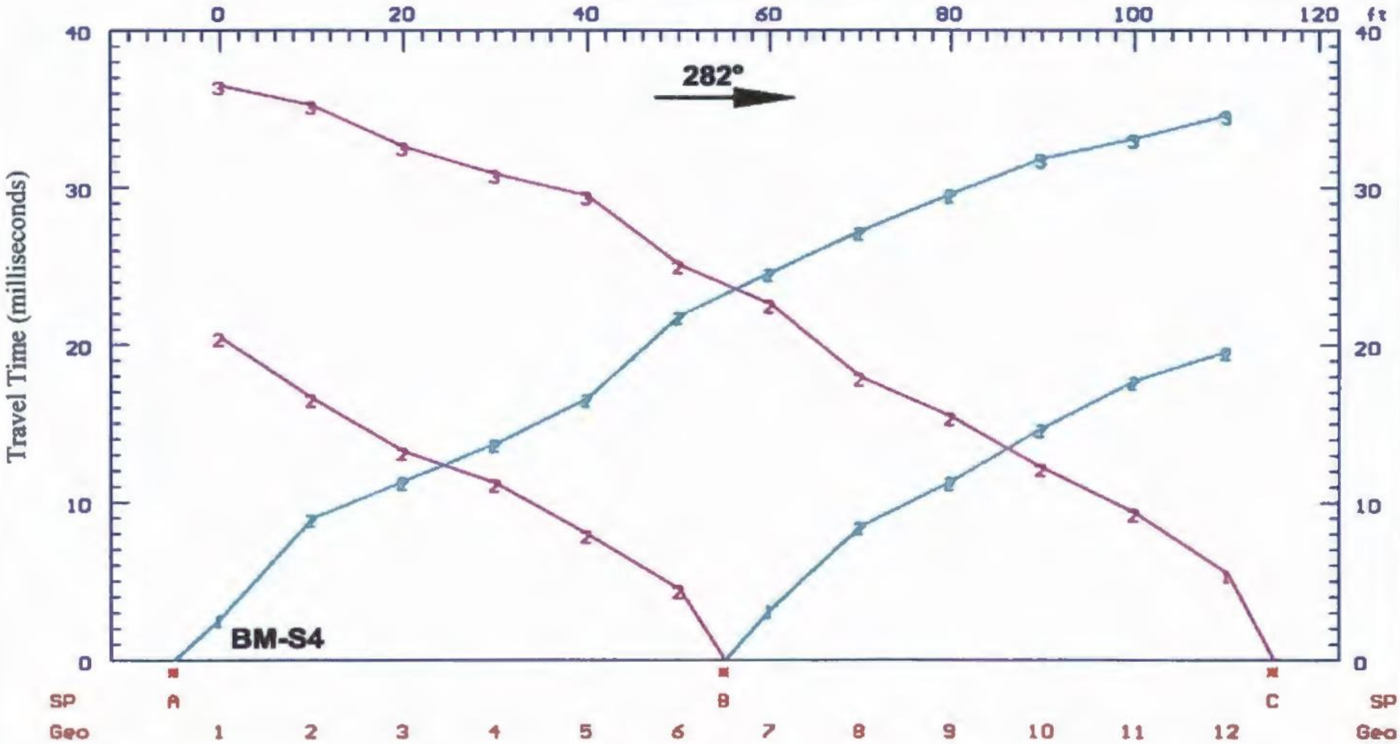


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 10 for photographs of the seismic survey line layout.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S4
Velocity Profile & Time-Distance Plot
Figure 9

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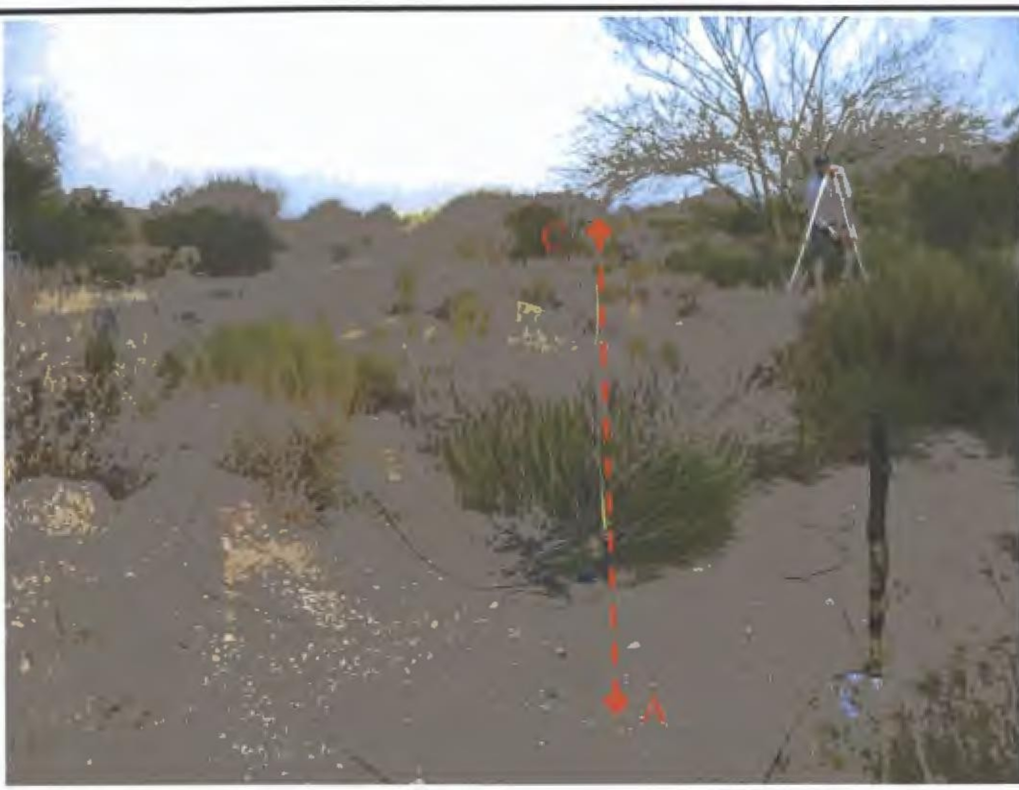

Figure 10; Photo 1: Seismic Survey Line BM-S4 view looking toward the east from Shot Point A toward Shot Point C.

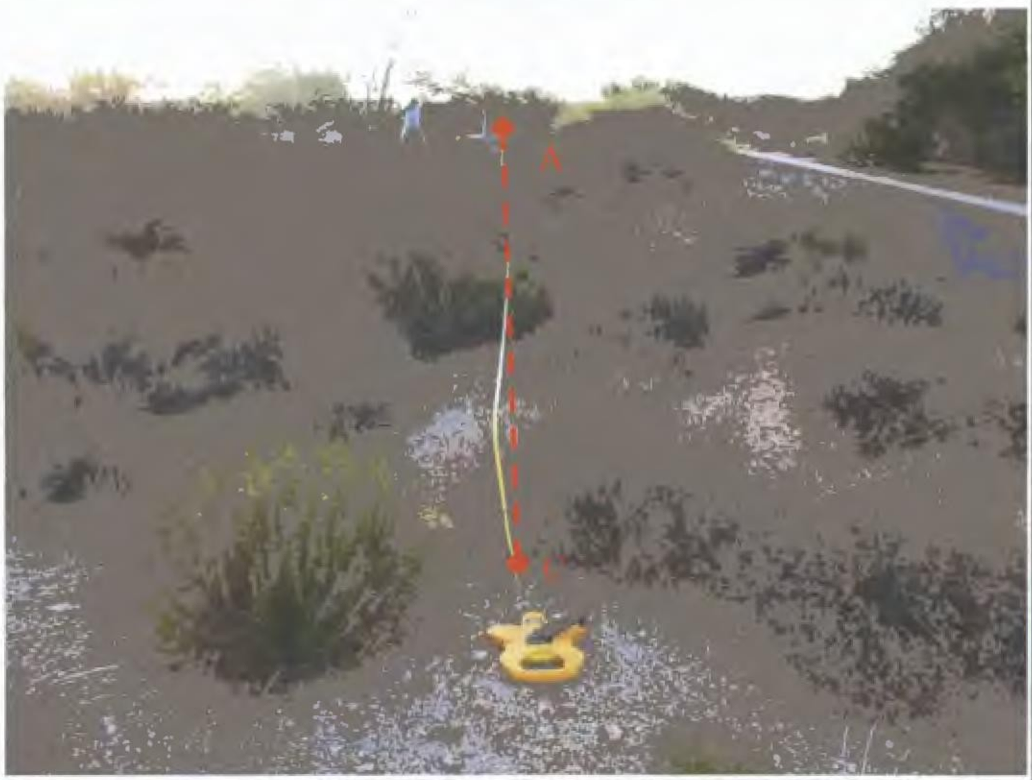

Figure 10; Photo 2: Seismic Survey Line BM-S4 view looking toward the west from Shot Point C toward Shot Point A.

Photographs of seismic survey line BM-S4 taken June 21, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

Explanation:

Line BM-S4

A **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 9 for interpreted seismic line profiles and travel time-distance plot.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S4 Photographs
Figure 10

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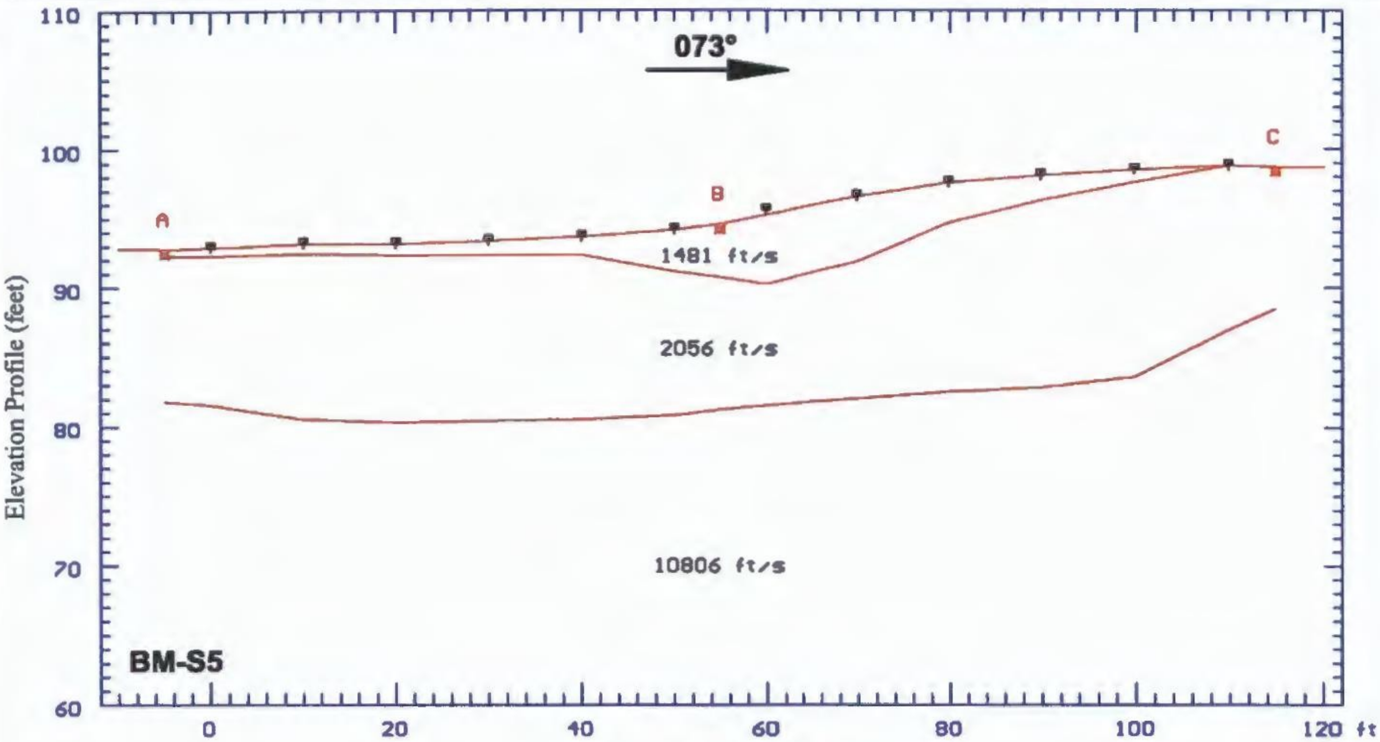
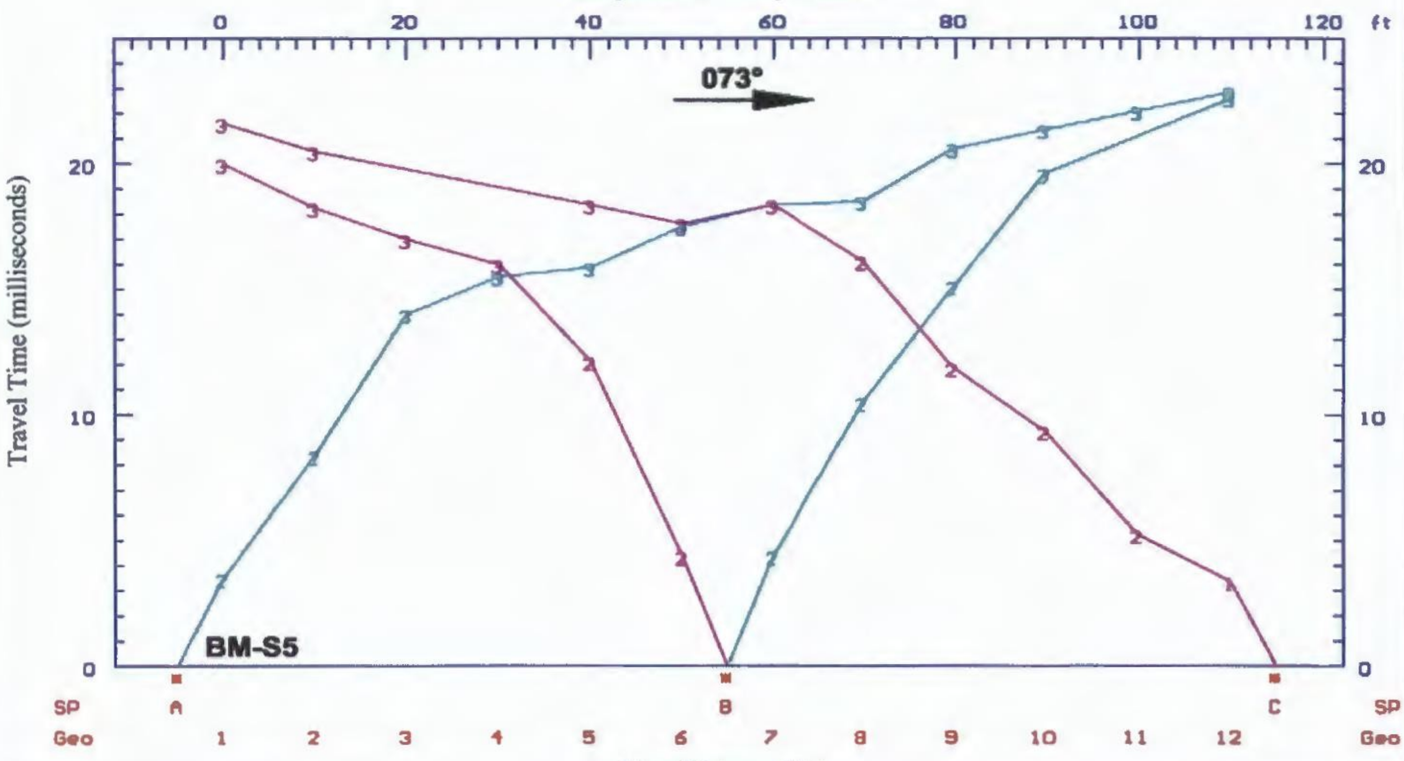


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 12 for photographs of the seismic survey line layout.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S5
Velocity Profile & Time-Distance Plot
Figure 11

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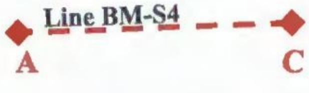
Figure 12; Photo 1: Seismic Survey Line BM-S5 view looking toward the east-northeast from Shot Point A toward Shot Point C.

