DOE/NV/25946--2442

RCRA PART B PERMIT APPLICATION

NEVADA NATIONAL SECURITY SITE (NNSS)

FOR WASTE MANAGEMENT ACTIVITIES AT THE NNSS MIXED WASTE STORAGE UNIT (MWSU)

OCTOBER 2015

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Acronyms

ac	acre(s)
AEA	*Atomic Energy Act*
AMEM	Assistant Manager for Environmental Management
ASTM	American Society for Testing and Materials
BFF	Bureau of Federal Facilities
BLM	Bureau of Land Management
CAAB	Controlled Area Access Building
CAP	Corrective Action Plan
CAR	Corrective Action Request
CAU/CAS	Corrective Action Unit/Corrective Action Site
CFR	Code of Federal Regulations
cm	centimeter(s)
cms	cubic meter(s) per second
DHP	Drum Holding Pad
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOECAP	U.S. Department of Energy Consolidated Accreditation Program
DOT	U.S. Department of Transportation
EODU	Explosive Ordnance Disposal Unit
EPA	U.S. Environmental Protection Agency
EPIP	Emergency Plan Implementing Procedure
FEMA	Federal Emergency Management Agency
FFACO	*Federal Facility Agreement and Consent Order*
FIRM	Flood Insurance Rate Map
ft	foot (feet)
ft^2	square foot (feet)
ft^3	cubic foot (feet)
gal	gallon(s)
ha	hectare(s)
HEC	Hydrologic Engineering Center
HOCs	halogenated organic compounds
HWSU	Hazardous Waste Storage Unit
in.	inch(es)
kg	kilogram(s)
km	kilometer(s)
km^2	square kilometer(s)
L	liter(s)
lb	pound(s)

Acronyms (continued)

LDR	land disposal restriction
LLMW	low-level mixed waste
LLW	low-level waste
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
mi	mile(s)
mi^2	square mile(s)
MWDU	Mixed Waste Disposal Unit
MWSU	Mixed Waste Storage Unit
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NNSA/NFO	U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office
NNSS	Nevada National Security Site
NNSSWAC	Nevada National Security Site Waste Acceptance Criteria
NRS	Nevada Revised Statutes
PCB	polychlorinated biphenyl
PLO	Public Land Order
PPE	personal protective equipment
ppm	parts per million
QA	quality assurance
QC	quality control
RCRA	*Resource Conservation and Recovery Act*
RCT	Radiological Control Technician
RTR	real-time radiography
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site
RWO	Radioactive Waste Operations
SDS	Safety Data Sheet
SIS	Sprung Instant Structure
TCLP	Toxicity Characterization Leaching Procedure
TID	tamper-indicating device
TP	Transuranic Pad
TPCB	Transuranic Pad Cover Building
TSDF	treatment, storage, and disposal facility
UHC	underlying hazardous constituent
UR	use restriction

Acronyms (continued)

USGS	U.S. Geological Survey
VERB	Visual Examination and Repackaging Building
WAP	Waste Analysis Plan
yd^3	cubic yard(s)

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B.1 Mixed Waste Storage Unit [40 CFR 270.14(b)(1)]

The Mixed Waste Storage Unit (MWSU) is located at the Area 5 Radioactive Waste Management Complex (RWMC). Existing facilities at the RWMC are used to store low-level mixed waste (LLMW) generated at or shipped to the Nevada National Security Site (NNSS) prior to disposal at the Mixed Waste Disposal Unit (MWDU).

LLMW generated onsite at the NNSS is currently stored at the MWSU under a permit with the Nevada Division of Environmental Protection (NDEP), Bureau of Federal Facilities (BFF). Polychlorinated biphenyl (PCB) waste and friable and non-friable asbestos waste that meet the acceptance criteria in the Waste Analysis Plan (WAP) for disposal in the MWDU are also stored at the MWSU. U.S. Department of Energy (DOE) non-radioactive classified hazardous waste and U.S. Department of Defense (DoD) non-radioactive classified hazardous waste are also stored at the MWSU prior to permanent disposal. In addition to *Resource Conservation and Recovery Act* (RCRA) requirements, the MWSU is subject to DOE Orders and other applicable federal and state regulations.

Table 1 lists metric conversion factors used in this application. Table 2 lists existing permits.

Table 1. Metric Conversion Factors

Unit	Equals
1 ha	2.471 ac
1 cm	0.394 in.
1 kg	2.205 lb
1 L	0.264 gal
1 m	3.281 ft
1 m^2	10.76 ft^2
1 m^3	35.32 ft^3
1 m^3	1.308 yd^3
1 km	0.621 mi
1 km^2	0.386 mi^2
1 metric ton	1.102 short tons
The actual value (or real value), which is in metric units, is converted to the corresponding value in English units using the conversion factors listed above. The converted value is then rounded in the following manner.	
Numerical Range	**Rounded to the Nearest…**
0–10	0.10
10–100	1
100–5,000	5
5,000–10,000	10
10,000–500,000	100
500,000–1,000,000	1,000
>1,000,000	10,000

Table 2. List of Existing Permits

Number	Type, Area, Location
NY-1054	Septic System, Area 3, Waste Management Office
NY-1069	Septic System, Area 18, 820th Red Horse Squadron
NY-1077	Septic System, Area 27, Baker Compound
NY-1106	Septic System, Area 5, Building 5-8
NY-1079	Septic System, Area 12 (U12g Tunnel)
NY-1080	Septic System, Area 23, Building 1103
NY-1081	Septic System, Area 6, CP-170
NY-1082	Septic System, Area 22, Building 22-1
NY-1083	Septic System, Area 5, Radioactive Material Management Site (RWMS)
NY-1084	Septic System, Area 6, Device Assembly Facility
NY-1085	Septic System, Area 25, Central Support Area
NY-1086	Septic System, Area 25, Reactor Control Point
NY-1087	Septic System, Area 27, Able Compound
NY-1089	Septic System, Area 12 Camp
NY-1090	Septic System, Area 6, LANL Construction Campsite
NY-1091	Septic System, Area 23, Gate 100
NY-1103	Septic System, Area 22, Desert Rock Airport
NY-1110-HAA-A	Individual Sewage Disposal System, A-12, Bldg. 12-910
NY-1112	Commercial Sewage Disposal System, U1a, Area 1
NY-1113	Commercial Sewage Disposal System, Area 1, Building 121
NY-1124	Commercial Individual Sewage Disposal System, Area 6
NY-1128	Area 6 Yucca Lake Project
NY-1130	Commercial Individual Sewage Disposal System, Area 6, Fire Station #2
NY-17-06839	Septic Tank Pumping Contractor (5 units)
GNEV93001	Water Pollution Control General Permit
NEV96021	Water Pollution Control for E-Tunnel Waste Water Disposal System and Monitoring Well ER-12-1
31297	NNSS Hazardous Materials Permit
31304	Nonproliferation Test and Evaluation Complex Hazardous Materials Permit
NEVHW0101	NNSS Hazardous Waste Management Permit (RCRA)
AP9711-2557	NNSS Class II Air Quality Operating Permit
AP9711-2659	UGTA Surface Area Disturbance Permit ER-EC-13 and ER-EC-15
AP9711-2824	UGTA Surface Area Disturbance Permit ER-EC-14
NY-0360-12NTNC	Public Water System Area 23 and Area 6
NY-4098-12TNCWS	Public Water System Area 25
NY-4099-12TNCWS	Public Water System Area 12
NY-0835-12NP	NNSS (Water Hauler) #84846
NY-0836-12NP	NNSS (Water Hauler) #84847
SW 532	Area 5 Asbestiform Low-Level Solid Waste Disposal Site
SW 13 097 02	Area 6 Hydrocarbon Disposal Site
SW 13 097 03	Area 9 U10c Solid Waste Disposal Site
SW 13 097 04	Area 23 Solid Waste Disposal Site
UNEV2012203	NNSS Underground Injection Control Permit

B.1.a MWSU Background

DOE submitted a Part B Permit application for LLMW storage in 1995. Land disposal restrictions (LDRs) for hazardous waste at that time limited NNSS characterization and remediation efforts since the LDRs offered limited waste treatment and disposal options. The permit application was set aside, and a Mutual Consent Agreement provided DOE an avenue to store onsite-generated LLMW while treatment and disposal options were developed. The Transuranic Pad (TP) was selected to store the waste because it was RCRA compliant for the storage of hazardous waste.

The currently permitted MWSU has been operated since December 2010. Each of the four designated storage areas is RCRA compliant for the storage of hazardous waste. This application represents a renewal request by DOE for the permitted MWSU.

B.1.b RCRA Permit Application History

In 1985 and 1987 DOE submitted Parts A and B, respectively, of the RCRA Permit Application to Region 9 of the U.S. Environmental Protection Agency (EPA) and the State of Nevada. The application provided detailed information on the disposal of LLMW at the Area 5 Pit 3 MWDU and the treatment of non-radioactive waste at the Area 11 Explosive Ordnance Disposal Unit (EODU). In September 1987, NDEP concurred that the Pit 3 MWDU and the EODU met the regulatory requirements of interim status. In 1992, DOE resubmitted the Part B Application with the addition of the Hazardous Waste Storage Unit (HWSU). From June 1992 through May 1995, DOE provided subsequent revisions to the application, including an additional proposal in January 1995 for an MWSU. In May 1995, NDEP issued a RCRA Part B Permit to DOE for the operation of two units, the Area 5 HWSU for the storage of non-radioactive hazardous waste and the Area 11 EODU for the treatment of non-radioactive waste explosives. This permit was renewed in November 2000 and 2005. In 2005, DOE requested accelerated closure of the Pit 3 MWDU and submitted a closure plan to NDEP. LLMW shipments for Pit 3 ended in November 2010. The MWSU permit, NEV HW0102, was issued in December 2010 with an effective date of October 17, 2010, and subsequently incorporated into Revision 2 of Permit NEV HW0101, which kept its original effective date of December 2010. Permit NEV HW0101 was subsequently modified in 2013 as Revision 3.