Figure 12; Photo 2: Seismic Survey Line BM-S5 view looking toward the west-southwest from Shot Point C toward Shot Point A.

Photographs of seismic survey line BM-S5 taken June 21, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

Explanation:



Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 11 for interpreted seismic line profiles and travel time-distance plot.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S5 Photographs
Figure 12

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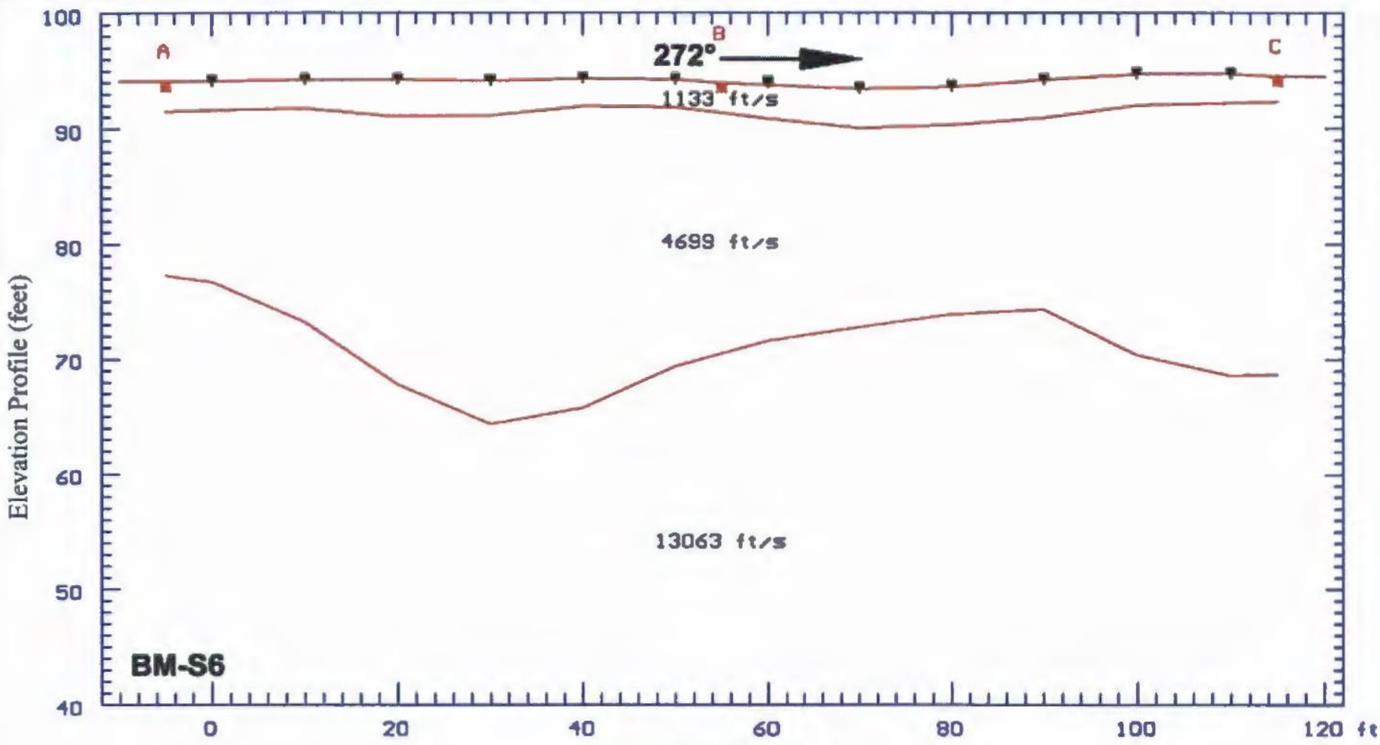
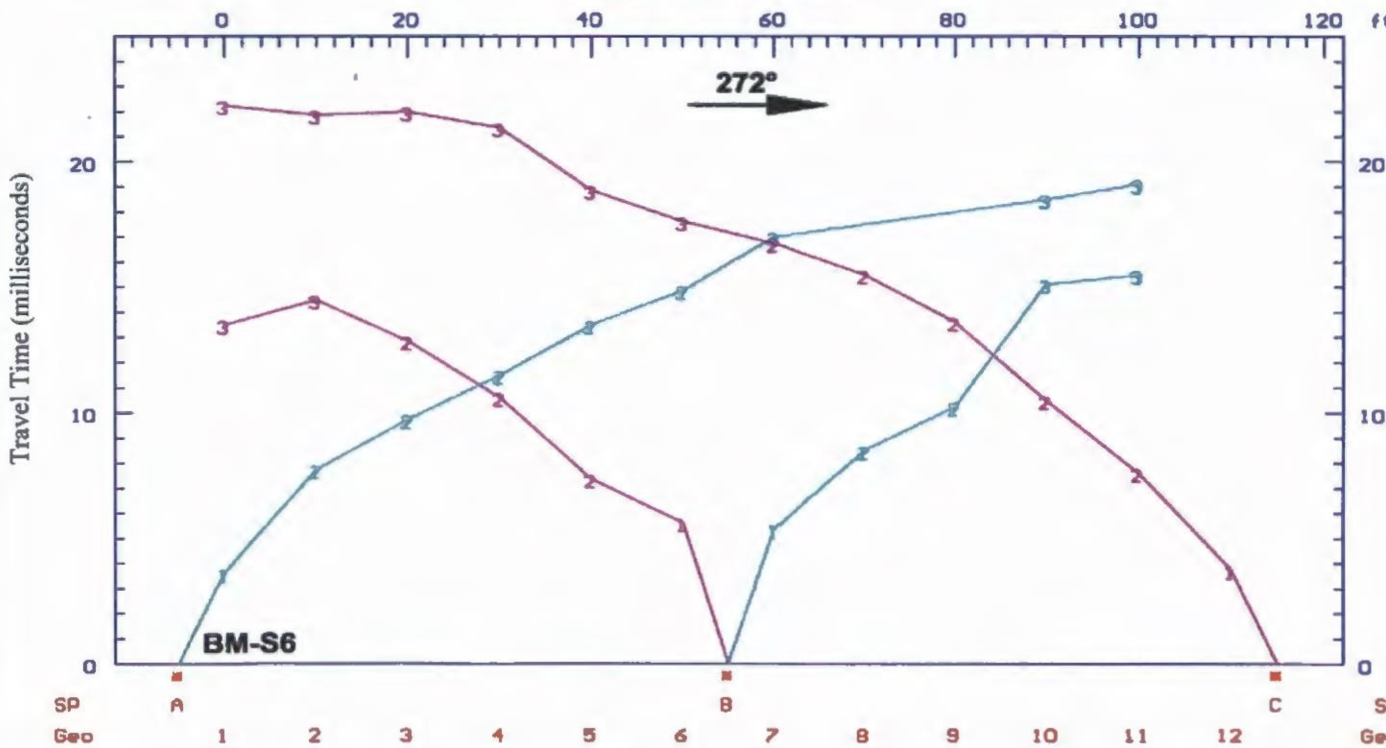


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 14 for photographs of the seismic survey line layout.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S6
Velocity Profile & Time-Distance Plot
Figure 13

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Figure 12; Photo 1: Seismic Survey Line BM-S6 view looking toward the east from Shot Point A toward Shot Point C.

Figure 14; Photo 2: Seismic Survey Line BM-S6 view looking toward the west from Shot Point C toward Shot Point A.

Photographs of seismic survey line BM-S6 taken June 21, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

Explanation:

Line BM-S6

A — C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 13 for interpreted seismic line profiles and travel time-distance plot.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S6 Photographs
Figure 14

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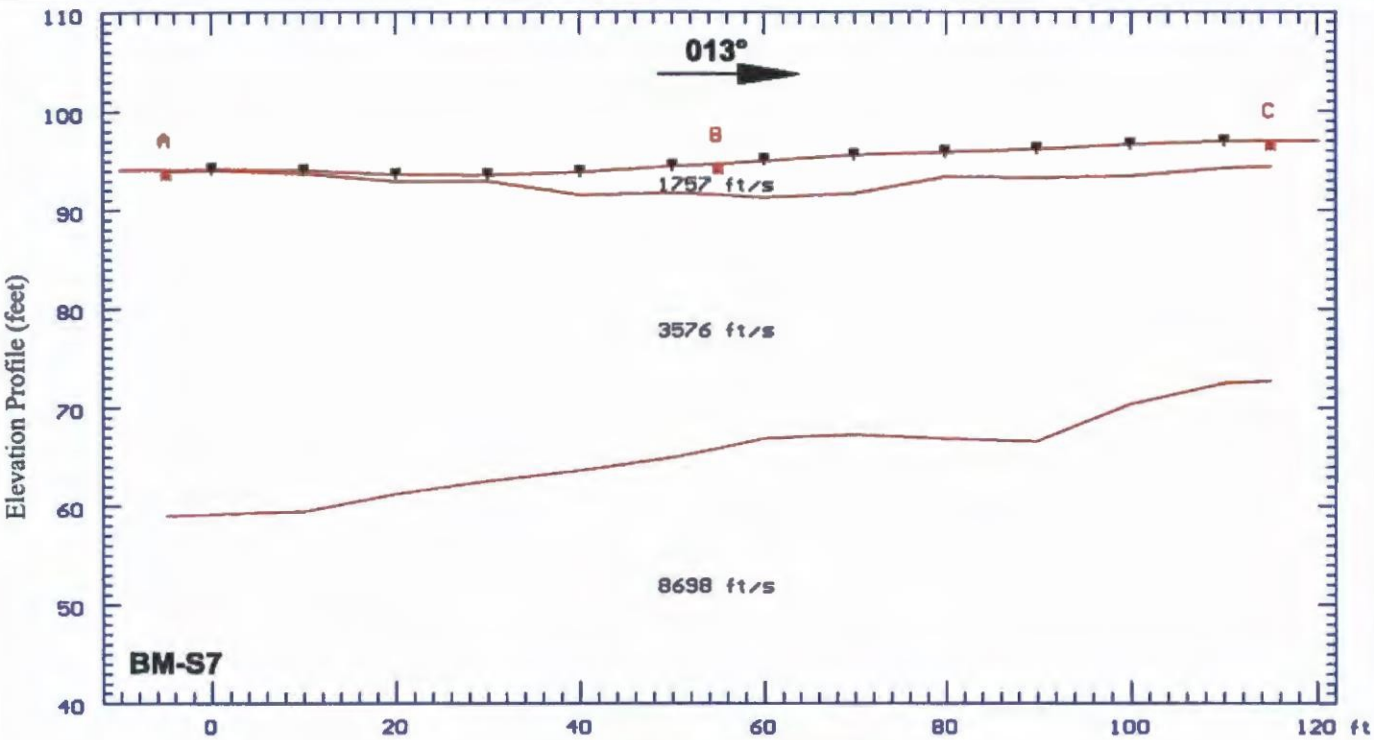
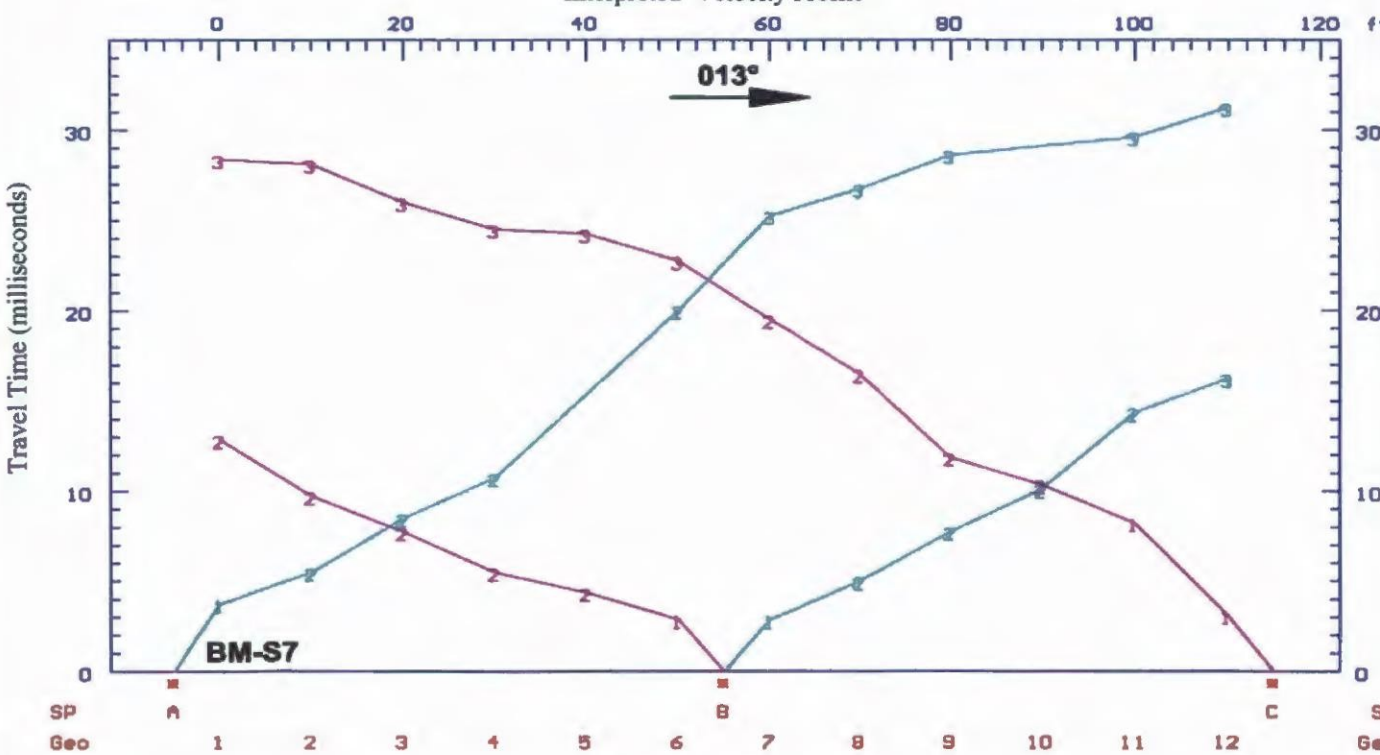


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 16 for photographs of the seismic survey line layout.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S7
Velocity Profile & Time-Distance Plot
Figure 15

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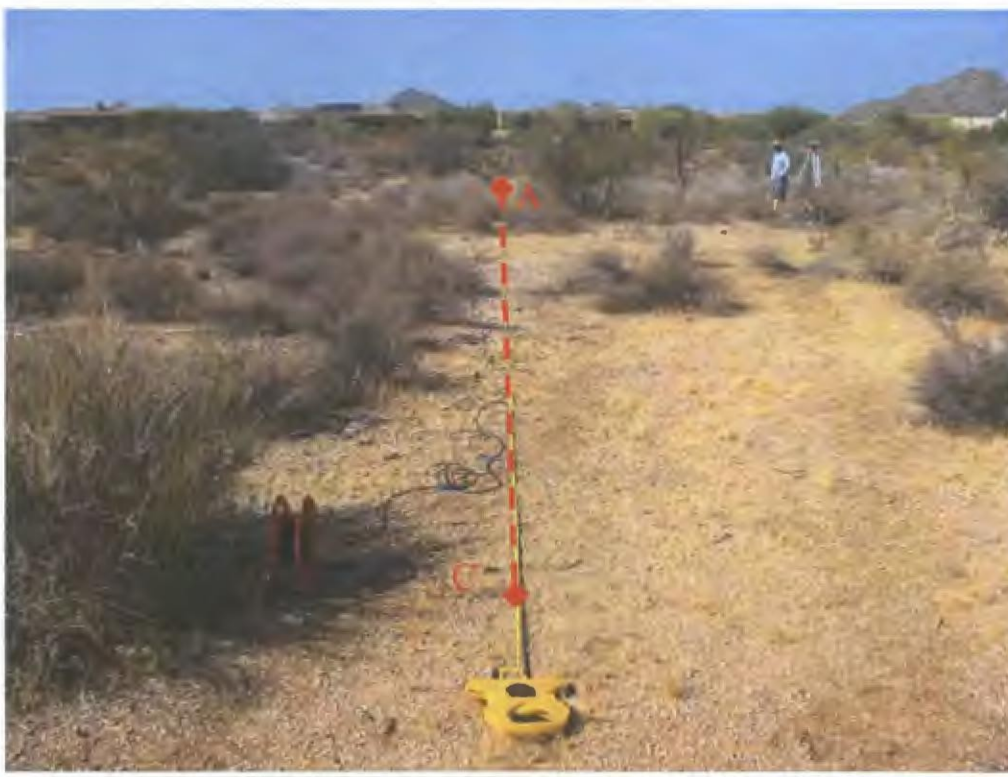
Figure 16; Photo 1: Seismic Survey Line BM-S7 view looking toward the north-northeast from Shot Point A toward Shot Point C.

Figure 16; Photo 2: Seismic Survey Line BM-S7 view looking toward the south-southwest from Shot Point C toward Shot Point A.



Photographs of seismic survey line BM-S7 taken June 21, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

Explanation:

Line BM-S7

A C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 15 for interpreted seismic line profiles and travel time-distance plot.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S7 Photographs
Figure 16

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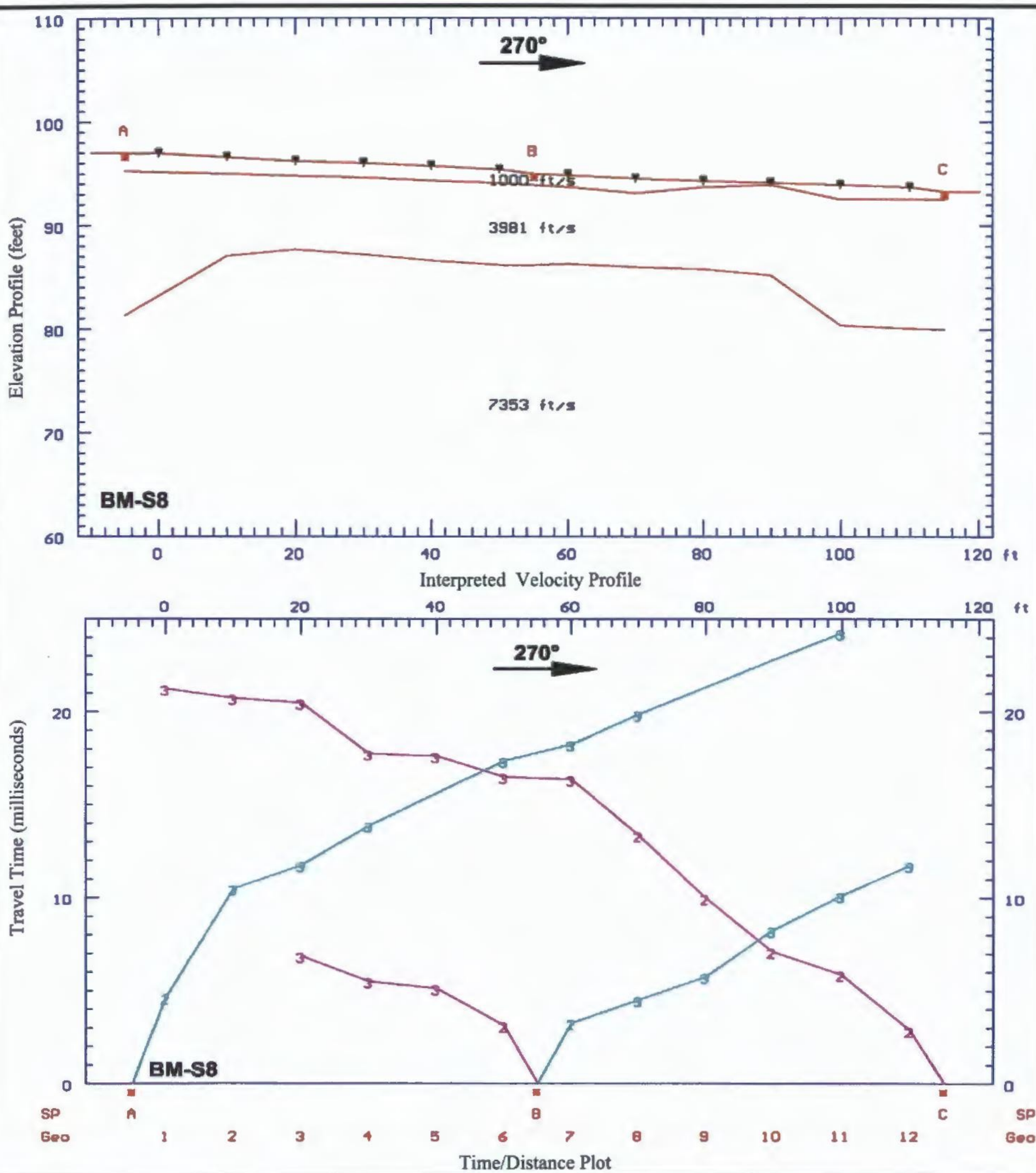

Refer to Figure 2 for seismic survey line location and Figure 18 for photographs of the seismic survey line layout.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S8
Velocity Profile & Time-Distance Plot
Figure 17

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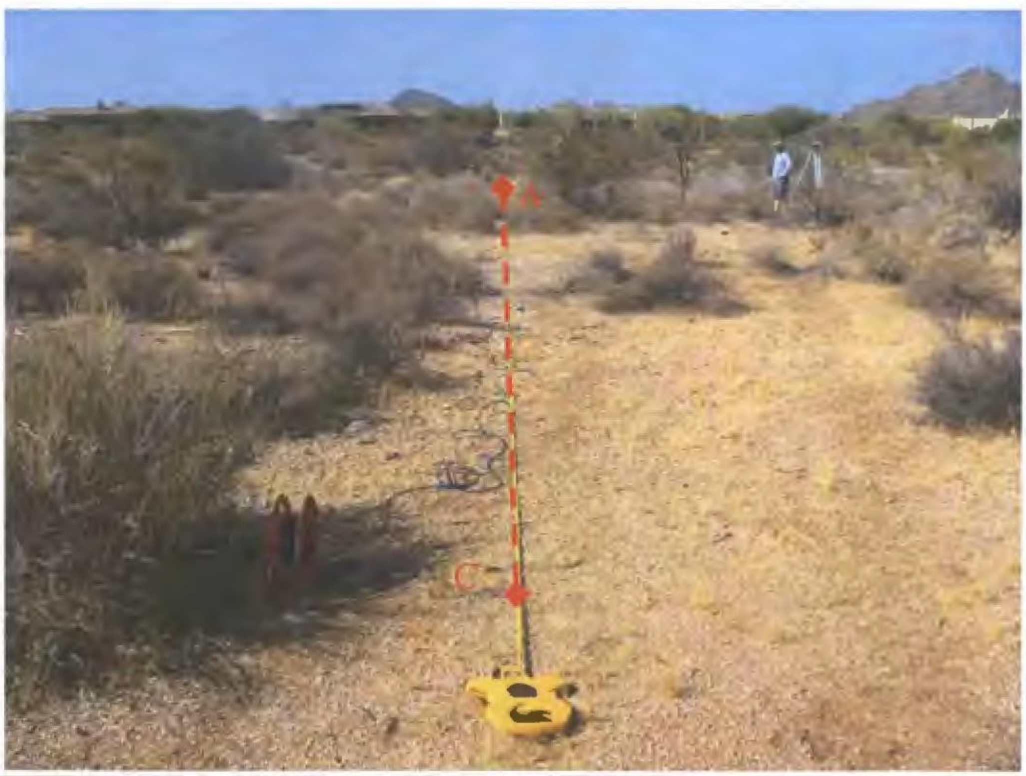
Figure 18; Photo 1: Seismic Survey Line BM-S8 view looking toward the west from Shot Point A toward Shot Point C.

Figure 18; Photo 2: Seismic Survey Line BM-S8 view looking toward the east from Shot Point C toward Shot Point A.



Photographs of seismic survey line BM-S8 taken June 21, 2016 by K. Enge, R.G.; Geological Consultants Inc. Project No. 2016-120.

Explanation:

Line BM-S8

A C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 17 for interpreted seismic line profiles and travel time-distance plot.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S8 Photographs
Figure 18

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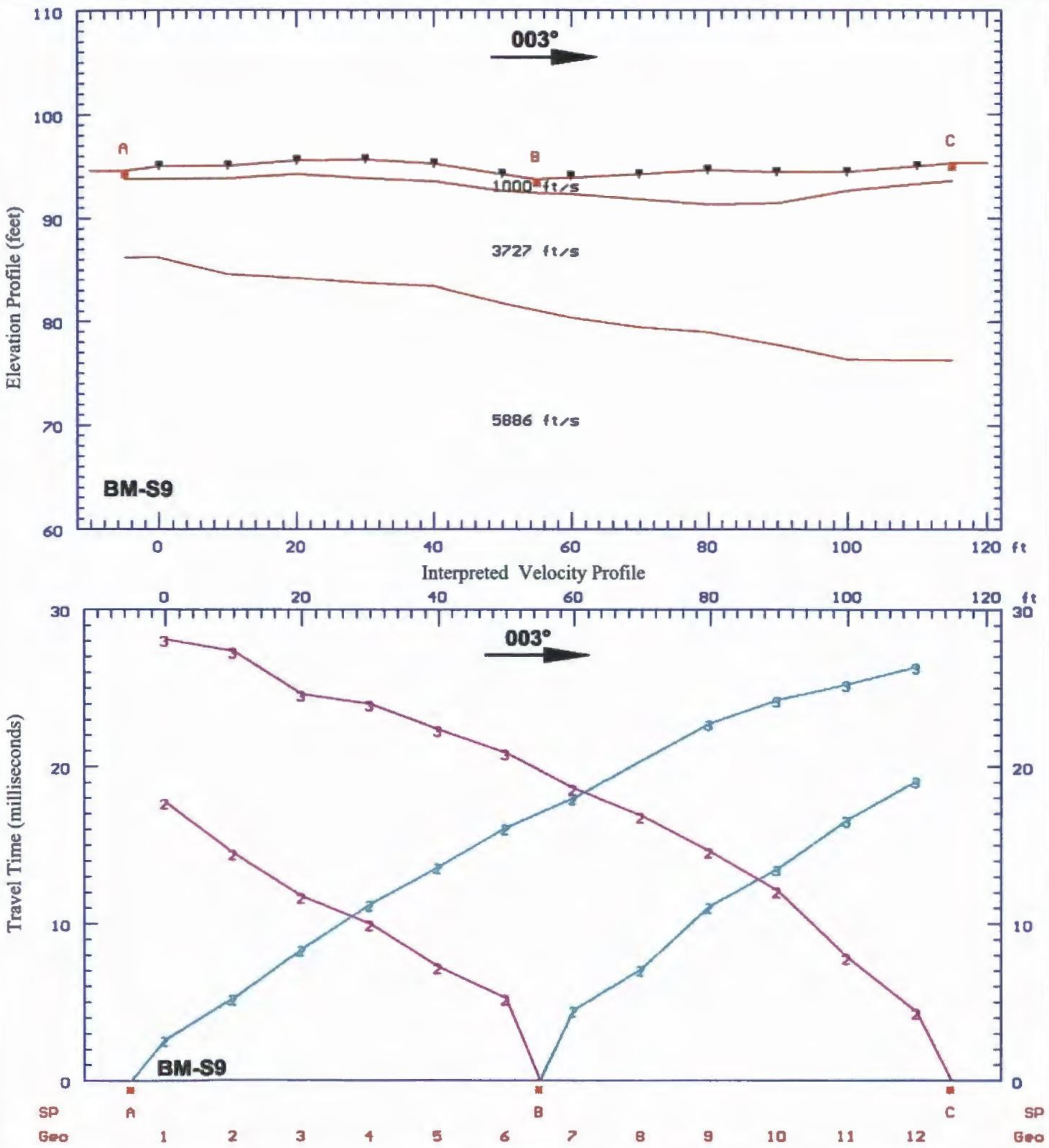

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 20 for photographs of the seismic survey line layout.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S9
Velocity Profile & Time-Distance Plot
Figure 19