B.1.c Summary of RCRA Operational Units

Figure 1 and Table 3 provide the location and status of each RCRA operational unit on the NNSS. Specific information for the Cell 18 MWDU, the Area 11 EODU, the Area 5 HWSU, and the Area 5 MWSU is found in the RCRA Part B Permit Application for each unit and the NDEP Permit for a Hazardous Waste Management Facility (NEV HW0101).

Table 3. Operational Unit Locations and Regulatory Status

Unit Name	Location	Regulatory Status	Permit	Effective Date
MWSU	Area 5 RWMC	Permitted	NEV HW0101	December 2010
Cell 18 MWDU	Area 5 RWMC	Permitted	NEV HW0101	December 2010
EODU	Area 11	Permitted	NEV HW0101	December 2010
HWSU	Area 5	Permitted	NEV HW0101	December 2010

Cell 18 MWDU

Cell 18 MWDU is a fully compliant, RCRA-permitted landfill that disposes of onsite and offsite containerized LLMW from an approved DOE nexus. The permitted capacity of the unit is 25,485 cubic meters (m^3) (33,300 cubic yards [yd^3]).

EODU

The Area 11 EODU is a permitted thermal treatment unit for explosive waste treatment operations. The unit encompasses approximately 8.1 hectares (ha) (20 acres [ac]) of land. A storage magazine is used to store explosive materials and serves as a satellite accumulation area for waste explosives. The unit has an annual estimated capacity of 1,875 kilograms (kg) (4,130 pounds [lb]) of waste. The process design capacity of the EODU is 45 kg per hour (100 lb per hour).

HWSU

The Area 5 HWSU is a permitted storage unit for hazardous non-radioactive waste generated on the NNSS. It is located immediately to the east of the Area 5 RWMC. The storage design capacity of the HWSU is approximately 61,600 liters (L) (16,300 gallons [gal]).

MWSU

The Area 5 MWSU is a permitted storage unit for onsite and offsite containerized LLMW from an approved DOE nexus. It is located within the Area 5 RWMC and uses existing facilities at the RWMC to store LLMW.

B.1.d NNSS General Facility Description

The NNSS is a U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office (NNSA/NFO) installation comprising approximately 3,561 square kilometers (km^2) (1,375 square miles [mi^2]) of federally owned land located in southeastern Nye County, Nevada. Located approximately 105 kilometers (km) (65 miles [mi]) northwest of Las Vegas, Nevada, the NNSS is accessed from U.S. Highway 95, which roughly forms the southern boundary of the site. The site is bordered to the west, north, and east by the Nevada Test and Training Range, another government-owned, restricted-access area. Public land to the south of the NNSS is managed by the Bureau of Land Management (BLM). Surrounding areas are predominantly rural, undeveloped public desert lands used for grazing and agriculture. The NNSS is well buffered from public access. Las Vegas is the closest major population center. Smaller, rural communities near the NNSS include Amargosa Valley and Pahrump.

The NNSS varies from 46 to 57 km (28 to 35 mi) in the east/west direction and from 65 to 90 km (40 to 55 mi) in the north/south direction. Elevation varies from 915 to 2,345 meters (m) (3,000 to 7,700 feet [ft]) above sea level. The terrain is characteristic of the Basin and Range Physiographic Province in Nevada, Arizona, and Utah, which is a province of nearly parallel intervening valleys and ranges. Numerous north to northeast trending mountain ranges are separated by gently sloping linear valleys and broad flat basins. The principal valleys are Frenchman Flat, Yucca Flat, and Jackass Flats. The principal highlands are Pahute Mesa, Rainier Mesa, Timber Mountain, and Shoshone Mountain. Large portions of the NNSS are within one or two elevation ranges from 915 to 1,220 m (3,000 to 4,000 ft) in the valleys to the south and east to 1,675 to 2,225 m (5,500 to 7,300 ft) in the high country to the north and west.

The Mercury base camp is located in the southeast corner of the site, approximately 6.5 km (4.0 mi) north of U.S. Highway 95. Mercury has administrative and maintenance structures that currently support a working population of approximately 1,000 workers and a residential capacity of approximately 350. NNSS areas outside of Mercury were used for many activities. In Area 5, the Frenchman Flat vicinity was designated for atmospheric testing, hazardous materials spill testing, underground testing, and radioactive waste management. Yucca Flat and Rainier Mesa were used for underground tests, and Yucca Flat was used for atmospheric nuclear tests. The Pahute Mesa vicinity was used for higher-yield underground tests.

Historically, the primary mission of the NNSS was to conduct nuclear weapons tests. Since the moratorium on nuclear testing began in October 1992, this mission has changed to maintaining readiness to conduct tests if so directed. Because of its favorable environment and infrastructure, the NNSS supports national security-related research, development, and testing programs, as well as waste management activities. Numerous government and/or research organizations use the NNSS for a variety of research activities and/or programs because of its specialized facilities, favorable climate, remote location, and controlled access. The research and testing activities comprising these programs are directly supported by NNSA/NFO.

National Security Technologies, LLC, the Management and Operations Contractor, provides a number of services including designing and operating the functioning hazardous waste management units at the NNSS. The contractor also provides onsite medical services and operates the NNSS Fire and Rescue Department. Additionally, NNSA/NFO maintains separate contracts for 24-hour security services (armed patrol and access control), while the Nye County Sheriff’s Office provides law enforcement support on the NNSS.

Figure 1, “General Location Map,” Figure 2 , “Topographic Features and Infrastructure,” Figure 3, “NNSS Land Use Map,” Figure 4, “Mixed Waste Storage Unit Aerial View,” and Figure 5, “Area 5 MWSU Topographic Map 1,000-Foot Boundary,” and Figure 6, “Overall Location Map,” provide additional information to support this Part B Application.

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Figure 1. General Location Map

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NATIONAL NUCLEAR SECURITY ADMINISTRATION
NEVADA FIELD OFFICE — LAS VEGAS, NEVADA

NEVADA NATIONAL SECURITY SITE — AREA 05A
RCRA UNITS

GENERAL LOCATION MAP

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
S. Plumb 4-21-15	J. Sorelle 4/21/15	N/A	G. Clifford 4/21/15	N/A

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P.O. BOX 98521 LAS VEGAS, NV 89193-8521

ENGINEERING NO. 01327
ORIGINAL SIGNATURES ON FILE
DRAWING NUMBER / WORK ORDER NUMBER: SK-01327-C-1001
REVISION 0

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Figure 2. Topographic Features and Infrastructure

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NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA FIELD OFFICE — LAS VEGAS, NEVADA

NEVADA NATIONAL SECURITY SITE — AREA 05A

RCRA UNITS

TOPOGRAPHIC FEATURES & INFRASTRUCTURE

DRAWN	DATE	PREPARER	DATE	CHECKER	DATE	PROJECT ENGINEER	DATE	APPROVER / USER	DATE
S. Pl[illegible]	4-21-15	J. S[illegible]	4/21/15	N/A		[illegible]	4/21/15	N/A	

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DRAWING NUMBER / WORK ORDER NUMBER: SK-01327-C-1002

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Figure 3. NNSS Land Use Map

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Figure 4. Mixed Waste Storage Unit Aerial View

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05A-24
TPCB
TP
05A-7
05A-6
05A-196402
05A-31
5-01 Road
05-21
05A-19
05A-B107019
SIS
05A-202617
05A-32
VERB
DHP
Mixed Waste Storage Unit Aerial View
Area 5, Nevada National Security Site
N
Fence
Red text identifies the facilities included in the MWSU
Black text identifies other buildings in the RWMC
0
125
250
500
Feet
0
25
50
100
Meters

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Figure 5. Area 5 MWSU Topographic Map 1,000-Foot Boundary

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Figure 6. Overall Location Map

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B.1.e MWSU Description

The MWSU occupies several existing facilities within the Area 5 RWMC. Total storage capacity for the MWSU is approximately 18,426 m^3 (651,000 ft^3). Exhibit 1 includes facility drawings (floor plans) and photographs for each of the MWSU facilities.

Transuranic Pad Cover Building (TPCB) and TP

The TPCB measures 25.8 m (85 ft) wide by 70.6 m (230 ft) long. The floor has two layers of asphaltic concrete that sandwich a petrochemical liner. The liner and asphalt form a 15-centimeter (cm) (6-inch [in.]) high curb at the edge of the building foundation. Roll-up doors on the east and west end of the TPCB accommodate the movement and placement of freight containers, waste boxes, and drums. The area available for storage in the TPCB is approximately 1,822 square meters (m^2) (19,600 square feet [ft^2]). A portion of the TPCB is used to macro-encapsulate and stage LLMW generated onsite for disposal at the MWDU.

The TPCB sits on the TP, which also has two layers of asphaltic concrete that sandwich a petrochemical liner and is also bermed. The TP offers an outdoor storage area. Both the TP and the footprint of the TPCB are available for storage. The available area on the TP is approximately 5,437 m^2 (58,500 ft^2). A portion of this area is used to accumulate LLMW generated onsite.

Maximum storage volume for the TPCB and TP is approximately 17,690 m^3 (625,000 ft^3). The volume estimate is based on freight containers (36.2 m^3 (1,280 ft^3)] stacked two high.

Sprung Instant Structure (SIS) Building

The SIS building measures 10.7 m (35 ft) wide by 18.3 m (60 ft) long. The floor is made up of a concrete portion and a gravel portion. The entire floor space is available for storage of waste boxes and drums [195.8 m^2 (2,105 ft^2)].

Maximum storage volume for the SIS building is approximately 365 m^3 (12,900 ft^3). The volume estimate is based on waste boxes (4.1 m^3 [145 ft^3]) with no stacking.

Visual Examination and Repackaging Building (VERB)

Usable storage in the VERB is approximately 6.4 m (21 ft) wide by 10.1 m (33 ft) long in the “permacon” portion of the building [64.6 m^2 (695 ft^2)]. The building floor is concrete. Doorways are not forklift accessible. This storage area is for waste boxes and drums.

Maximum storage volume for the VERB is approximately 240 m^3 (8,477 ft^3). The volume estimate is based on waste boxes (4.1 m^3 [145 ft^3]) stacked two high.

Drum Holding Pad (DHP)

The DHP is a concrete pad located adjacent to the VERB. The entrance slopes down onto the pad, creating a bermed pad. The DHP is fenced and partially covered. The covered portion of the pad measures 4.9 m (16 ft) wide by 7.3 m (24 ft) long (35.8 m^2 [385 ft^2]) and can accommodate waste boxes and drums.

Maximum storage volume for the DHP is approximately 131 m^3 (4,625 ft^3). The volume estimate is based on waste boxes (4.1 m^3 [145 ft^3]) stacked two high.

B.1.e.1 Storm Water Run-On and Runoff Control [40 CFR 270.21(b)(2)]

Run-On Protection

The MWSU is protected from flooding from upstream watersheds by two flood control channels (west and east of the RWMC) and berms. The berms extend along the western, northern, and eastern sides of the RWMC. The channels are designed to divert the peak flow from a 25-year, 24-hour storm event, evaluated using the U.S. Army Corps of Engineers Hydrologic Engineering Center (HEC) HEC-2 model. The 25-year flood peaks were derived using a HEC-1 model developed for the 100-year floodplain mapping that assumed that floodwater from the entire Barren Wash drainage basin would pass through the west channel. Therefore, the channel design is highly conservative. The flood control channels divert storm water around the RWMC and onto Frenchman Flat.

A 25-year flood event occurred at the RWMC on February 23 and 24, 1998 (French and Curtis, 1999). The observed flow depth in the west channel during this storm was a few inches. The channel is designed for 242 cubic meters per second (cms) (316 yd^3 per second). The modeled peak for the event was 96 cms (126 yd^3 per second), and the estimated flow rate corresponding to observed water depth in the channel was less than 1.5 cms (2.0 yd^3 per second).

In addition, all waste stored at the MWSU is containerized to prevent precipitation from contacting waste. All waste in the MWSU is also placed on metal pallets to ensure it remains above any standing water.

Runoff Protection

Runoff is not anticipated because waste is containerized. The TP outdoor storage area is bermed (asphaltic concrete). Pallets are used to ensure that containers do not contact precipitation that may collect on the pad. The DHP has a sloped entry and a sunken floor with curbs and no drains. Pallets are used to ensure that containers do not contact precipitation that may collect on the bermed floor.

Erosion Protection

Erosion from precipitation events is not applicable for MWSU facilities.

EXHIBIT 1. Facility Drawings (TPCB, TP, SIS Building, VERB, and DHP)

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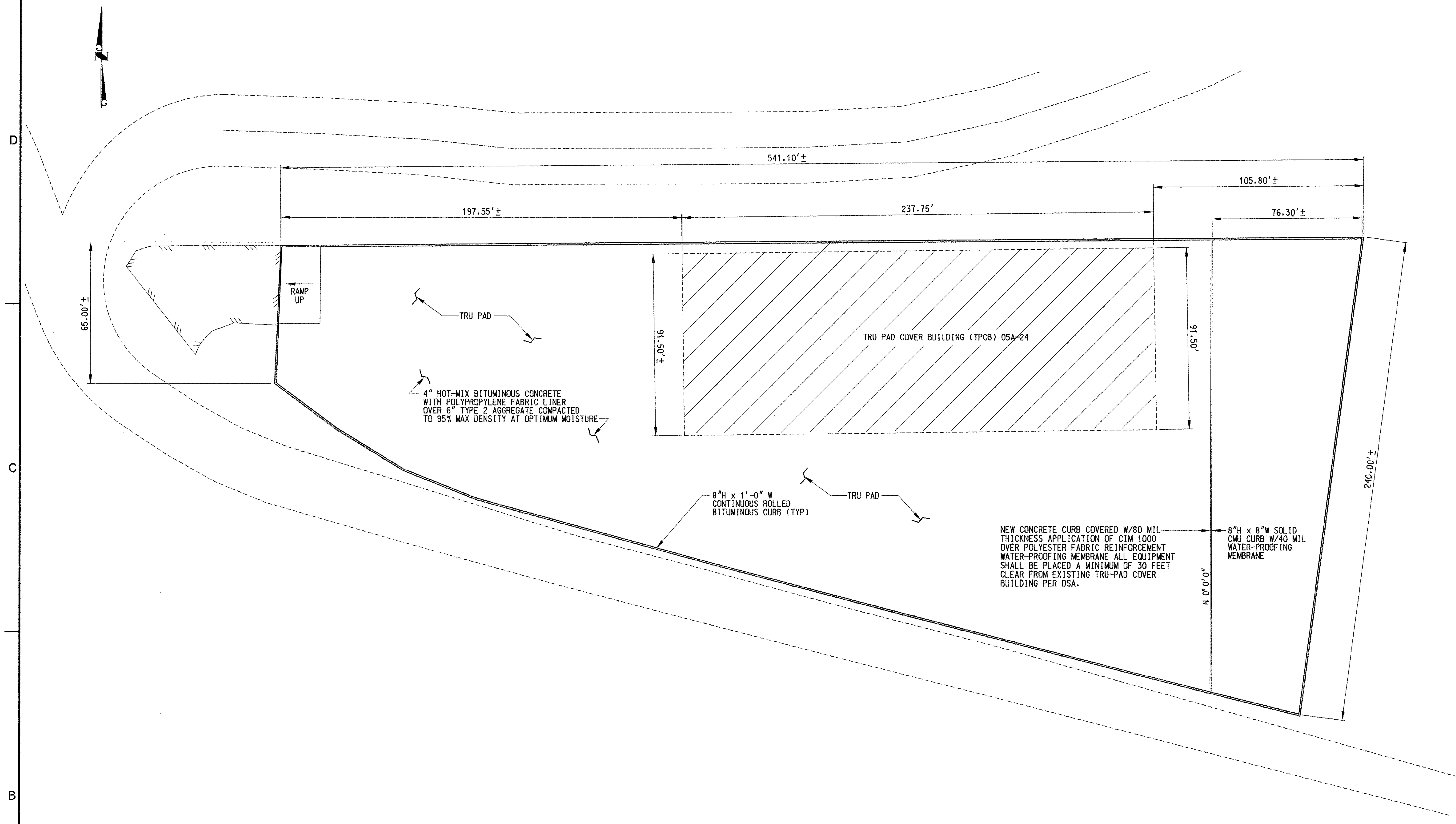

REFERENCES

PLAN, PROFILE, SECTION & DETAIL	5-RWMS-C20.2
PLANS & SECTION	JS-005-024-C1.1
SITE PLAN	02153-000-MLU-C1 REV 1, DCN 03
PLAN VIEW	02153-000-MLU-S1 REV 0, DCN 02
SURVEY DATA	DATED MARCH 2003

SITE PLAN

SCALE : 1" = 30'

GRAPHIC SCALE

0 30 60 90 FEET

1" = 30'

GS

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA FIELD OFFICE — LAS VEGAS, NEVADA

NEVADA NATIONAL SECURITY SITE — AREA 05A

MWSU

TRU PAD

TPCB BUILDING 05A-24

SITE PLAN

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
S. Plumb 4/21/15	[signature] 4/21/15	N/A	[signature] 4/21/15	N/A