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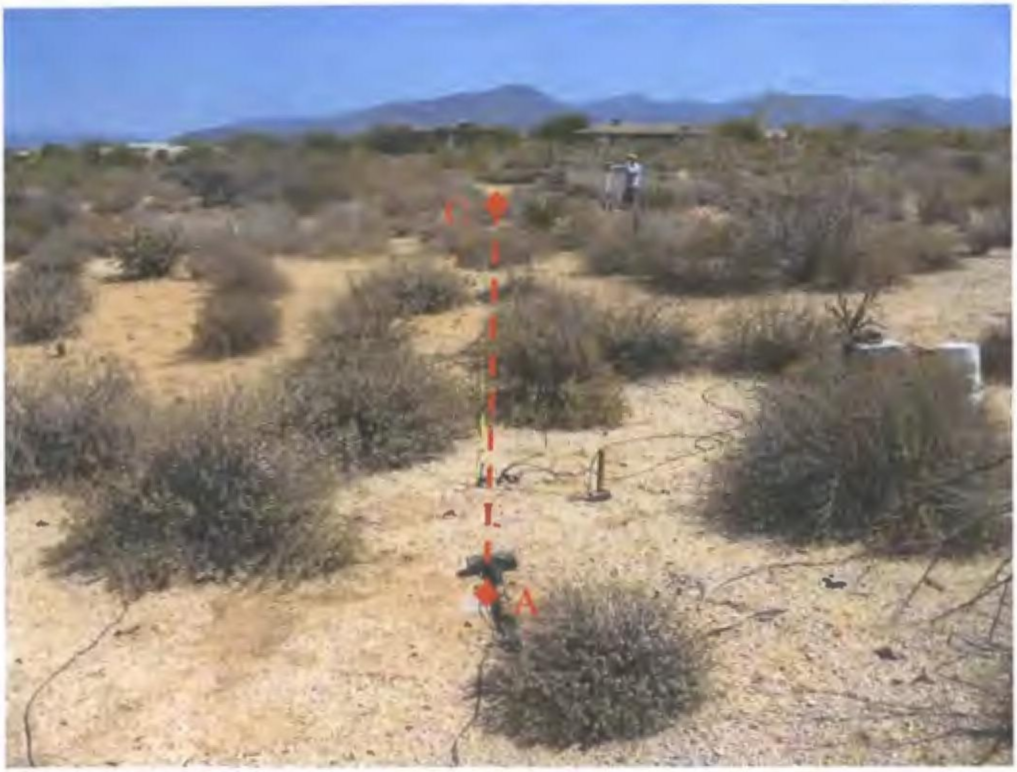

Figure 20; Photo 1: Seismic Survey Line BM-S9 view looking toward the north from Shot Point A toward Shot Point C.

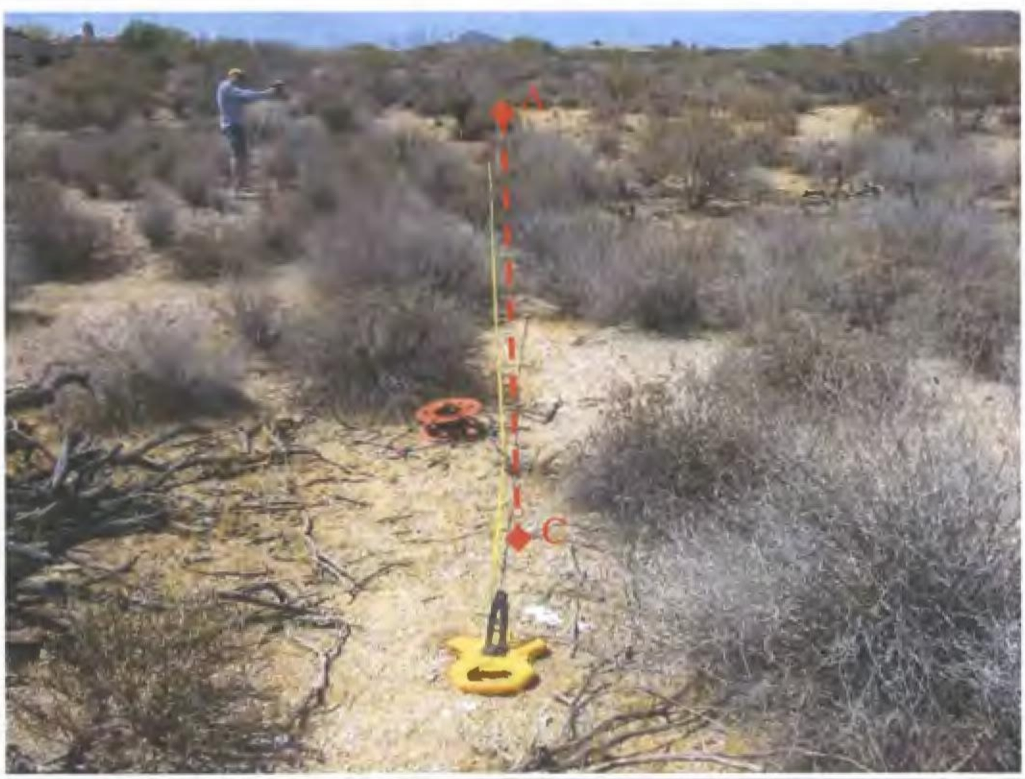

Figure 20; Photo 2: Seismic Survey Line BM-S9 view looking toward the south from Shot Point C toward Shot Point A.

Photographs of seismic survey line BM-S9 taken June 21, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

Explanation:

Line BM-S9

A C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 19 for interpreted seismic line profiles and travel time-distance plot.

84th Street Residential
NWC 84th Street & Black Mountain Road
Seismic Survey BM-S9 Photographs
Figure 20

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Figure 21; Photo 1: Portion of caliche cemented overburden soil formed above the contact boundary separating the overburden soil from the underlying granite bedrock. Exposure in shallow stream channel cut near the east end of seismic line BM-S3.

Figure 21; Photo 2: Close-up view of tan to light brown , weathered, caliche– cemented overburden cap. Exposure in shallow stream channel cut near the east end of seismic line BM-S3.

Photographs of outcrops near BM-S3 alignment taken June 14, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

84th Street Residential
NWC 84th Street & Black Mountain Road
Outcrop Photos Near BM-S3 Alignment
Figure 21

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Figure 22; Photo 1: Porphyritic granite outcrop near seismic survey line BM-S6. Large (1-inch to 2 inches in cross-section) feldspar crystals are common. Outcrop is an example of a very hard core stone exposed due to the weathering and erosion of decomposed granite

Figure 22; Photo 2: Exposed section of well-formed Stage IV-V caliche locally capping the underlying decomposed granite and less weathered granite at depth. Outcrop exposed in shallow road cut paralleling the north side of Black Mountain Road near seismic survey line BM -S6.

Photographs of outcrops near BM-S6 alignment taken June 21, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

84th Street Residential
NWC 84th Street & Black Mountain Road
Outcrop Photos Near BM-S6 Alignment
Figure 22

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Figure 23; Photo 1: Caliche-capped exhumed pediment surface. Caliche mantles the underlying decomposed granite.

Figure 23; Photo 2: Exposed, large, very hard, porphyritic granite bed-rock balds stripped of the caliche cap and decomposed granite.

Photographs of outcrops near BM-S7 alignment taken June 21, 2016 by K. Euge, R.G.; Geological Consultants Inc. Project No. 2016-120.

84th Street Residential
NWC 84th Street & Black Mountain Road
Outcrop Photos Near BM-S7 Alignment
Figure 23

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APPENDIX A

SEISMIC REFRACTION SURVEY

APPENDIX A
SEISMIC REFRACTION SURVEY

A.1 GENERAL

In general, seismic wave velocities are related to the hardness, consolidation, and density of the materials through which seismic (shock) waves travel. Seismic velocities of subsurface soils and bedrock can be correlated to some of the physical properties of the material with reasonable levels of confidence. As with rock rippability (ease of excavation) for example, the Caterpillar tractor Company has correlated ranges of seismic velocities in different rock and soil materials to qualitative estimates of rippability for their D-9 tractor with a mounted hydraulic No.9 ripper.

The use of seismic velocities measured in various soils and rock types are considered reasonably conservative for evaluating soil and rock characteristics by "indirect" shallow geophysical seismic methods. Some general correlations are as follows:

- Soil, loose surface material, alluvium and strongly weathered and broken bedrock has velocities ranging from 500 feet per second (fps) to 1,200 fps;
- Moderately hard, slightly to moderately cemented, dense alluvial and colluvial sediments and moderately weathered and broken bedrock range from 1,200 fps to 3,000 fps;
- Very dense, hard, well-cemented soils and moderately competent bedrock range from 3,000 fps to 6,000 fps;
- Sound, relatively homogeneous or tightly jointed bedrock and uniformly, strongly cemented soils (silica hardpan, caliche, calcrete, etc.) have seismic velocities greater than 6,000 fps.

Soils and rock with velocities of less than 3,000 fps can usually be excavated with conventional earth moving equipment. Where materials with velocities in excess of 6,000 fps are found, blasting would normally be required for efficient fragmentation. However, if the rock is thinly bedded, jointed, or fractured, it may be possible to break the rock with heavy ripping using a single shank ripper or large ram-hoe. The resulting fragments will be of a size consistent with the fracture spacing and the progress of the excavation would be very slow. The intermediate material (velocities between 3,000 fps and 6,000 fps) would likely require heavy equipment and possibly the localized use of jack- hammers, ram-hoes, or selective blasting to provide cost-effective excavation.

A.2 DATA COLLECTION

Refraction data were collected along seismic survey lines consisting of 12 geophones spaced 10 feet apart. This geometry provided coverage of about 110 feet along each survey line. Refer to Figure 2 for the seismic survey line locations. Seismic waves were generated at shot points located at line ends and the center to measure shallow materials (near-surface) seismic velocities. Data were recorded from both line ends so the effect of layer inclination, or dip on velocity boundaries, could be calculated. This geometry provided at least 40 feet, or more, of penetration at most line locations.

A.3 REFRACTION SEISMIC SURVEY LIMITATIONS

The seismic survey data presented in this report are derived from and interpreted from an indirect geophysical investigative technique (seismic refraction surveys) employed at the specific locations indicated and from observations made of the surface geologic conditions exposed at the site. The interpretations made at the specific seismic survey sites are believed to be reasonable based on the information available at the time of this study. The interpretations may not represent, nor are they intended to represent, the subsurface condition at other locations.

Geologic contacts between rock and soil units are approximate, may be either gradual or abrupt, and the calculated depths could vary from 10 to 20 percent or more. Geological and geotechnical information provided others and our experience on similar projects in similar geological terrain were considered in the interpretations of subsurface conditions.

A.4 REFRACTION DATA PROCESSING

Seismic Refraction Interpretation Programs (SIP) computer programs by RIMROCK GEOPHYSICS, were used to analyze seismic data obtained in the field. The programs calculate average velocities of any number of layers assuming the multilayered intervals do not include velocity inversions or "hidden" zones (i.e., high velocity zone over a low velocity zone). Thicknesses of each layer, except for the lowermost layer, are calculated along with the dip (inclination) angle of the layer boundary. The depth below the ground surface to each layer boundary is also provided.

Input data, velocity of each layer and seismic wave arrival times, obtained during the field work are checked by the computer program to assure that they satisfy reciprocity at least within 20 percent. These data are used to develop a meaningful geological model used to interpret subsurface stratigraphic conditions.

APPENDIX B

ROCK HARDNESS & EXCAVATION CHARACTERISTICS

Tables B-1, B-2, and B-3

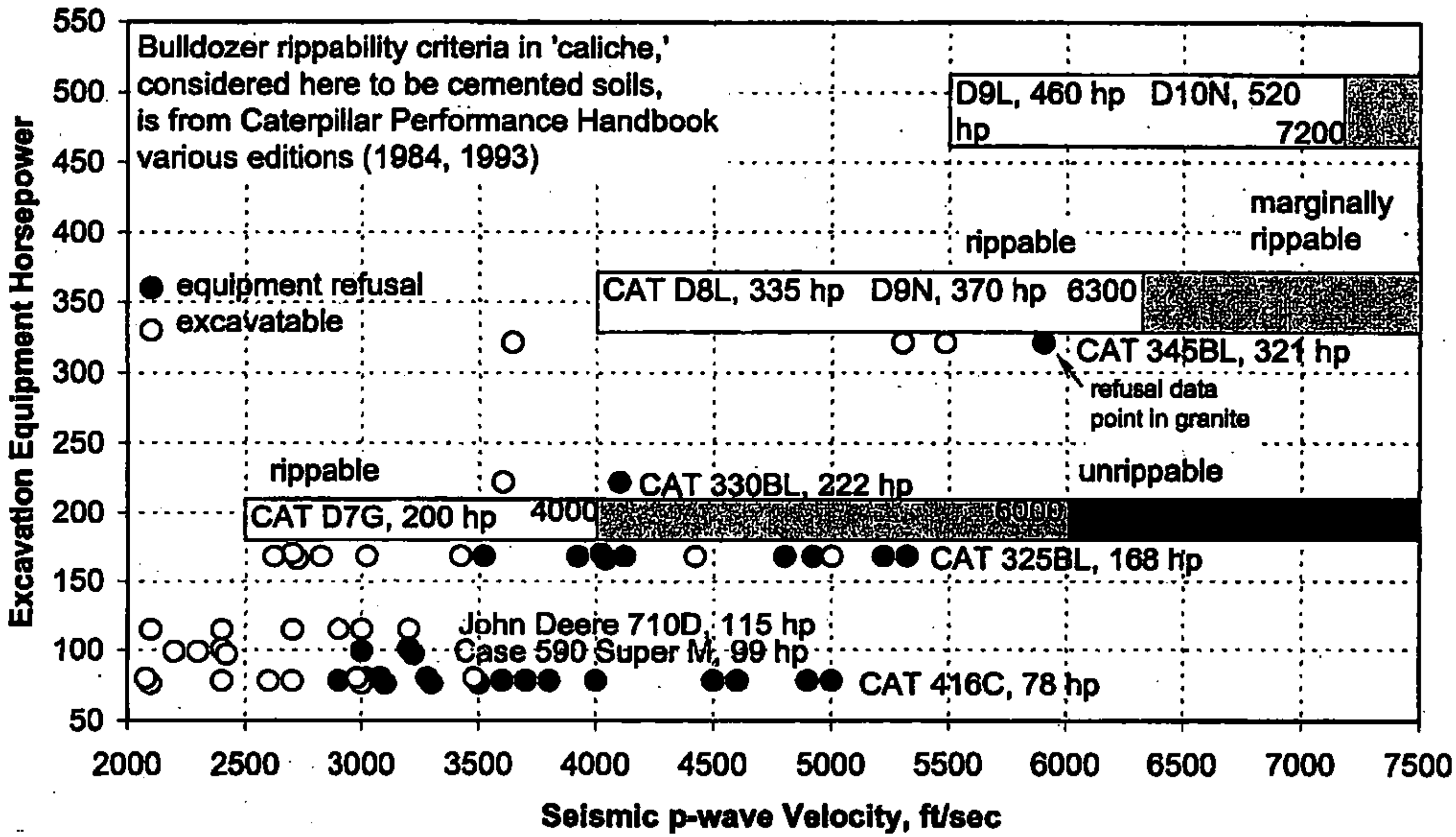
Table B-1
Rock Hardness & Excavation Characteristics[1]

Rock Hardness Description	Identification Criteria	Unconfined Compressive Strength		Seismic Compression (P-Wave) Velocity		Excavation Characteristics
		MPa	psi	m/s	f/s	
Very Soft Rock	Material crumbles under firm blows with sharp end of geological pick; can be peeled with a knife; too hard to cut a triaxial sample by hand. SPT will refuse. Pieces up to 3-cm thick can be broken by finger pressure.	1.7 - 3.0	246 - 435	450 - 1,200	1,475 - 3,935	Easy Ripping
Soft Rock	Can just be scraped with a knife; indentations 1-mm to 3-mm show in specimen with firm blows of the pick point; has dull sound under hammer.	3.0 - 10.0	435 - 1,450	1,200 - 1,500	3,935 - 4,920	Hard Ripping
Hard Rock	Cannot be scraped with a knife; hand specimen can be broken with a pick with a single firm blow; rock rings under hammer.	10.0 - 20.0	1,450 - 2,900	1,500 - 1,850	4,920 - 6,070	Very Hard Ripping
Very Hard Rock	Hand specimen breaks with a pick after more than one blow; rock rings under hammer	20.0 - 70.0	2,900 - 10,150	1,850 - 2,150	6,070 - 7,050	Extremely Hard Ripping or Blasting
Extremely Hard Rock	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.	> 70.0	> 10,150	> 2,150	> 7,080	Blasting

Note: (1) Table from Weaver, J.M.; 1975; Geological Factors Significant in the Assessment of Rippability; The Civil Engineer in South Africa (*Die siviele ilngenieur in Suid-Afrika*); Volume 17, Issue 12, December 1975; pp. 313-316.