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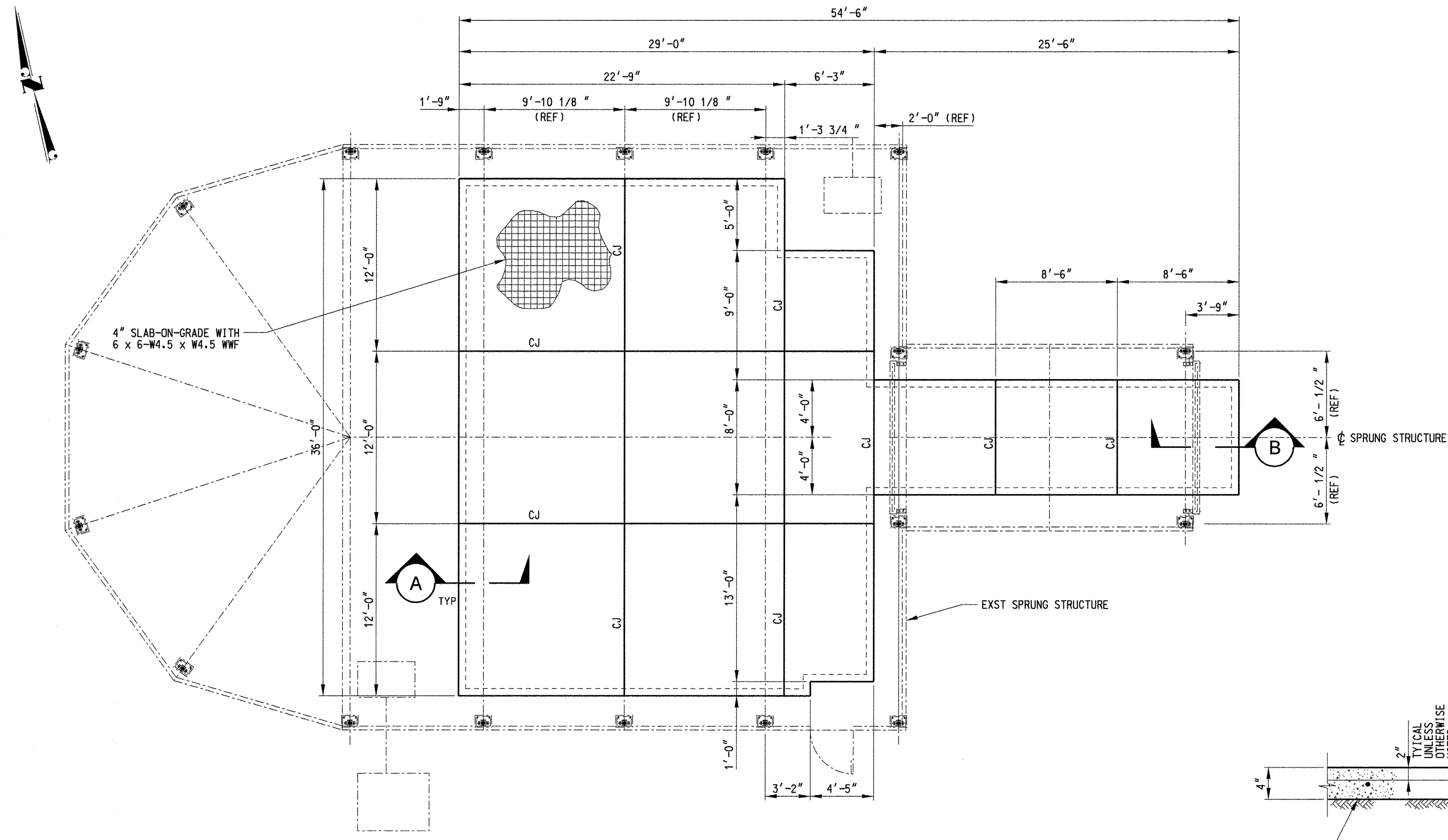
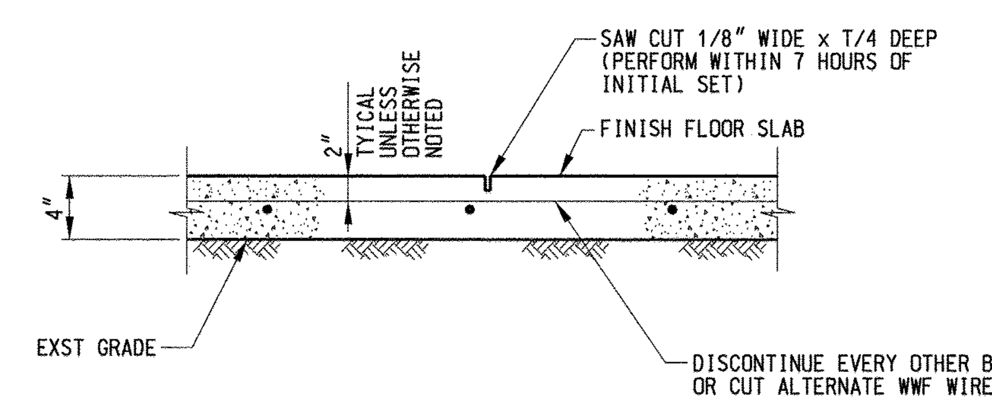


PLAN

SCALE : 3/16"= 1'-0"



TYPICAL
CONTROL JOINT DETAIL

SCALE : NOT TO SCALE

CONCRETE NOTES

1. CONCRETE SHALL CONFORM TO ACI 318, LATEST EDITION.

2. CONCRETE MIX SHALL BE DESIGNED BY A QUALIFIED TESTING LABORATORY AND APPROVED BY BECHTEL NEVADA ENGINEERING.

3. ALL CAST IN PLACE CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS, UNLESS OTHERWISE NOTED ON THE DRAWINGS AND APPROVED BY BECHTEL NEVADA DESIGN ENGINEERING.

   ADDITIONAL CONCRETE PERFORMANCE REQUIREMENTS ARE:

   SHRINKAGE LIMIT: 0.030% (DESIGN TARGET)
   0.035% (MAXIMUM VALUE)

   WATER/CEMENT RATIO: 0.40% (DESIGN TARGET)
   0.45% (MAXIMUM VALUE)

   EXTERIOR CONCRETE WILL BE WITH 5 TO 8% AIR ENTRAINMENT

4. ALL CONCRETE REINFORCEMENT DETAILING SHALL BE IN ACCORDANCE WITH THE ACI DETAILING MANUAL, LATEST EDITION.

5. CONCRETE REINFORCEMENT :

   REBARS - ASTM A615, GR 60.
   WWF - ASTM A185.

6. CONTROL JOINTS SHALL BE SAW CUT WITHIN 7 HOURS OF INITIAL SET OR MADE WITH PREFORMED PLASTIC STRIP.

7. ALL SUBGRADE SURFACES TO BE IN DIRECT CONTACT WITH FRESH CONCRETE SHALL BE THOROUGHLY MOISTENED, BUT NOT MUDDY OR FROZEN AT THE TIME THE CONCRETE IS PLACED.

8. CONCRETE SURFACE FINISH:
   ALL EXTERIOR SURFACES EXPOSED TO WEATHER - ROUGH BROOM FINISH.
   FINISH SURFACE OF SLAB SHALL BE LEVEL WITHIN 1/8" IN 10'-0".

9. ALL REBAR BENDS MUST BE MADE COLD. REBENDING OF BARS WILL NOT BE ALLOWED.

10. CHAMFER ALL EXPOSED CORNERS AND EDGES 3/4" X 45 DEGREE.

11. CONCRETE SHALL NOT BE DROPPED MORE THAN 3 FEET.

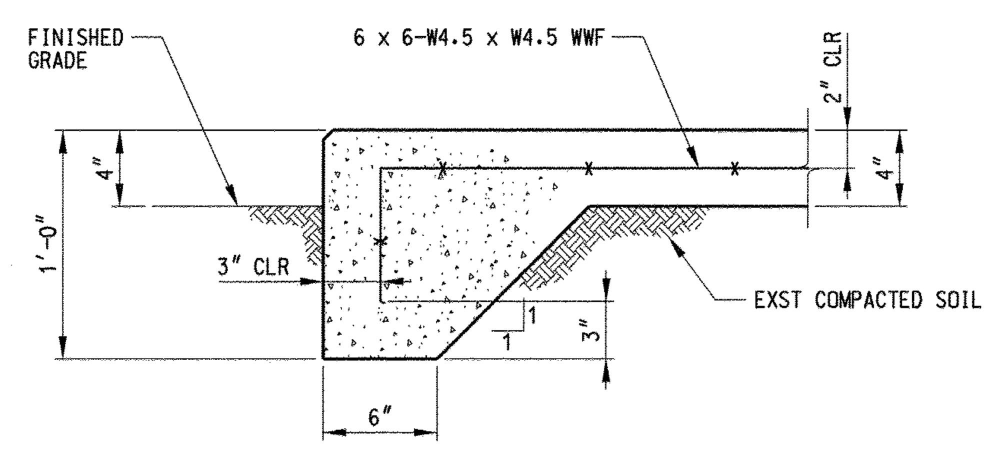
12. CONCRETE PLACEMENT AND REINFORCMENT PLACEMENT TOLERANCES SHALL BE IN ACCORDANCE WITH ACI CODE LATEST EDITION.

13. FOR ELECTRICAL GROUNDING (EMBEDMENTS IN CONCRETE) REFER TO ELECTRICAL DRAWINGS.

14. EXCAVATION SHALL BE CLEANED OF ALL LOOSE ROCK AND DEBRIS. SURFACES TO BE IN DIRECT CONTACT WITH FRESH CONCRETE SHALL BE THOROUGHLY MOISTENED BUT NOT MUDDY OR FROZEN AT THE TIME OF CONCRETE PLACEMENT. ALL OVER EXCAVATION SHALL BE FILLED WITH LEAN CONCRETE.

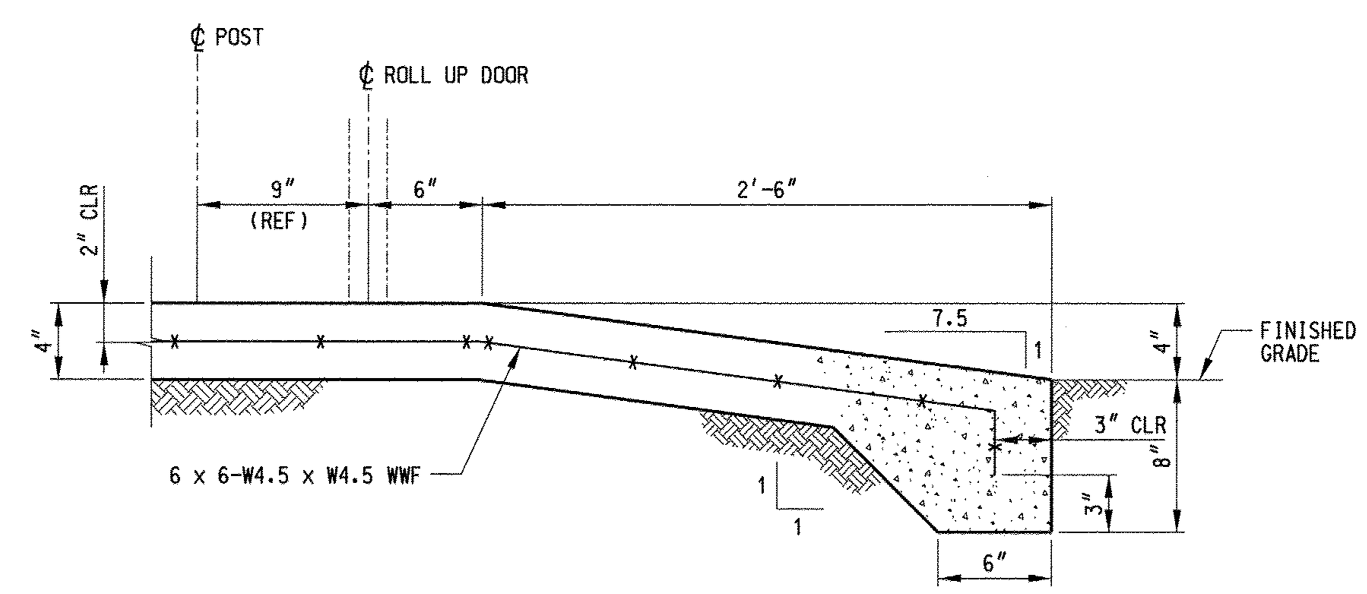
15. CONCRETE CURING SHALL BE IN ACCORDANCE WITH THE DOE/NTS STANDARD CONSTRUCTION SPECIFICATION SECTION 03001-2.06 AND 3.07.

16. TESTING OF CONCRETE SHALL BE IN ACCORDANCE WITH DOE/NV STANDARD CONSTRUCTION SPECIFICATION SECTION 03001-1.06.



SECTION (A)

SCALE : 1 1/2 " = 1'-0



SECTION (B)

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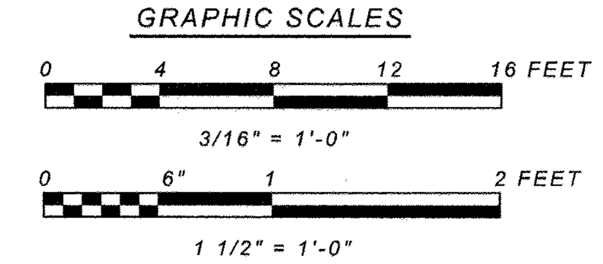
GRAPHIC SCALES



NATIONAL NUCLEAR SECURITY ADMINISTRATION NEVADA FIELD OFFICE — LAS VEGAS, NEVADA	
NEVADA NATIONAL SECURITY SITE — AREA 05A MWSU	
SIS PLAN, SECTIONS & DETAIL	
DRAWN: [signature] 4-21-15 DATE	PREPARER: [signature] 4/21/15 DATE
CHECKER: N/A DATE	PROJECT ENGINEER: [signature] 4/21/15 DATE
APPROVER / USER: N/A DATE	
National Security Technologies LLC — Vision • Service • Partnership NEVADA OPERATIONS P.O. BOX 98521 LAS VEGAS, NV 89193-8521	ENGINEERING NO. 01327 ORIGINAL SIGNATURES ON FILE
DRAWING NUMBER / WORK ORDER NUMBER: SK-01327-C-1018	REVISION 0

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REFERENCES

FOUNDATION PLAN	JS-005-32-S1
FLOOR PLAN	JS-005-32-A2

FLOOR PLAN

SCALE : 1/4" = 1'-0"

GRAPHIC SCALE

0 2 4 8 12 FEET

1/4" = 1'-0"

GS

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA FIELD OFFICE LAS VEGAS, NEVADA

NEVADA NATIONAL SECURITY SITE — AREA 05A

MWSU

VERB

BUILDING 05A-32

FLOOR PLAN

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
S. [signature] 4-21-15 DATE	[signature] 4/21/15 DATE	N/A DATE	[signature] 4/21/15 DATE	N/A DATE

National Security Technologies LLC
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NEVADA OPERATIONS
P.O. BOX 98521 LAS VEGAS, NV 89193-8521

ENGINEERING NO. 01327

ORIGINAL SIGNATURES ON FILE

DRAWING NUMBER / WORK ORDER NUMBER SK-01327-C-1014

REVISION 0

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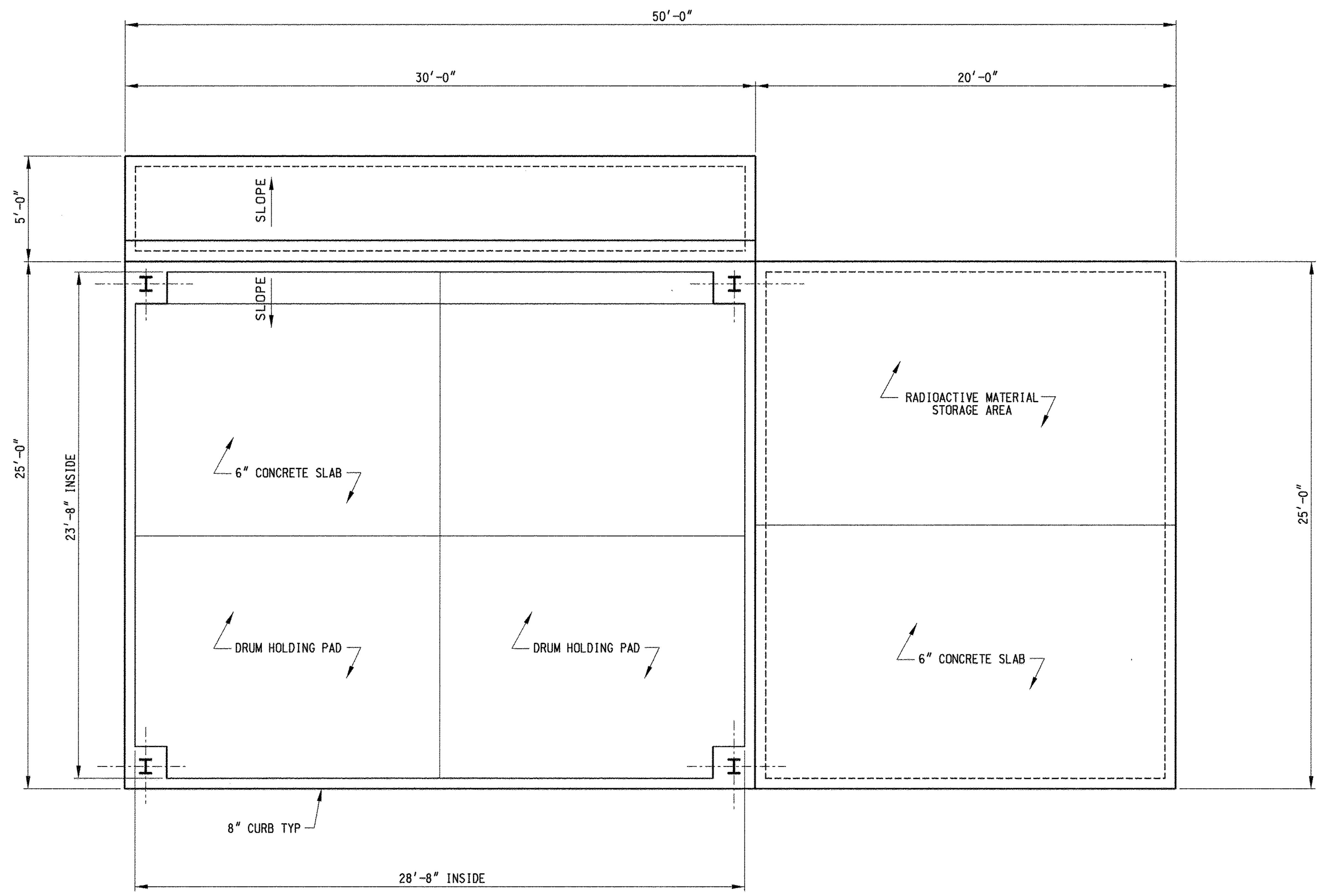

REFERENCES

HOLDING PAD FOUNDATION	JS-005-32-S2

FOUNDATION PLAN

SCALE : 1/4" = 1'-0"

GRAPHIC SCALE

0 2 4 8 12 FEET

1/4" = 1'-0"

GS

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA FIELD OFFICE — LAS VEGAS, NEVADA

NEVADA NATIONAL SECURITY SITE — AREA 05A

MWSU

DRUM HOLDING PAD (DHP)

FOUNDATION PLAN

DRAWN	DATE	PREPARER	DATE	CHECKER	DATE	PROJECT ENGINEER	DATE	APPROVER / USER	DATE
S.P.	4-21-15	J. S.	4/21/15	N/A			4/21/15	N/A	

National Security Technologies LLC — Vision • Service • Partnership

NEVADA OPERATIONS

P.O. BOX 98521 LAS VEGAS, NV 89193-8521

ENGINEERING NO. 01327

ORIGINAL SIGNATURES ON FILE

DRAWING NUMBER / WORK ORDER NUMBER: SK-01327-C-1016

REVISION 0

B.2 Chemical and Physical Analysis [40 CFR 270.14(b)(2)]

B.2.a Volume and Composition of Hazardous Waste [40 CFR 264.13(a)]

LLMW contains both radioactive and hazardous material components as defined by the *Atomic Energy Act* (AEA), RCRA, Nevada Revised Statutes (NRS), and Nevada Administrative Code (NAC). LLMW contains metals, solvents, organics, and listed constituents; or wastes from specific processes regulated by **40 CFR 261**. LLMW accepted for storage at the MWSU may carry no codes other than the EPA hazardous waste codes listed in Table 4.