Table B-2
Typical Excavatability Performance in Cemented Soils(2)

Figure 1 - Typical Excavatability Performance in Cemented Soils for Various Equipment Completing Test Pits in Salt River Valley Area



Note: (2) From Caterpillar, Inc.; 2013; Caterpillar Performance Handbook, Edition 43; Section 18, Rippers, Seismic Wave Velocity Charts; pp. 18-75 to 18-80.

Table B-3
Excavatability of Materials(3)

TABLE 1
Approximate Excavatability of Materials Using Various Ripping & Trenching Equipment

Material & Range of Marginal Rippability by Seismic Velocity (Cat, 1984; 1993)	Typical Bulldozer Used as Ripper (Cat, 1984; 1993)	Equivalent Backhoe (Kirsten, 1982; 1988)
"Caliche"		
4,000 – 6,000 fps	D7G, 200 HP	235
6,300 – 8,600 fps	D8L, 335 HP	245
6,300 – 8,700 fps	D9N, 370 HP	-
7,200 – 10,300 fps	D9L, 460 HP	RH 40
7,200 – 10,300 fps	D10N, 520 HP	-
7,400 – 10,600 fps	D10, 700 HP	-
7,600 – 11,000 fps	D11N, 770 HP	-
Conglomerate		
4,600 – 5,700 fps	D7G, 200 HP	235
7,600 – 9,300 fps	D8L, 335 HP	245
7,600 – 9,300 fps	D9N, 370 HP	-
8,400 – 10,600 fps	D9L, 460 HP	RH 40
8,400 – 10,600 fps	D10N, 520 HP	-
9,000 – 11,000 fps	D10, 700 HP	-
9,300 – 11,500 fps	D11N, 770 HP	-
Granite		
4,300 – 4,800 fps	D7G, 200 HP	235
6,800 – 8,000 fps	D8L, 335 HP	245
6,800 – 8,000 fps	D9N, 370 HP	-
7,300 – 8,400 fps	D9L, 460 HP	RH 40
7,300 – 8,400 fps	D10N, 520 HP	-
7,800 – 9,000 fps	D10, 700 HP	-
8,100 – 9,500 fps	D11N, 770 HP	-
Schist		
4,300 – 5,300 fps	D7G, 200 HP	235
7,200 – 9,000 fps	D8L, 335 HP	245
7,200 – 9,000 fps	D9N, 370 HP	-
7,700 – 9,500 fps	D9L, 460 HP	RH 40
7,700 – 9,500 fps	D10N, 520 HP	-
8,000 – 10,000 fps	D10, 700 HP	-
8,300 – 10,600 fps	D11N, 770 HP	-

Note: Bulldozer and backhoe power are presented by Kirsten (1982, 1988) as a measure of equivalent performance for excavation. The Caterpillar D6D bulldozer and 225 backhoe and D4E/D5B bulldozer and 215 backhoe are considered equivalent. Seismic velocities below marginal indicate that the material is rippable. Seismic velocities above marginal indicate that the material is non-rippable. All velocities are approximate and represent a typical range. See the Caterpillar Performance Handbook (Caterpillar, 1984, 1993 or current edition) for details on use of this information. Different model configurations include variations in weight and horsepower.

From AMEC, 2005

Note: (3) From AMEC; 2005; consultants report prepared for City of Phoenix entitled "Refraction Seismic Evaluation, Deer Valley Road-7th Street to Cave Creek Road"; COP Project No. ST85100044, AMEC Job No. 5-119-000199, Report No. 2; 2 September 2005.

Solution:

1. Total Cycle Time = 3.41 + 0.25 = 3.66 min

   $$\text{Cycles/hour} = \frac{60 \text{ min/hr}}{3.66 \text{ min/cycle}} = 16.4$$

2. $\text{Production per cycle} = \frac{300 \times 3 \times 2}{27} =$ 66.7 BCY/cycle

3. Production = 66.7 BCY/cycle × 16.4 cycles/hr = 1094 BCY/hour

4. Remember results of this method are usually 10 to 20% high.
   Actual Production = 80% × 1094 = 875 BCY/hr
   or 90% × 1094 = 984 BCY/hr

5. Owning and Operating Costs
   A D10T (ripping only) could have a $115.00/hr O & O costs including $30/hr operator

6. Loosening Costs
   $115.00/hr ÷ 875 BCY/hr = $0.131/BCY
   $115.00/hr ÷ 984 BCY/hr = $0.117/BCY
   The loosening cost should range from 11.7¢ to 13.1¢/BCY

●●●

USE OF SEISMIC VELOCITY CHARTS

The charts of ripper performance estimated by seismic wave velocities have been developed from field tests conducted in a variety of materials. Considering the extreme variations among materials and even among rocks of a specific classification, the charts must be recognized as being at best only one indicator of rippability.

Accordingly, consider the following precautions when evaluating the feasibility of ripping a given formation:

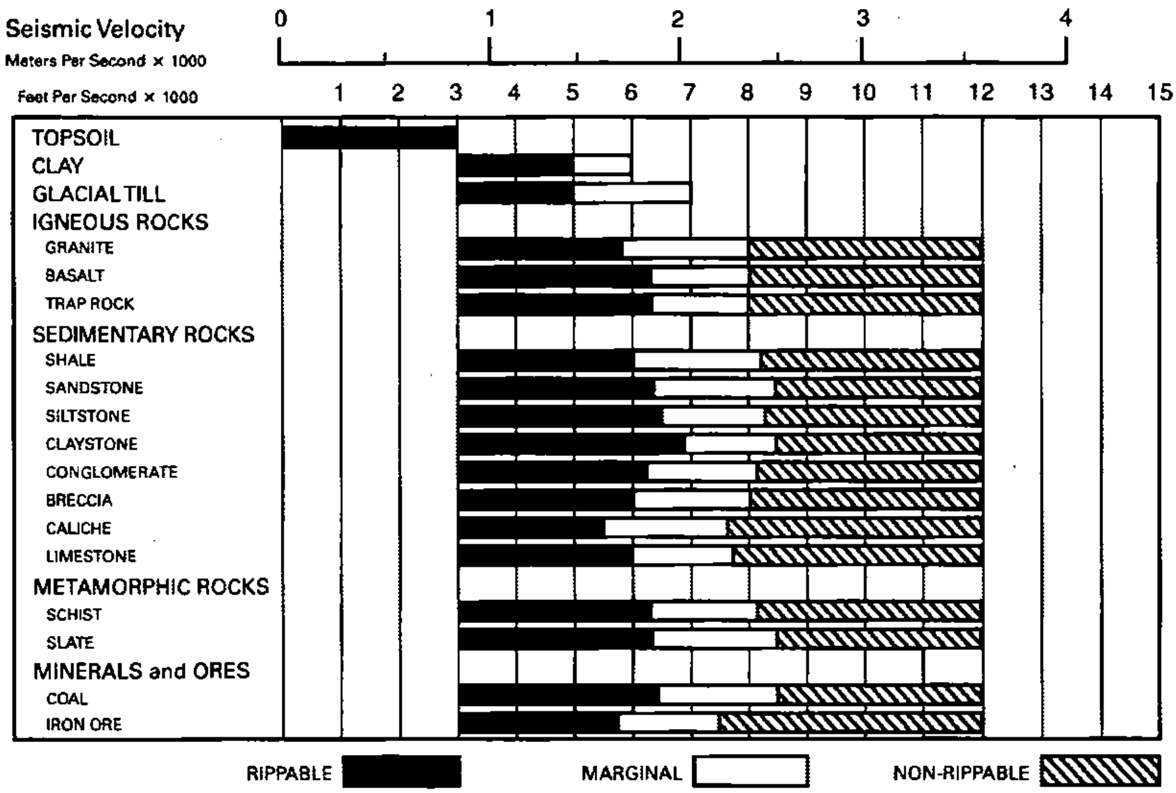
— Tooth penetration is often the key to ripping success, regardless of seismic velocity. This is particularly true in homogeneous materials such as mudstones and claystones and the fine-grained caliches. It is also true in tightly cemented formations such as conglomerates, some glacial tills and caliches containing rock fragments.

— Low seismic velocities of sedimentaries can indicate probable rippability. However, if the fractures and bedding joints do not allow tooth penetration, the material may not be ripped effectively.

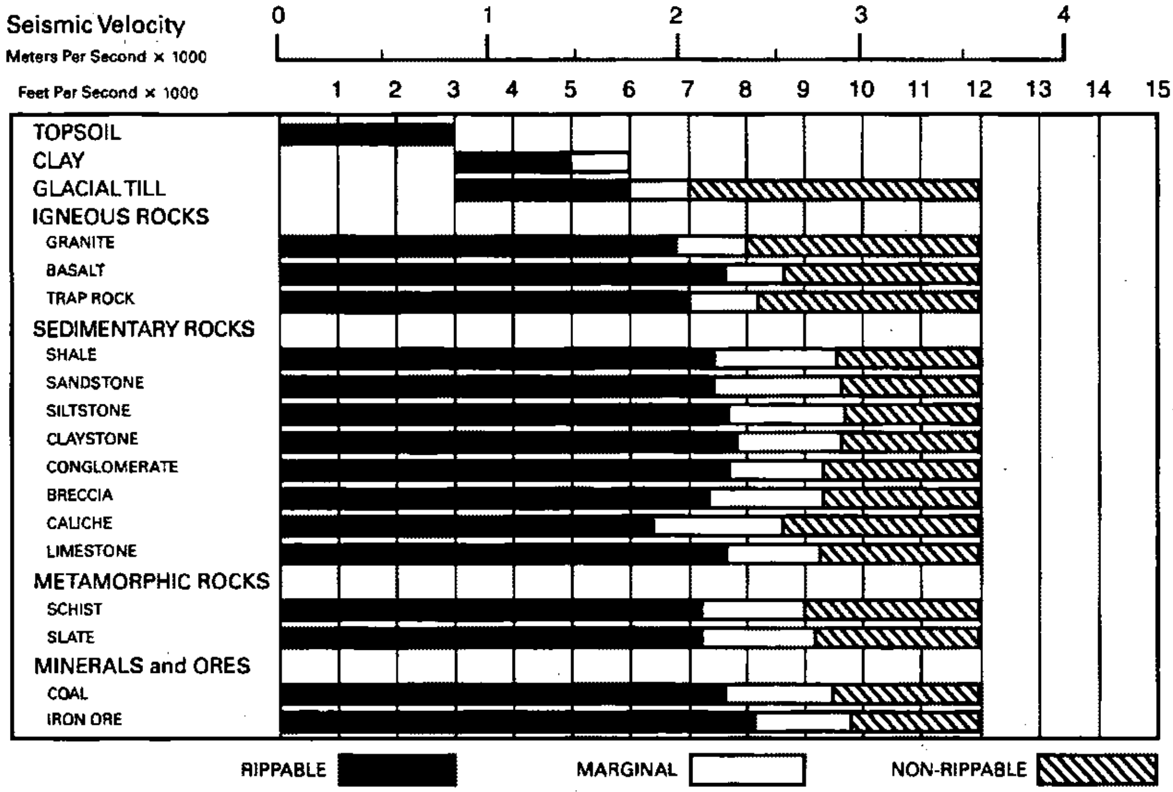
— Pre-blasting or "popping" may induce sufficient fracturing to permit tooth entry, particularly in the caliches, conglomerates and some other rocks; but the economics should be checked carefully when considering popping in the higher grades of sandstones, limestones and granites.

Ripping is still more art than science, and much will depend on operator skill and experience. Ripping for scraper loading may call for different techniques than if the same material is to be dozed away. Cross-ripping requires a change in approach. The number of shanks used, length and depth of shank, tooth angle, direction, throttle position — all must be adjusted according to field conditions. Ripping success may well depend on the operator finding the proper combination for those conditions.