State-only designated hazardous waste may be received at the NNSS as hazardous waste. LLMW and low-level waste (LLW) containing friable or non-friable asbestos may be stored in the MWSU.

DOE non-radioactive classified hazardous waste and DoD non-radioactive classified hazardous waste may also be stored at the MWSU prior to permanent disposal. PCBs that meet the requirements for disposal in a hazardous waste landfill as specified in **40 CFR 761** and **NAC 444.9452** are also accepted. LLMW accepted for storage may also contain bulk PCB remediation waste (**40 CFR 761.3**) and PCB bulk product waste (**40 CFR 761.3**).

Table 4 lists waste codes accepted for storage at the MWSU and design capacity of the unit.

Table 4. General Information – Area 5 MWSU

Process Code	S01 (Container Storage)
Waste Codes	D001 through D043
	F001 through F011, F027, and F039
	P001 through P018, P020 through P024, P026 through P031, P033, P034, P036 through P051, P054, P056 through P060, P062 through P078, P081, P082, P084, P085, P087 through P089, P092 through P099, P101 through P106, P108 through P116, P118 through P123, P127, P128, P185, P188 through P192, P194, P196 through P199, and P201 through P205
	U001 through U012, U014 through U039, U041 through U053, U055 through U064, U066 through U099, U101 through U103, U105 through U138, U140 through U174, U176 through U194, U196, U197, U200, U201, U203 through U211, U213 through U223, U225 through U228, U234 through U240, U243, U244, U246 through U249, U271, U278 through U280, U328, U353, U359, U364, U367, U372, U373, U387, U389, U394, U395, U404, and U409 through U411 Polychlorinated biphenyls (PCBs) – state hazardous waste
Process Design Capacity	18,429 m^3 (650,000 ft^3) (Estimated)

B.2.a.1. Offsite-Generated LLMW

Offsite-generated LLMW destined for the MWSU must be containerized, be fully characterized, be LDR compliant, and contain no free liquids. These wastes will not contain D001, D002, or D003 waste codes.

B.2.a.2 Onsite-Generated LLMW

Onsite-generated LLMW received for storage is not required to be fully characterized or LDR compliant, may contain free liquids, and may be RCRA-characteristic waste. LLMW received from NNSS generators includes metals, solvents, organics, compressed gases, and listed constituents; or waste from specific processes regulated by **40 CFR 261**. Onsite wastes must be containerized and compatible with the container and other waste components.

Wastes that are not LDR compliant

Non-LDR compliant onsite-generated LLMW is staged at the MWSU while treatment technology options are considered or while treatment and disposal subcontracts are developed. Approximately 80 percent of onsite-generated LLMW requires treatment by macro-encapsulation to become LDR compliant. Other onsite-generated wastes (approximately 20 percent) are destined for offsite treatment and disposal at a permitted facility. Macro-encapsulation of non-LDR compliant waste is performed at the RWMC under a treatment plan that is regulated by the NDEP BFF. Macro-encapsulated waste is disposed at the MWDU.

Wastes that contain free liquids

Non-LDR compliant onsite-generated LLMW accepted for storage at the MWSU may contain free liquids. These wastes are destined for offsite treatment and disposal at a permitted facility. These wastes are containerized and stored on spill pallets while at the MWSU. These wastes are typically related to remediation projects and could include hydraulic fluids, septic tank wastes, corrosive liquids, or solvents.

Wastes that exhibit RCRA characteristics

Onsite-generated LLMW that exhibits RCRA characteristics is accepted for storage at the MWSU. Some of these wastes are destined for offsite treatment and disposal at a permitted facility. These wastes are typically ignitable (solvents, organic liquids), corrosive liquids, or compressed gases. Lead solids are macro-encapsulated under a treatment plan at the RWMC that is regulated by the NDEP BFF. Macro-encapsulated waste is disposed at the MWDU.

B.2.b Compatibility of Waste with Containers [40 CFR 264.172]

General requirements for containers include the following:

1. Incompatible wastes or incompatible wastes and materials shall not be placed in the same container.
2. LLMW containers of 450 L (119 gal) or less must be marked with the hazardous characteristics of the waste.
3. A tamper-indicating device (TID) may be employed on packages that are inspected offsite as part of verification. The number of the TID must be recorded on the verification documentation. Some waste packaging does not allow for the application of TIDs (e.g., welded boxes).
4. Waste containers must meet the requirements of the U.S. Department of Transportation (DOT); the waste profile; and the treatment, storage, and disposal facility (TSDF).
5. Intermodal containers that are emptied and returned to the generator are prohibited.

B.3 Waste Analysis Plan [40 CFR 270.14(b)(3)]

B.3.a Offsite-Generated LLMW

The Nevada National Security Site Waste Acceptance Criteria (NNSSWAC) establishes NNSS waste acceptance requirements that generators shall meet. It includes requirements for waste certification programs, characterization, traceability, prohibited items, waste profiling, waste form, and packaging and shipment of waste. The NNSSWAC outlines the process requirements for generators to receive NNSA/NFO Assistant Manager for Environmental Management (AMEM) approval to ship LLMW to the NNSS. Applicable portions of this WAP are incorporated into the NNSSWAC. This WAP applies to LLMW accepted at the NNSS. References are made throughout this plan to EPA regulations regarding waste analysis requirements for hazardous waste management facilities. These requirements are generally found in **40 CFR 264, Subpart B**, and unless otherwise stated have been adopted by reference in the NAC.

B.3.a.1 Waste Description and Sources

Accepted wastes are generated from DOE and NNSA/NFO activities, including routine waste generation, remediation, and decontamination and decommissioning. Wastes may include contaminated soil and debris, pond sludge, personnel protective equipment (PPE), spill residue, decontamination effluent, lead debris and shielding, and other forms of contaminated media. The final treated waste forms may include incinerator ash, stabilized ash, debris, macro-encapsulated debris and lead, and soil. NNSA/NFO may also accept wastes treated by equivalent technologies, provided NDEP has approved the technologies. Acceptable hazardous waste codes are provided in Table 4.

B.3.a.2 Waste Characteristics

LLMW accepted at the NNSS contains both radioactive and hazardous material components as defined by the AEA, RCRA, NRS, and NAC (**NAC 444** and **459**). LLMW accepted at the NNSS may carry only the EPA hazardous waste numbers listed in Table 4 and must meet the NNSSWAC. Waste must also meet the LDR treatment standard requirements in **40 CFR 268.40** and **268.45**, including applicable standards for underlying hazardous constituents (UHCs). Waste meeting the alternative LDR treatment standard for contaminated soil (**40 CFR 268.49**) or equivalent treatment technologies (**40 CFR 268.42[b]**) approved by NDEP are also accepted. State-only designated hazardous waste may be received at the NNSS as hazardous waste. PCBs that meet the requirements for disposal in a permitted hazardous waste landfill as specified in **40 CFR 761** and **NAC 444.9452** are also accepted. LLMW received from generators may include waste containing metals, solvents, organics, and/or listed constituents; or waste from specific processes regulated by **40 CFR 261**.

B.3.a.3 Waste Identification Parameters [40 CFR 264.13(b)(1)]

NNSS onsite generators, DOE offsite generators, and TSDFs sending DOE waste to the NNSS are referred to as “generators.” The operating organization is required to test certain LLMW, depending on the treatment standard, to ensure that the waste or treatment residual complies with applicable LDR requirements. Testing is performed at the frequency specified in this WAP.

Characterization data are developed under **40 CFR 261**. Data may be obtained from acceptable knowledge and/or sampling and analysis. When demonstrating that the concentration-based LDR treatment standards in **40 CFR 268.40** have been met, a representative sample of the waste is taken by the generator and submitted to a laboratory accepted under Section B.3.a.12.4. When demonstrating that a treatment technology standard has been met, an LDR certification is submitted.

B.3.a.4 Waste Form and Containers

B.3.a.4.1 Prohibited Waste Forms

The following waste forms are prohibited:

1. RCRA D, F, P, K, or U waste numbers other than those listed in Table 4
2. Wastes that contain only a hazardous component, unless the waste is classified
3. Non-LDR (**40 CFR 268**) compliant waste
4. Pathogens, infectious wastes, or other etiologic agents
5. Compressed gases (Aerosol cans must be punctured and valve mechanisms removed from expended gas cylinders.)
6. Free liquids (Free liquids must be absorbed, stabilized, or otherwise removed from the waste. Containerized free liquids such as ampules and small articles that contain free liquids required for the article to function are acceptable. Provisions for additional sorbent should be made when significant temperature and atmospheric differences exist between the generating site and the disposal site.)
7. Non-biodegradable sorbents (**40 CFR 264.314[e]**)
8. PCBs not classified as bulk product waste (**40 CFR 761.62**) or remediation waste (**40 CFR 761.61**)
9. Chelating or complexing agents in amounts greater than 1 percent of the waste unless stabilized or solidified

B.3.a.4.2 LLMW Containers

Containers must meet the following requirements:

1. Incompatible wastes or incompatible wastes and materials shall not be placed in the same container if such placement results in any of the following:
    a. Generates extreme heat or pressure, fire or explosion, or violent reaction
    b. Produces uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health
    c. Produces uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosion
    d. Damages the structural integrity of the device containing the waste
2. LLMW containers of 450 L (119 gal) or less must be marked with the hazardous characteristics of the waste. Containers must be marked with all of the following:
    a. The words "HAZARDOUS WASTE – FEDERAL LAW PROHIBITS IMPROPER DISPOSAL. If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency."
    b. Generator's name and address

   c. Manifest Document Number

3. LLMW container markings must be:
   a. Durable
   b. In English
   c. Printed on or affixed to the surface of a package or on a label, tag, or sign
   d. Displayed on a background of sharply contrasting color
   e. Unobscured by other labels or attachments
   f. Located away from any marking that could substantially reduce its effectiveness.
4. LLMW packages must be at least 90 percent full (**40 CFR 264.315[a]**).
5. A TID may be employed on packages that are inspected offsite as part of verification. The number of the TID must be recorded on the verification documentation. Some waste packaging does not allow for the application of TIDs (e.g., welded boxes).
6. Intermodal containers that are emptied and returned to the generator are prohibited.