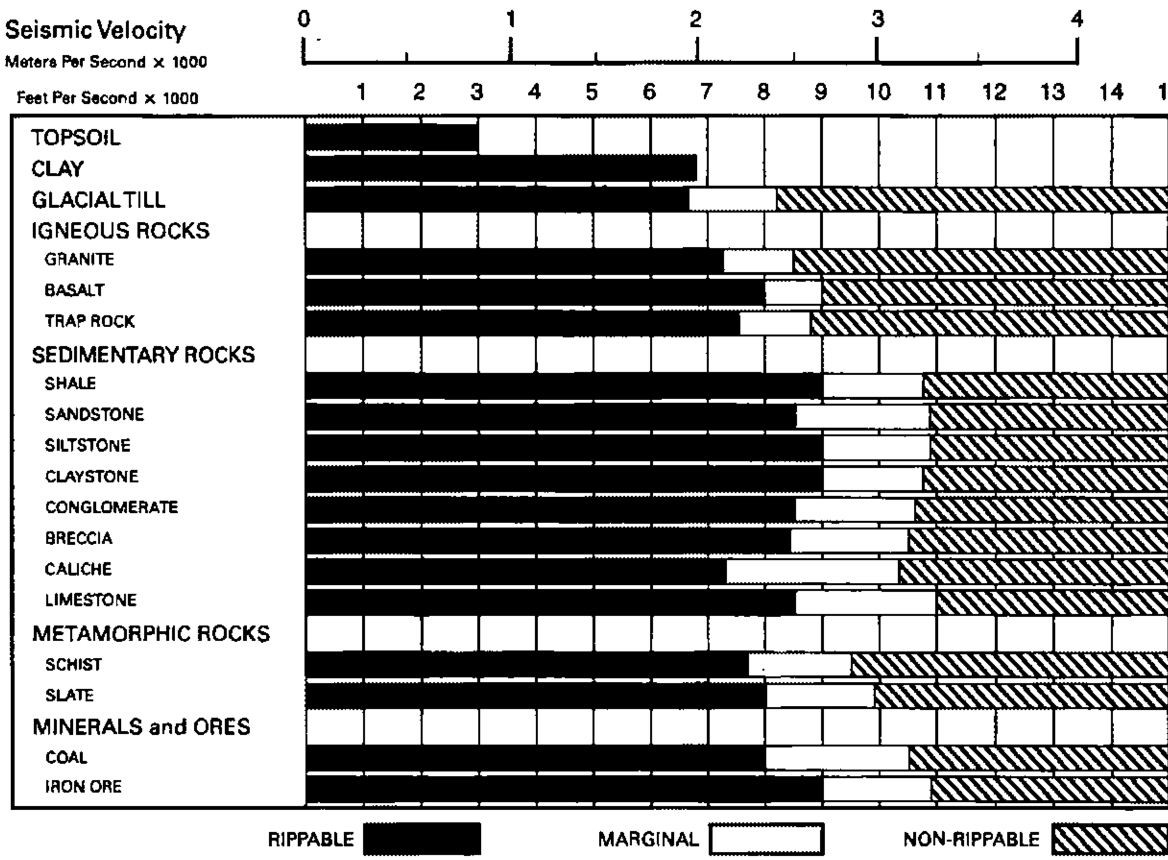
D8R/D8T
● Multi- or Single Shank No. 8 Ripper
● Estimated by Seismic Wave Velocities



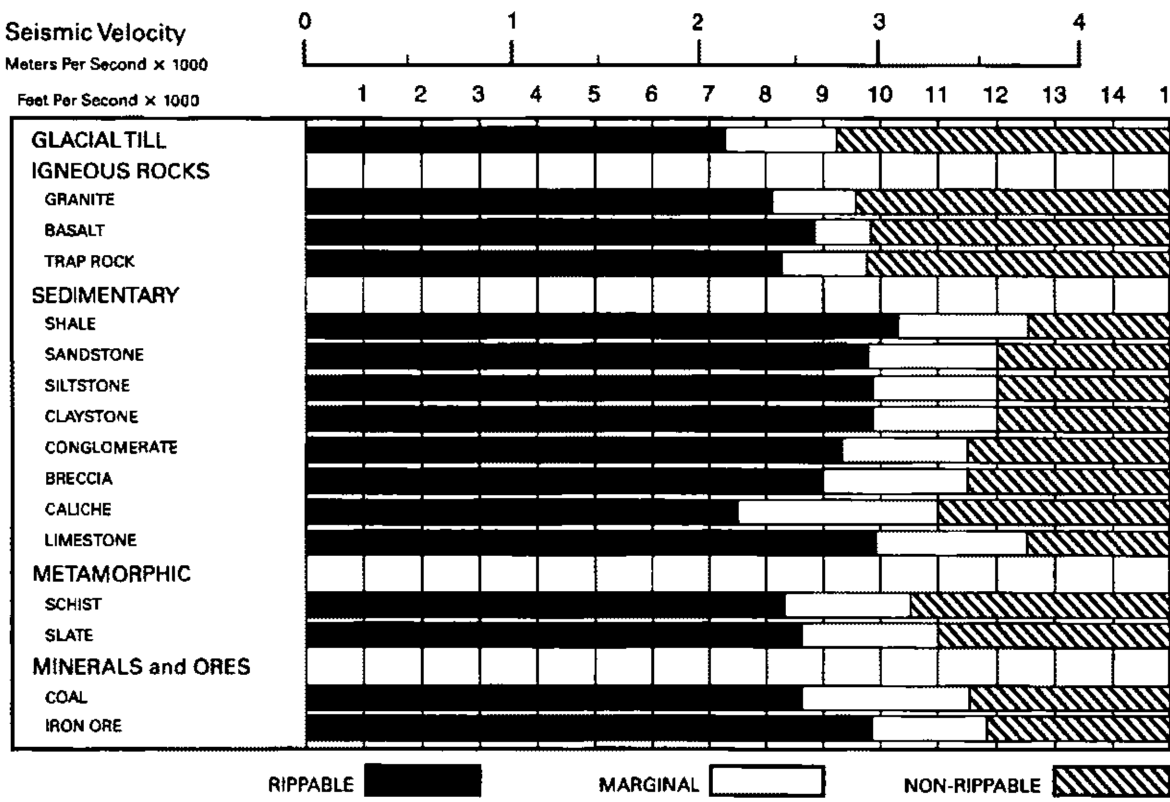
D9R/D9T
● Multi- or Single Shank No. 9 Ripper
● Estimated by Seismic Wave Velocities



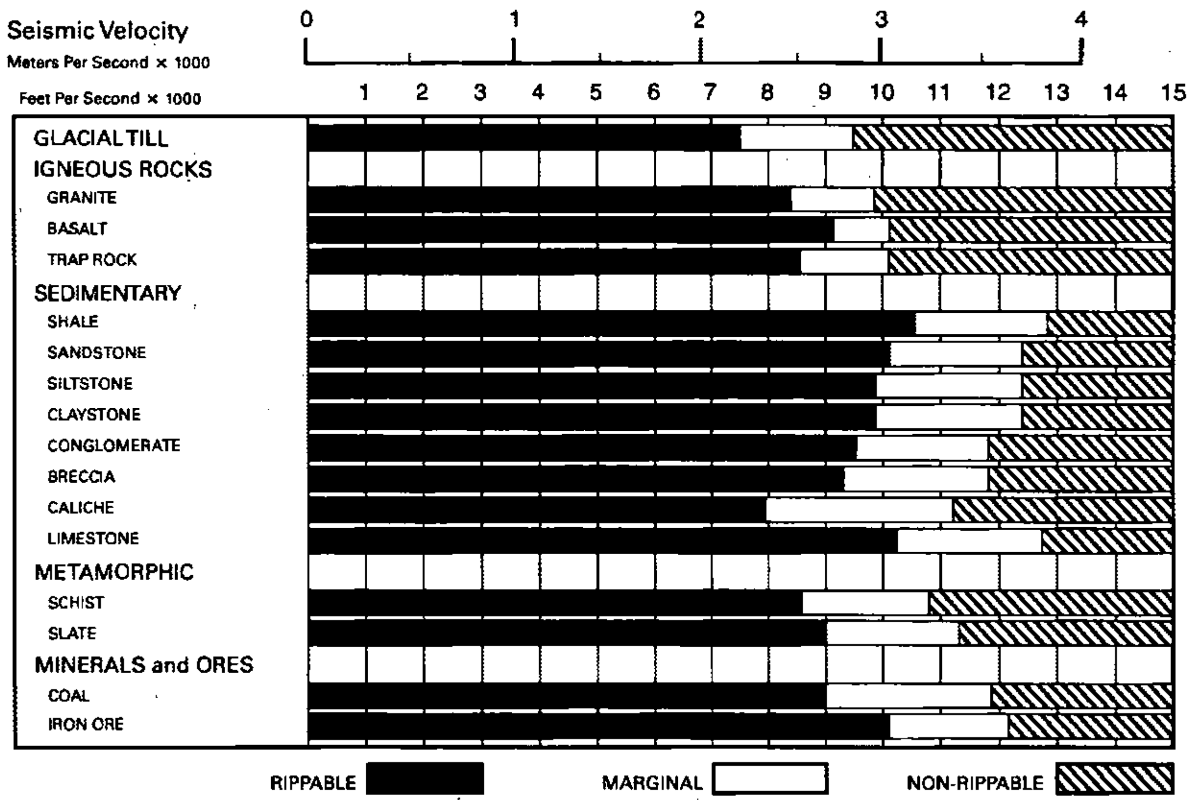
D10T
● Multi- or Single Shank No. 10 Ripper
● Estimated by Seismic Wave Velocities



D11T
● Multi- or Single Shank No. 11 Ripper
● Estimated by Seismic Wave Velocities



D11T CD
- **Single Shank No. 11 Ripper**
- **Estimated by Seismic Wave Velocities**



Appendix E – Sandflower Sewer Capacity Calculations

Reserve at Black Mountain- Sand Flower Downstream Capacity Prepared By: Kimley Horn October 28,2016										
			Existing Sandflower Master Plan				Adding Reserve at Black Mountain			
			Sandflower Calculations				Using Peaking Factor Per AAC Title 18 Ch 9			
Upstream Manhole	Diameter	Slope	DU	Population	d/D	Base Flow (MGD)	Peaking Factor	Peak Flow (MGD)	new d (ft)	new d/D
1	10									
2	10	2.50%	993	2483	0.58	0.558	2.13	1.19	0.43	0.516
3	10	0.70%	993	2483	0.72	0.558	2.13	1.19	0.69	0.828
4	10	0.70%	993	2483	0.72	0.558	2.13	1.19	0.69	0.828
5	10	0.70%	993	2483	0.72	0.558	2.13	1.19	0.69	0.828
6	10	0.70%	993	2483	0.72	0.558	2.13	1.19	0.69	0.828
7	10	0.70%	993	2483	0.72	0.558	2.13	1.19	0.69	0.828
8	10	0.70%	993	2483	0.72	0.558	2.13	1.19	0.69	0.828
9	10	0.70%	861	2153	0.65	0.525	2.17	1.14	0.69	0.828
10	10	0.70%	861	2153	0.65	0.525	2.17	1.14	0.69	0.828
13	10	1.50%	861	2153	0.7	0.525	2.17	1.14	0.49	0.588
14	8	4.87%	20	50	0.08	0.315	3.62	1.14	0.39	0.585
15	8	2.41%	16	40	0.09	0.314	3.62	1.14	0.25	0.375
16	8	1.58%	4	10	0.08	0.311	3.62	1.13	0.25	0.375
17	8	3.20%	3	8	0.06	0.311	3.62	1.12	0.46	0.69
18	8	1.60%	11	28	0.08	0.313	3.62	1.13	0.49	0.735
19	8	1.60%	7	18	0.08	0.312	3.62	1.13	0.49	0.735

Appendix F – Sandflower Sewer Master Plan Report

60-4

WATER AND SEWER MASTER PLAN FOR SANDFLOWER SUBDIVISION

Prepared For:

City of Scottsdale
7447 East Indian School Road
Scottsdale, Arizona 85251

Prepared by:

EVANS, KUHN & ASSOCIATES, INC.
727 East Bethany Home Road
Suite D-225
Phoenix, Arizona 85014

Registered Professional Engineer (Civil)
CERTIFICATE NO.
30176
GARY W.
LAFORGE
Date Signed 6/24/94
ARIZONA, U.S.A.

EKA

EVANS, KUHN & ASSOCIATES, INC.

EKA# 3548
November 17, 1993
Revised June 24, 1994

IV. SEWER SYSTEM

A. Existing Sewer System

The nearest existing City of Scottsdale sewer is the 8" line located at the intersection of Westland Drive and Hayden Road. It is proposed that this development will obtain sewer service by connecting to the system at the 8" line at the intersection of Hayden Road and Westland Drive. This connection would be made by running an 8" line south in the Hayden Road alignment to Westland Drive and connecting to the existing 8" line at that point.

B. Sandflower Sewer System

The proposed Sandflower sewer system is shown on Sewer Master Plan. The Sandflower Subdivision sewer system will outfall to the existing system at the intersection of Hayden Road and Westland Drive. Operation and maintenance of the sewer system will be by the City of Scottsdale.

The Sewer System Master Plan shows line sizes, slopes, and inverts at the manhole and cleanout locations. The following table shows the anticipated flows from the development and four off-site areas.

Area of Service	Dwelling Units	Flow Rate, MGD
Sandflower On-site	100	0.1
Off-site Area 1	288	0.3
Off-site Area 2	271	0.3
Off-site Area 3	202	0.2
Off-site Area 4	132	0.1

As the table indicates, the proposed sewer line in Hayden Road has capacity for the above described areas (also shown on MAP I-A). The flows calculated in the table are based on the City of Scottsdale's peak design requirement of 400 gpcd for sewers 12" and less in diameter and that the population density would be 2.5 persons per dwelling unit.

Map I-A, located in Appendix B, indicates the area included in the Sandflower sewer capacity analysis. The areas indicated by triangles and numbered 1, 2, 3 and 4 (also shaded) are the areas included in the Sandflower system analysis. The Sandflower system will be able to accept flows from these areas in the ultimate build-out condition. The Sandflower sewer system was also evaluated for the possibility of only the Sandflower subdivision being developed. Both of these design conditions area contained in Appendix B and show velocities in the Hayden Road line greater than 2 fps. The 10" pipe which is proposed has a slightly lower velocity under the 0.1 MGD flow condition, but allows for the 1.1 MGD ultimate capacity. The construction of a 8" line was also evaluated, but would limit the ultimate capacity of the Hayden Road line to approximately 0.6 MGD or 600 dwelling units. Therefore, the slight increase in velocity does not justify the construction of the 8" line over the proposed 10" line.