B.3.a.5 LDR Notification and Certification

40 CFR 268.7(a) requires each generator to evaluate waste to determine if it is restricted from land disposal. As applicable, wastes containing specific hazardous characteristics must be evaluated for UHCs reasonably expected to be in the waste. LLMW destined for disposal at the MWDU must meet LDR requirements prior to shipment to the NNSS. LDR notification and certification forms must be submitted per **40 CFR 268.7**. The information on the notification (i.e., manifest number, EPA waste code[s], waste constituents to be monitored, category of waste, and waste analysis data) is compared with accompanying shipment documentation. If a certification statement is missing or unsigned and the discrepancy cannot be resolved, the waste shipment is not accepted and will be returned to a generator-specified facility.

Generators are required to perform hazardous waste determinations including evaluating LDR treatment standard requirements on their waste streams. Generators are required to test the waste to ensure compliance with applicable concentration-based treatment standards. On the waste profile, generators identify the applicable treatment standard, and whether the waste meets the standards as generated, is excluded, or requires treatment before disposal.

When shipping waste to the NNSS, generators are required to submit all information, notifications, and certifications described in **40 CFR 268.7** to the operating organization. If the waste information changes, the generator must submit a new notification and certification.

B.3.a.6 Waste Profile and Data Quality Assurance Process

Characterization data must be sufficient to verify compliance with the NNSSWAC, ensure safe management, identify UHCs, and verify that the waste meets LDR treatment standards prior to disposal. The waste profile shall provide a clear picture of the radiological, physical, and chemical characteristics; regulatory classification; and packaging. Generator-supplied data are the primary means by which NNSA/NFO demonstrates compliance with **40 CFR 264.13(a)** and **264.13(b)(5)** for obtaining detailed chemical, physical, and radiological analysis. Generators shall determine the appropriate analysis (total vs. Toxicity Characterization Leaching Procedure [TCLP]) to use when performing hazardous waste determinations and identifying UHCs. Waste characterization data must be based on samples collected using methods specified in EPA SW-846 or other equivalent methods.

B.3.a.6.1 General Waste Profile Requirements

Waste profiles are submitted to NNSA/NFO for review and approval.

Changes to approved waste streams may be submitted at any time. Depending on the significance of the change, the approval to ship may be temporarily suspended until the changes are reviewed and approved.

Waste profiles shall have annual expiration dates if not recertified by the generator.

Generators shall notify NNSA/NFO in writing when terminating an approved waste profile.

B.3.a.6.2 Specific Waste Profile Requirements

The following information shall be included:

1. EPA waste codes
2. Applicable State waste codes
3. Sorbent(s) used and certification of the use of non-biodegradable sorbents
4. Chemical, physical, radiological, and general characteristics and properties
5. Compliance with NNSSWAC item-prohibitions
6. Container type, size, weight, dose rate, and approximate number
7. Demonstration of compliance with LDR standards including compliance with Universal Treatment Standards, if applicable
8. Supplemental attachments consisting of container drawings, process flow information, analytical data, etc., if necessary
9. Visual inspection forms, analytical results or log books, and/or procedures or treatability test results, as necessary

B.3.a.7 Pre-Acceptance Approval Process

The NNSSWAC establishes the requirements generators shall meet to dispose of waste at the NNSS. It includes requirements for waste certification programs, characterization, traceability, prohibited items, waste profiling, waste form, and packaging and shipment of waste. The NNSSWAC outlines the process requirements for generators to receive NNSA/NFO AMEM approval to ship LLW and LLMW to the NNSS. Applicable portions of this WAP are incorporated into the NNSSWAC. Approval flow diagrams are provided in Exhibit 2.

The NNSSWAC establishes a facility evaluation system (audit and surveillance) to approve the generator’s shipment of waste to the NNSS. These evaluations, conducted by the operating organization, include rigorous attention to the characterization, certification, and quality assurance (QA) programs at the generator site. The evaluations are conducted in accordance with written procedures and checklists.

During the evaluation of the generator's waste management program, Corrective Action Requests (CARs) may be issued for quality-affecting problems. These CARs must be answered by a Corrective Action Plan (CAP) identifying the root cause, corrective actions, and actions to preclude re-occurrence. The generator is not approved until all CARs are closed.

Once the NNSA/NFO AMEM approves the generator, waste profiles are accepted for review. The NNSA/NFO AMEM can suspend approvals at any time, based on programmatic or waste stream deficiencies.

B.3.a.7.1 Generator Approval Process

Once a generator is approved for shipping waste to the NNSS, a waste stream approval process is initiated. This process includes submitting a notification and/or waste profile, reviewing the waste profile, and determining the physical screening type and frequency. The generator's program and waste profile are reevaluated at the specified frequency. If the waste analysis data are sufficient and the waste stream meets the NNSSWAC, the waste profile is approved. The approved waste is then scheduled for receipt at the NNSS.

The operating organization obtains detailed chemical and physical analysis of LLMW from generators requesting disposal in the MWDU. Before waste can be disposed, generators must perform a hazardous waste determination as required by their State regulations, **40 CFR 262.11**, and **40 CFR 268.7**. The characterization data are used to complete a waste profile for each waste stream.

A notification form (Exhibit 3) is submitted for waste that has not yet been treated. By requiring generators to submit the notification, coordination of remote sampling and offsite visual verification is more readily accomplished. A waste profile form is submitted for post-treatment final waste forms. For waste already treated, the generator submits the waste profile. The notification and/or waste profile is submitted to NNSA/NFO for review and approval.

In general, LLMW received from onsite generators is managed the same as waste received from offsite generators. Differences include, but are not limited to, physical and chemical screening and shipping documentation (Uniform Hazardous Waste Manifests for waste from offsite generators, and onsite waste manifest forms for waste from onsite generators).

Generators shall provide, as necessary, sampling and analysis data that are of a known precision and accuracy to identify the physical and chemical properties of the waste.

B.3.a.7.2 Notification Review

If treatment is required but has yet to occur, the operating organization reviews the notification form, determines the physical screening frequency (Section B.3.a.7.4), and schedules offsite verification activities with the generator. Exhibit 3 includes an example notification review form.

B.3.a.7.3 Waste Profile Review

The operating organization reviews the initial generator-supplied waste analysis for waste profile approval in accordance with **40 CFR 264.13(b)(4)**. The operating organization reviews the waste profile information including general waste stream information, chemical and physical characterization, treatment, and packaging information to verify that waste streams are defined adequately. This demonstrates that the waste meets the NNSSWAC and complies with appropriate LDR treatment standards. If discrepancies are found or inadequate characterization data have been provided, the operating organization requests additional information from the generators. Resolutions could include providing processing or treatment procedures, drawings, process flow information, or supplemental analytical data. Results from the review are documented in the operating record (Exhibit 4 includes an example Waste Stream Recommendation Form).

The operating organization evaluates sampling and analysis documentation to ensure that: (1) samples are representative of the waste stream, (2) appropriate analytical procedures are used, and (3) sufficient quality controls are established to allow measurement and documentation of data quality. The initial physical screening frequency is determined.

Generators that submit a notification form include verification activity documentation with the waste profile. This information is reviewed for final approval of the waste profile. After approval, generators can schedule waste shipments.

B.3.a.7.4 Analytical Frequency [40 CFR 264.13(b)(4)]

The screening frequency is determined by the operating organization with the following process:

1. The generator waste profile is reviewed to determine the relative potential for mischaracterization or inappropriate segregation based on all relevant information, including any previous experience with the generator. Based on this review, the operating organization identifies any concerns associated with the following criteria:
    a. Documented waste management program
    b. Waste stream characterization information
    c. Potential for inappropriate segregation
    d. Waste type and packaging
2. The physical screening frequency is established for the waste stream.
3. The physical screening minimum is 5 percent of the waste stream.

B.3.a.7.5 Screening Options

The following screening options are available:

1. Offsite (at generator or treatment facility) visual inspection
2. Offsite chemical screening
3. Offsite or onsite review of photographs, videos, real-time radiography (RTR) images, and/or RTR recordings of treatment
4. Onsite RTR
5. Onsite visual inspection of container exterior (100 percent)

B.3.a.8 Physical and Chemical Screening

Verification activities are performed as required by **40 CFR 264.13[c]**. Activities include container receipt inspection and could also include physical and/or chemical screening. Containers can be inspected visually, verified by RTR, or sampled for field or laboratory analysis to confirm that the waste matches the waste profile and container data information supplied by the generator. Discrepancies between the verification results and the waste profile must be resolved before acceptance at the MWDU.

Screening methods have sufficient performance levels to yield valid decisions when considering method variability (precision and accuracy). When screening is performed at a location not within the RWMC, TIDs may be applied to each container examined and, on receipt, verified as acceptable to ensure that no changes could have occurred to the packaging or waste content. Written procedures are maintained that detail the requirements for applying TIDs. Some waste packaging does not allow for the application of TIDs (e.g., welded boxes). The following elements are used to verify and provide sufficient data to ensure that waste received is correctly described in the shipping documentation.