Bethi Road 225
x, AZ
(602) 241-0782

29-Jun-94
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SANDFLOWER SUBDIVISION - SEWER MASTER PLAN

Manhole Number	Invert Elev. ft	Pipe Slope %	Pipe Length ft	Pipe Diameter inches	Pipe Capacity MGD	Full Velocity fps	Dwelling Units	People per Dwelling	Required Capacity MGD	Partial Flow Depth inches	Ratio of Depth to Diameter	Partial Flow Area sq.ft	Partial Perimeter ft	Partial Velocity fps	Partial Capacity MGD
MH-53	2,483.7	2.10	250	8	1.13	5.02	271	2.5	0.27	2.8	0.35	0.10	0.84	4.12	0.28
MH-52	2,478.3														
CO-1	2,483.5	2.00	135	8	1.10	4.90	3	2.5	0.00	0.6	0.08	0.01	0.37	1.74	0.01
MH-68	2,480.7	1.98	122	8	1.10	4.87	5	2.5	0.01	0.6	0.08	0.01	0.37	1.73	0.01
MH-52	2,478.3														
MH-52	2,478.3	2.10	240	8	1.13	5.02	277	2.5	0.28	2.8	0.35	0.10	0.84	4.12	0.28
MH-51	2,473.2	1.80	225	8	1.05	4.65	278	2.5	0.28	3.0	0.38	0.12	0.88	4.01	0.30
MH-50	2,469.0														
MH-67	2,472.7	1.96	185	8	1.09	4.84	4	2.5	0.00	0.6	0.08	0.01	0.37	1.72	0.01
MH-50	2,469.0														
MH-50	2,469.0	2.30	350	8	1.18	5.25	284	2.5	0.28	2.7	0.34	0.10	0.83	4.25	0.28
MH-49	2,460.9														
MH-66	2,472.3	2.00	130	8	1.10	4.90	2	2.5	0.00	0.3	0.04	0.00	0.26	1.11	0.00
MH-65	2,469.6	2.00	130	8	1.10	4.90	3	2.5	0.00	0.6	0.08	0.01	0.37	1.74	0.01
MH-64	2,466.9	2.00	130	8	1.10	4.90	4	2.5	0.00	0.6	0.08	0.01	0.37	1.74	0.01
MH-63	2,464.2	1.84	180	8	1.06	4.70	6	2.5	0.01	0.6	0.08	0.01	0.37	1.67	0.01
MH-49	2,460.9														
MH-49	2,460.9	2.30	205	8	1.18	5.25	291	2.5	0.29	2.8	0.35	0.10	0.84	4.31	0.29
MH-48	2,456.1	2.10	215	8	1.13	5.02	292	2.5	0.29	2.9	0.36	0.11	0.86	4.17	0.29
MH-47	2,451.5	2.10	212	8	1.13	5.02	293	2.5	0.29	2.9	0.36	0.11	0.86	4.17	0.29
MH-46	2,446.9	2.10	285	8	1.13	5.02	294	2.5	0.29	2.9	0.36	0.11	0.86	4.17	0.29
MH-45	2,440.8														
MH-69	2,448.2	2.03	364	8	1.11	4.94	288	2.5	0.29	2.9	0.36	0.11	0.86	4.10	0.29
MH-45	2,440.8														
MH-45	2,440.8	1.00	302	8	0.78	3.46	584	2.5	0.58	5.3	0.66	0.24	1.27	3.77	0.58
MH-44	2,437.7	0.90	291	8	0.74	3.29	586	2.5	0.59	5.5	0.69	0.25	1.30	3.63	0.59
MH-54	2,435.0														
CO-2	2,442.8	2.00	150	8	1.10	4.90	0	2.5	0.00	0.6	0.08	0.01	0.37	1.74	0.01
MH-55	2,439.7														
MH-62	2,473.3	2.00	235	8	1.10	4.90	202	2.5	0.20	2.5	0.31	0.09	0.79	3.74	0.21
MH-61	2,468.5	2.00	225	8	1.10	4.90	204	2.5	0.20	2.5	0.31	0.09	0.79	3.74	0.21
MH-60	2,463.9	2.00	199	8	1.10	4.90	207	2.5	0.21	2.5	0.31	0.09	0.79	3.74	0.21

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SANDFLOWER SUBDIVISION - SEWER MASTER PLAN

Manhole Number	Invert Elev. ft	Pipe Slope %	Pipe Length ft	Pipe Diameter inches	Pipe Capacity MGD	Full Velocity fps	Dwelling Units	People per Dwelling	Required Capacity MGD	Partial Flow Depth inches	Ratio of Depth to Diameter	Partial Flow Area sq ft	Partial Perimeter ft	Partial Velocity fps	Partial Capacity MGD
MH-59	2,459.9	2.00	105	8	1.10	4.90	210	2.5	0.21	2.5	0.31	0.09	0.79	3.74	0.21
MH-58	2,457.7	2.00	467	8	1.10	4.90	211	2.5	0.21	2.5	0.31	0.09	0.79	3.74	0.21
MH-57	2,448.2	2.00	40	8	1.10	4.90	212	2.5	0.21	2.5	0.31	0.09	0.79	3.74	0.21
MH-56	2,447.3	1.88	406	8	1.07	4.74	212	2.5	0.21	2.5	0.31	0.09	0.79	3.63	0.21
MH-55	2,439.7														
MH-55	2,439.7	2.01	234	8	1.11	4.91	218	2.5	0.22	2.6	0.33	0.10	0.81	3.92	0.24
MH-54	2,435.0														
MH-54	2,435.0	1.00	151	8	0.78	3.46	804	2.5	0.80	6.9	0.86	0.32	1.59	3.90	0.80
MH-33	2,433.4	1.00	150	8	0.78	3.46	804	2.5	0.80	6.9	0.86	0.32	1.59	3.90	0.80
MH-24	2,431.8														
MH-23	2,435.6	1.42	271	8	0.93	4.13	2	2.5	0.00	0.6	0.08	0.01	0.37	1.47	0.01
MH-24	2,431.8														
MH-24	2,431.8	4.30	102	8	1.62	7.18	809	2.5	0.81	4.2	0.53	0.18	1.08	7.27	0.86
MH-32	2,427.3	2.30	261	8	1.18	5.25	810	2.5	0.81	5.0	0.63	0.23	1.22	5.67	0.83
MH-31	2,421.2														
MH-43	2,432.8	1.00	206	8	0.78	3.46	3	2.5	0.00	0.7	0.09	0.02	0.40	1.31	0.01
MH-42	2,430.6	1.00	173	8	0.78	3.46	3	2.5	0.00	0.7	0.09	0.02	0.40	1.31	0.01
MH-41	2,428.8	1.00	175	8	0.78	3.46	6	2.5	0.01	0.7	0.09	0.02	0.40	1.31	0.01
MH-40	2,426.9	0.70	181	8	0.65	2.90	8	2.5	0.01	0.7	0.09	0.02	0.40	1.10	0.01
MH-39	2,425.5	0.70	133	8	0.65	2.90	10	2.5	0.01	0.7	0.09	0.02	0.40	1.10	0.01
MH-38	2,424.5	0.70	167	8	0.65	2.90	10	2.5	0.01	0.7	0.09	0.02	0.40	1.10	0.01
MH-37	2,423.2	0.70	97	8	0.65	2.90	12	2.5	0.01	0.7	0.09	0.02	0.40	1.10	0.01
MH-36	2,422.5	0.67	190	8	0.64	2.84	13	2.5	0.01	0.7	0.09	0.02	0.40	1.08	0.01
MH-31	2,421.2														
MH-31	2,421.2	1.15	152	8	0.84	3.71	825	2.5	0.83	8.0	1.00	0.35	2.09	3.71	0.84
MH-30	2,419.3														
CO-3	2,428.7	2.00	115	8	1.10	4.90	0	2.5	0.00	0.5	0.06	0.01	0.34	1.17	0.00
MH-35	2,426.3	2.30	302	8	1.18	5.25	2	2.5	0.00	0.3	0.04	0.00	0.28	1.19	0.00
MH-30	2,419.3														
MH-30	2,419.3	1.90	117	8	1.08	4.77	831	2.5	0.83	5.4	0.68	0.25	1.29	5.27	0.85
MH-29	2,417.1	2.00	262	8	1.10	4.90	831	2.5	0.83	5.3	0.66	0.24	1.27	5.33	0.83
MH-28	2,411.9	2.00	106	8	1.10	4.90	831	2.5	0.83	5.3	0.66	0.24	1.27	5.33	0.83
MH-27	2,409.8														

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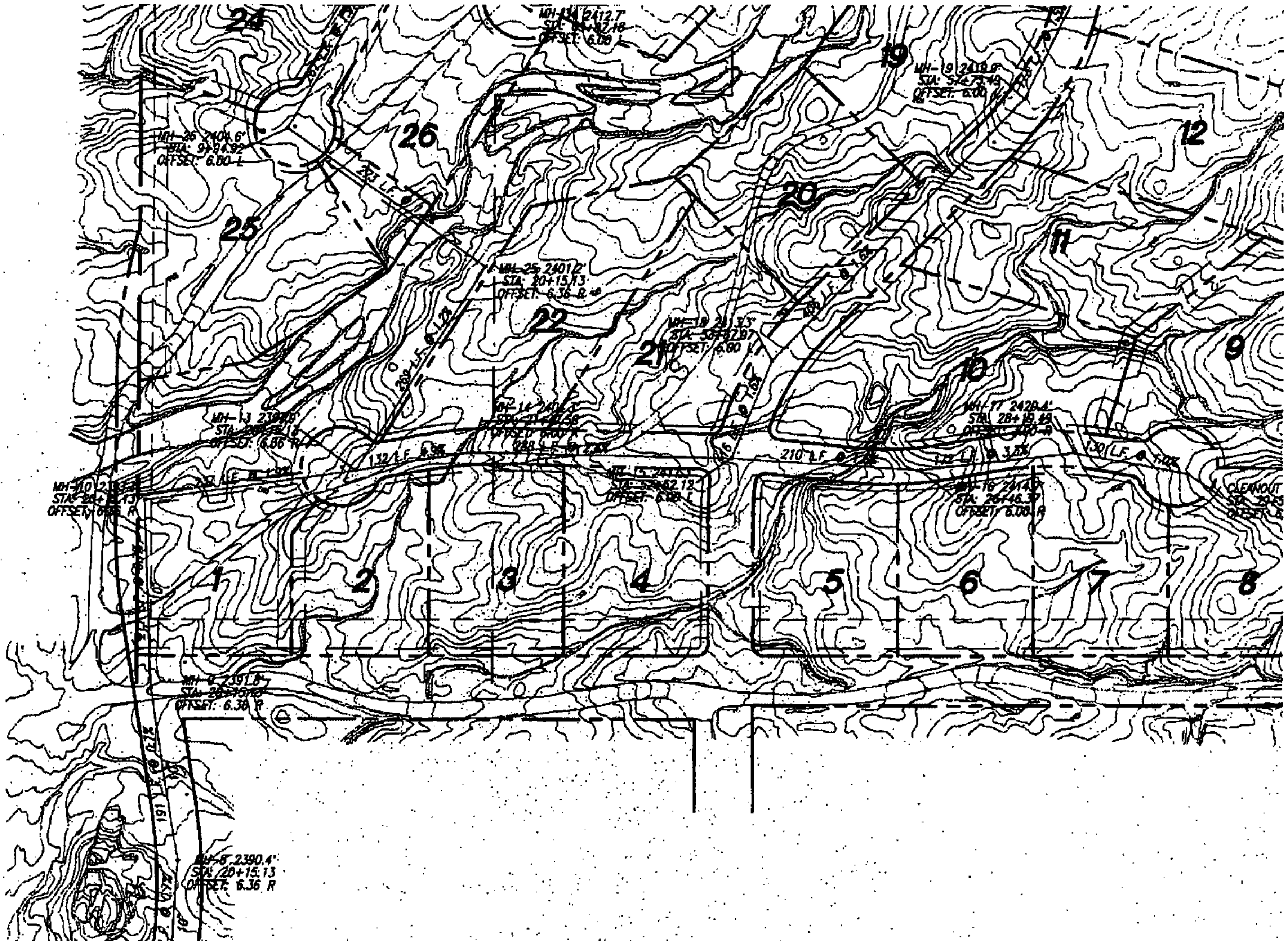
SANDFLOWER SUBDIVISION - SEWER MASTER PLAN

Manhole Number	Invert Elev. ft	Pipe Slope %	Pipe Length ft	Pipe Diameter inches	Pipe Capacity MGD	Full Velocity fps	Dwelling Units	People per Dwelling	Required Capacity MGD	Partial Flow Depth inches	Ratio of Depth to Diameter	Partial Flow Area sq.ft.	Partial Perimeter ft	Partial Velocity fps	Partial Capacity MGD
MH-34	2,412.7	1.76	170	8	1.03	4.59	3	2.5	0.00	0.4	0.05	0.01	0.30	1.18	0.00
MH-27	2,409.8														
MH-27	2,409.8	1.90	267	8	1.08	4.77	836	2.5	0.84	5.4	0.68	0.25	1.29	5.27	0.85
MH-26	2,404.6	1.20	273	8	0.86	3.79	837	2.5	0.84	8.0	1.00	0.35	2.09	3.79	0.85
MH-25	2,401.2	1.20	269	8	0.86	3.79	839	2.5	0.84	8.0	1.00	0.35	2.09	3.79	0.85
MH-13	2,397.9														
MH-22	2,432.0	2.30	133	8	1.18	5.25	0	2.5	0.00	0.4	0.05	0.01	0.30	1.35	0.01
MH-21	2,428.9	1.50	412	8	0.96	4.24	2	2.5	0.00	0.6	0.08	0.01	0.37	1.51	0.01
MH-20	2,422.6	1.50	173	8	0.96	4.24	6	2.5	0.01	0.6	0.08	0.01	0.37	1.51	0.01
MH-19	2,419.9	1.60	406	8	0.99	4.38	7	2.5	0.01	0.6	0.08	0.01	0.37	1.56	0.01
MH-18	2,413.3	1.60	116	8	0.99	4.38	11	2.5	0.01	0.6	0.08	0.01	0.37	1.56	0.01
MH-15	2,411.3														
CO-4	2,421.7	0.96	130	8	0.76	3.39	0	2.5	0.00	0.6	0.08	0.01	0.37	1.21	0.01
MH-17	2,420.4	3.27	172	8	1.41	6.26	3	2.5	0.00	0.5	0.06	0.01	0.34	1.49	0.01
MH-16	2,414.7	1.58	210	8	0.98	4.36	4	2.5	0.00	0.6	0.08	0.01	0.37	1.55	0.01
MH-15	2,411.3														
MH-15	2,411.3	2.41	288	8	1.21	5.38	16	2.5	0.02	0.7	0.09	0.02	0.40	2.04	0.02
MH-14	2,404.3	4.87	132	8	1.72	7.64	20	2.5	0.02	0.6	0.08	0.01	0.37	2.72	0.02
MH-13	2,397.9														
MH-13	2,397.9	1.85	237	8	1.06	4.71	860	2.5	0.86	5.6	0.70	0.26	1.32	5.22	0.87
MH-10	2,393.4	0.70	211	10	1.18	3.36	861	2.5	0.86	6.5	0.65	0.37	1.56	3.65	0.87
MH-9	2,391.8	0.70	191	10	1.18	3.36	861	2.5	0.86	6.5	0.65	0.37	1.56	3.65	0.87
MH-8	2,390.4	0.70	141	10	1.18	3.36	993	2.5	0.99	7.2	0.72	0.41	1.69	3.75	1.00
MH-7	2,389.3	0.70	278	10	1.18	3.36	993	2.5	0.99	7.2	0.72	0.41	1.69	3.75	1.00
MH-6	2,387.2	0.70	150	10	1.18	3.36	993	2.5	0.99	7.2	0.72	0.41	1.69	3.75	1.00
MH-5	2,386.1	0.70	475	10	1.18	3.36	993	2.5	0.99	7.2	0.72	0.41	1.69	3.75	1.00
MH-4	2,382.7	0.70	475	10	1.18	3.36	993	2.5	0.99	7.2	0.72	0.41	1.69	3.75	1.00
MH-3	2,379.2	0.70	475	10	1.18	3.36	993	2.5	0.99	7.2	0.72	0.41	1.69	3.75	1.00
MH-2	2,375.8	2.50	475	10	2.24	6.36	993	2.5	0.99	5.8	0.58	0.32	1.44	6.64	1.38
MH-1	2,363.9														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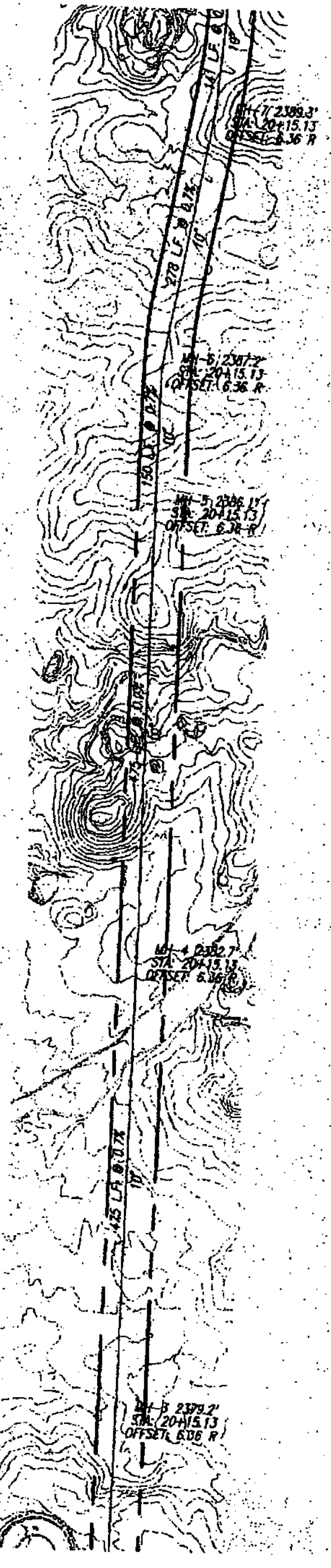
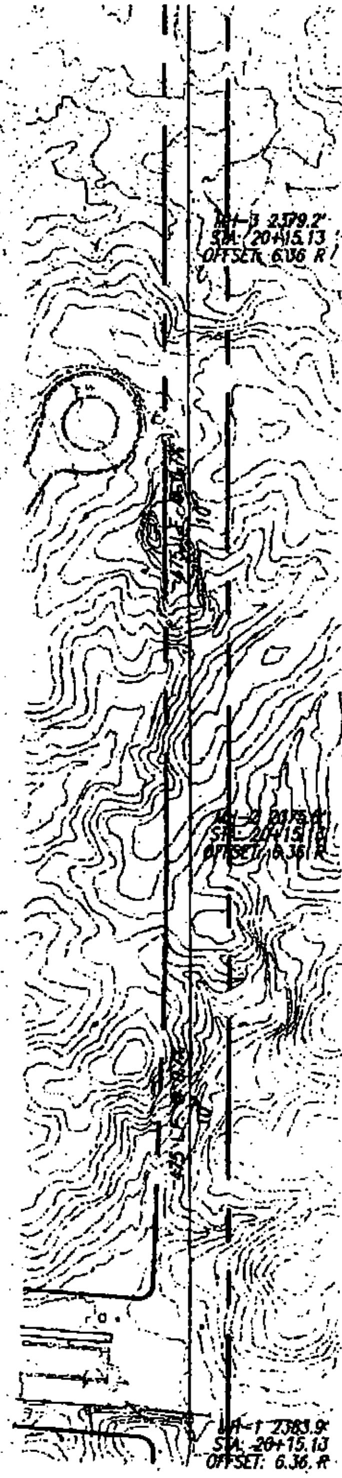
8
MH-26 2404.6'
STA: 9+94.92
OFFSET: 6.00 L
MH-8 2390.4'
STA: 20+15.13
OFFSET: 6.36 R



MH-7 2389.3'
STA. 20+15.13
OFFSET: 6.36' R
MH-6 2387.2'
STA. 20+15.13
OFFSET: 6.36' R
MH-5 2386.1'
STA. 20+15.13
OFFSET: 6.36' R
MH-4 2382.7'
STA. 20+15.13
OFFSET: 6.36' R
MH-3 2379.2'
STA. 20+15.13
OFFSET: 6.36' R


STA. 20+15.13
OFFSET: 6.36 R

A CLASS III CULTURAL RESOURCE SURVEY OF 45 ACRES AT 35026 NORTH 84TH STREET, AT THE SOUTHWEST CORNER OF 84TH STREET AND CAVALRY DRIVE IN SCOTTSDALE, MARICOPA COUNTY, ARIZONA

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CULTURAL RESOURCE, ENVIRONMENTAL MANAGEMENT AND GIS SERVICES

26-ZN-2016
01/10/2017

A CLASS III CULTURAL RESOURCE SURVEY OF 45 ACRES AT 35026 NORTH 84TH STREET, AT THE SOUTHWEST CORNER OF 84TH STREET AND CAVALRY DRIVE IN SCOTTSDALE, MARICOPA COUNTY, ARIZONA

Prepared for
Criterion Land Management LLC
7440 E Pinnacle Peak Rd.
Scottsdale, Arizona 85255

Prepared by
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Submitted by
Douglas R. Mitchell, M.A., RPA

Archaeological Consulting Services, Ltd.
Project No. 16-137 CSUR3
November 14, 2016
December 21, 2016 (Submittal 2)

SHPO SURVEY REPORT ABSTRACT

Report Title: A Class III Cultural Resource Survey of 45 Acres at 35026 North 84th Street, at the Southwest Corner of 84th Street and Cavalry Drive in Scottsdale, Maricopa County, Arizona

Report Date: November 14, 2016; December 21, 2016 (Submittal 2)

Project Name: 84th Street and Cavalry Drive

Project Location: The project area is located at 35026 North 84th Street, on the southwest corner of 84th Street and Cavalry Drive in Scottsdale, Arizona.

Project Locator UTM: N3740719 E416608 **Zone:** 12 NAD 83

Project Sponsor: Criterion Land Management LLC

Sponsor Project Number(s): n/a

Lead Agency: City of Scottsdale (COS)

Other Involved Agencies: n/a

Applicable Regulations: Under City of Scottsdale (COS) Ordinance 3242, adopted July 13, 1999, the Historic Property (HP) zoning overlay district is intended to protect and enhance the cultural, historical, social or archaeological heritage of the COS. The HP District encourages the retention of historic resources by keeping them in active use in their original appearance, setting, and placement. Under COS Ordinance 3243, adopted July 13, 1999, effective date August 12, 1999, amended April 16, 2002 by Ordinance 3432, before the construction can begin, a cultural resource assessment needs to take place to identify and evaluate any cultural resources that might be present within the project area. Arizona Revised Statute (A.R.S.) §41-865 refers to the state burial law as it applies to private land.

Funding Source: Private

ASLD ROW Application Number: n/a

Description of the Project/Undertaking: Criterion Land Management LLC. contracted with Archaeological Consulting Services Ltd. (ACS) to conduct a cultural resources survey of 45 acres of privately owned land for a proposed residential development.

Project Area/Area of Potential Effects (APE): The project area is located at 35026 North 84th Street, on the southwest corner of 84th Street and Cavalry Drive in Scottsdale, Arizona.

Legal Description: The project is located in Section 1, Township 5 North, Range 4 East, Gila and Salt Baseline Meridian as depicted on the Cave Creek 7.5 USGS topographic quadrangle.

Land Jurisdiction: Private

Total Acres: 45

Acres Surveyed: 45

Acres Not Surveyed: 0

SHPO SURVEY REPORT ABSTRACT

Consultant Firm/Organization: ACS

Project Number: 16-137:CSUR3

Permit Number(s): n/a

Date(s) of Fieldwork: July 7, September 2, November 10, 2016

Number of IOs Recorded: 5

Number of Sites Recorded: 0

Eligible Sites: 0

Ineligible Sites: 0

Unevaluated Sites: 0

Sites Not Relocated: 0

Site Summary Table

Land Jurisdiction	Identification Status	Site Number/ Property Address	Eligibility Status/ Criterion/Criteria	Recommended Treatment
N/A	N/A	N/A	N/A	N/A

Comments: ACS' intensive cultural resources survey of 45 acres at 35026 North 84th Street, located on the southwest corner of 84th Street and Cavalry Drive, identified five isolated occurrences and no archaeological sites. The isolated occurrences do not meet COS site criteria and are not considered significant. Mapping and field recording have exhausted their information potential. Based on the results of this survey and background research, no historic properties would be affected by this proposed project. Therefore, it is recommended that the proposed project be granted a Certificate of No Effect and be allowed to proceed without further cultural resource work.

Should a previously unidentified archaeological site be discovered in the course of construction, the property owner shall immediately notify the City Archaeologist and/or Historic Preservation Officer. The property owner shall have a preliminary study made by a qualified archaeologist to determine the effect that the proposed development project may have on the site. The City Archaeologist and/or Historic Preservation Officer, with concurrence from the qualified archaeologist hired by the property owner, shall evaluate on-site the significance of the archaeological finding as soon as possible. When the Historic Preservation Officer, the qualified archaeologist hired by the property owner, and the City Archaeologist concur that no adverse effect on the archaeological site will take place, the project may proceed immediately. Where an adverse effect on a significant archaeological site will take place, the project shall be referred to the Historic Preservation Commission at the commission's next regular meeting or a called meeting for review following the same procedure set forth for identified significant archaeological sites.

If human remains or funerary objects are identified during construction, work must stop in the vicinity of the find and the Arizona State Museum (Dr. Todd Pitezel, 520-621-4795) shall be notified, pursuant to

SHPO SURVEY REPORT ABSTRACT

A.R.S. §41-865. Work in that area shall not resume until authorization is received from the Arizona State Museum

Figure 1. Portion of the USGS 7.5' Cave Creek, Ariz. topographic quadrangle, showing the location of the project area and land jurisdiction.

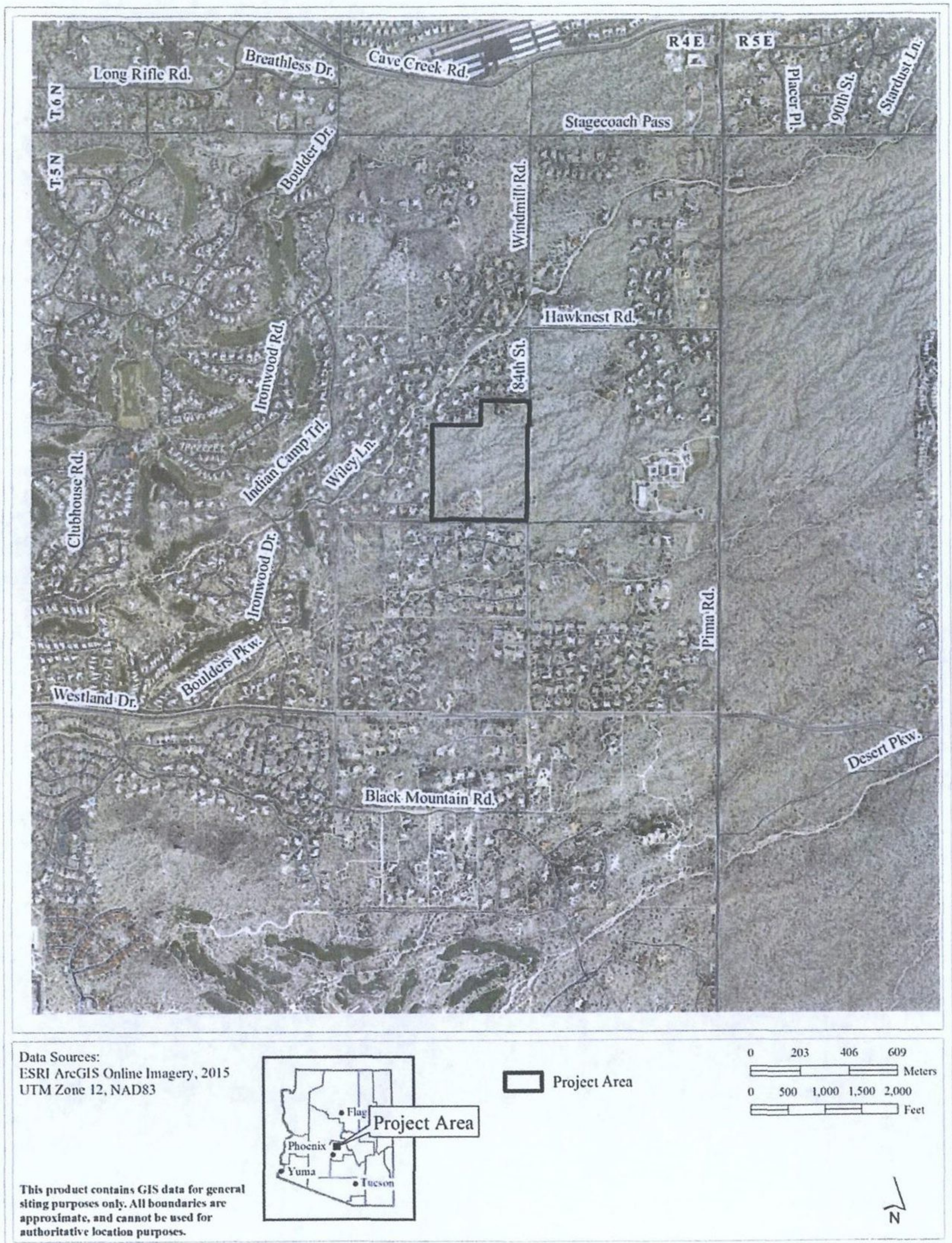

Figure 2. Contemporary aerial of North Scottsdale, showing the location of the project area at 84th Street and Cavalry Drive.

CERTIFICATE OF NO EFFECT
ARCHAEOLOGICAL RESOURCES

26-ZN-2016

84th & Black Mountain

APPLICATION INFORMATION			
LOCATION:	34834 N 83rd St	APPLICANT:	Alex Stedman
PARCEL:	216-34-267	COMPANY:	Alex Stedman
Q.S.:	59-47	ADDRESS:	120 S. Ash Ave. Tempe, AZ 85281
		PHONE:	480-994-0994

Request by owner for a Zoning District Map Amendment from the Single-family Residential, Environmentally Sensitive Lands (R1-190/ESL) zoning district, to the Single-family Residential, Environmentally Sensitive Lands (R1-43 ESL) zoning district, on a +/- 45-acre site, generally located at the northwest corner of N. 84th Street and E. Black Mountain Road.

Certificate of No Effect Criteria:
In accordance with Chapter 46, Article VI, of the Scottsdale Revised City Code, the Historic Preservation Officer finds that:

- No archaeological resources are located on the property according to the archaeological survey and report and based upon the city's review of the report.

STIPULATIONS

1. Any development on the property is subject to the requirements of Scottsdale Revised Code, Chapter 46, Article VI, Protection of Archaeological Resources, Section 46-134 - Discoveries of archaeological resources during construction.

SIGNATURE: Steve Venker DATE: 1/11/17

Steve Venker, City Archaeologist 480-312-2831