B.3.a.8.1 Physical Screening

This section describes the methods, frequency, and exceptions for physical screening verification. Physical screening can be performed before the waste is shipped to the NNSS.

B.3.a.8.1.1 Physical Screening Frequency

The minimum physical screening frequency is 5 percent. The operating organization adjusts the visual and RTR inspection levels for generators based on objective performance criteria.

B.3.a.8.1.2 Physical Screening Exceptions

Waste that cannot be physically screened at the RWMC may be visually inspected at the generator location (e.g., classified LLMW, large components, remote-handled containers that cannot be opened or will not fit in RTR).

Waste that was treated prior to issuance of the Permit is considered previously treated waste. The operating organization will evaluate the generator's approved Waste Certification Program, the waste profile including the LDR Certification Statement, treatment and packaging procedures, package inventories, acceptable knowledge information, and historical analytical data for acceptability.

B.3.a.8.1.3 Physical Screening Methods

The following physical screening methods comply with the requirement to verify waste (**40 CFR 264.13[c]**):

1. Visual inspection
2. RTR

B.3.a.8.1.4 Physical Screening Quality Control (QC)

Physical screening QC ensures that quality data are obtained when performing RTR. Visual inspection does not use instrumentation or chemical tests. The operating organization RTR procedures and training requirements identify necessary QC elements.

B.3.a.8.1.5 Physical Screening Parameters

The following methods are approved for use.

Visual Inspection

Rationale: Because the NNSS does not have a container-opening facility, a visual verification of the waste will be accomplished at the generator or treatment facility. This method meets the requirement to ensure consistency among the waste containers and the waste profile.

Method: The container is opened, and the contents are inspected by direct visual observation or review of the images of the treatment process and package. Homogenous loose solids are probed. If the waste is being treated, direct visual observation of the treatment and container-filling process is performed. Visual observations are compared with the applicable waste profile and container-specific information. Visual observations may include review of available RTR tapes, videotapes, photographs, and digital images of the treatment and packaging process to ensure compliance.

Failure Criteria: A container fails inspection for any of the following: (1) undocumented or improperly packaged waste, (2) discovery of prohibited articles or materials, (3) discovery of material not consistent with the applicable waste profile (i.e., waste form), or (4) void space greater than 10 percent.

RTR

Rationale: This method meets the requirement to ensure the absence of prohibited items and consistency among waste containers, the waste profile, and the shipment documentation. Containers that are not amenable to visual inspection because of physical or radiological content can be examined safely and economically.

Method: The container is scanned with an RTR system. Images are observed on a video monitor and/or captured on videotape. Personnel trained in the interpretation of RTR imagery record their observations. These observations are compared to the contents listed on the waste profile and accompanying shipment documentation.

Failure Criteria: A container fails inspection for any of the following: (1) undocumented or improperly packaged waste, (2) discovery of prohibited articles or materials, (3) image data inconsistent with the waste profile or shipment documentation, or (4) void space greater than 10 percent.

B.3.a.8.2 Chemical Screening

Chemical screening is performed before the waste is shipped to the NNSS. The operating organization determines which screening parameters are appropriate for the waste stream. Interpretation of the appropriate chemical screening method(s) are conducted and performed by trained personnel. Unless otherwise noted, chemical screening tests are qualitative, not quantitative. The objective of chemical screening is to obtain reasonable assurance that the waste received is consistent with the description of the waste on the waste profile and to ensure that the waste is safely managed.

B.3.a.8.2.1 Chemical Screening Frequency

At a minimum, 10 percent of the waste containers amenable to chemical screening and verified by visual inspection will be chemically screened.

B.3.a.8.2.2 Chemical Screening Exceptions

The following are cases in which chemical screening is not required:

1. Waste subject to a technology-based treatment standard
2. Chemical-containing equipment removed from service (e.g., ballasts, batteries)
3. Waste containing regulated asbestos
4. Waste containing beryllium
5. Waste, environmental media, and/or debris from the cleanup of spills or release of a single substance, commercial product, or otherwise known material (e.g., material for which a Safety Data Sheet [SDS] can be provided)
6. Confirmed noninfectious waste (e.g., xylene, acetone, ethyl alcohol, isopropyl alcohol) generated from laboratory tissue preparation, slide staining, or fixing processes
7. Hazardous debris
8. Package greater than 100 millirems per hour at 30 cm

B.3.a.8.2.3 Chemical Screening Sampling

Chemical screening methods do not require sample preservation methods because the screening tests are performed at the time and location of sampling or as soon as possible thereafter. When a delay is required, the samples are stored in a manner that maintains chain-of-custody controls and protects the sample composition. The equipment requirements in Table 5 may apply to sampling for chemical screening.

Individual containers are selected based on a review of the contents described in the associated documentation. If the containers and their contents are similar, containers are selected randomly for screening. If there are substantial differences among the containers or their contents, the containers are selected by stratified sampling with the strata being the types of containers and or contents presented.

B.3.a.8.2.4 Chemical Screening QC

The following QC elements are used when performing chemical screening:

1. Containers and equipment of the appropriate size, given the analytical method, and that are chemically compatible with the waste and testing reagents
2. Chemicals and test kits that are labeled so that they are traceable
3. QC checks performed on each test kit and associated replacements at the frequency specified in operating procedures

B.3.a.8.2.5 Chemical Screening Parameters

The following methods are approved for use.

pH Screening

Rationale: This method identifies the pH and corrosive nature of waste and confirms consistency with the shipment documentation.

Method: Full-range pH paper is used for the initial screening. If the initial screening indicates a pH below 4 or above 10, a pH meter or a narrow-range pH paper can be used. Solids are mixed with an equal weight of water, and the liquid portion of the solution is tested.

Failure Criteria: If the pH of a matrix exceeds regulatory limits (less than or equal to 2.0 or greater than or equal to 12.5), the container fails verification.

Peroxide Screening

Rationale: This method determines the presence of organic peroxides in solvent waste, alerts personnel to potential hazards, and confirms consistency with the shipment documentation. The test is sensitive to low parts per million (ppm).

Method: Solids are tested by wetting the test strip with water and contacting a small sample of the waste. A color change indicates a positive reaction. The color change is compared with a chart on the packaging to determine an approximate organic peroxide concentration.

Failure Criteria: Peroxide concentrations greater than 20 ppm in liquid waste constituents that are known organic peroxide formers and are not documented as having been stabilized constitute failure.

Paint Filter Test

Rationale: This method verifies the presence or absence of free liquid in solid or semisolid material.

Method: Using a standard paint filter, 100 cubic centimeters or 100 grams of waste are added and allowed to settle for 5 minutes. Any liquid passing through the filter signifies failure of the test. EPA SW-846 requires Method 9095 for the paint filter test.

Failure Criteria: Failure of the test constitutes failure of the container. Small quantities of condensate trapped in inner plastic liner folds are acceptable.

Oxidizer Screening

Rationale: This method determines if a waste exhibits oxidizing properties and confirms consistency with the shipment documentation.

Method: Acidified potassium iodide test paper is used to measure the oxidizing properties of waste in accordance with written procedures or the manufacturer's suggested method.

Failure Criteria: A positive oxidizing indication in a waste that is not consistent with documented constituents fails verification.

Water Reactivity Screening

Rationale: This method determines if the waste has the potential to vigorously react with water or to form gases or other reaction products. This information is used to confirm consistency with the shipment documentation.

Method: Water reactivity screening is performed in accordance with written procedures or the manufacturer's suggested method.

Failure Criteria: A positive reactivity indication in a waste that is not consistent with documented properties fails verification.

Cyanide Screening

Rationale: This method indicates if waste releases hydrogen cyanide upon acidification near pH 2. This information is used to confirm consistency with the shipment documentation.

Method: A cyanide screening is performed in accordance with written procedures or the manufacturer's suggested method.

Failure Criteria: A positive cyanide indication in a waste that is not consistent with documented constituents fails verification.

Sulfide Screening

Rationale: This method indicates if the waste could release hydrogen sulfide upon acidification near pH 2. This information is used to confirm consistency with the shipment documentation.

Method: A sulfide screening is performed in accordance with written procedures or the manufacturer's suggested method.

Failure Criteria: A positive indication in a waste that is not consistent with documented constituents fails verification.

B.3.a.9 Pre-Shipment Authorization Process for Approved Wastes

For each shipment that is a candidate for disposal, the generator provides the following information:

1. Container identification number
2. Profile number
3. Waste description
4. Generator information (e.g., name, address, point of contact, telephone number)
5. Container information (e.g., type, size, weight)
6. EPA waste code(s)
7. Waste composition
8. Packaging materials and quantities
9. Applicable treatment standard/technology

Where potential nonconformance issues exist in the information provided (i.e., waste characteristics do not match the waste profile information, waste does not meet the NNSSWAC, or additional constituents are expected to be present that do not appear in the documentation), the generator is contacted and the issue is addressed. Container data are compared to waste profile data to ensure that the waste to be shipped is as described on the profile. Screening provides a means to minimize the potential for acceptance of incorrectly identified waste.

B.3.a.9.1 Paperwork Review

Every shipment is reviewed to ensure that the waste meets the NNSSWAC. If the shipment information is verified to be acceptable, the operating organization determines if any of the waste containers requires RTR verification.

B.3.a.9.2 Visual Inspection and Chemical Screening Documentation Review

For waste streams that underwent verification at the generator site or offsite TSDF, the verification documentation is reviewed for completeness.

B.3.a.9.3 RTR Container Selection

A list of waste packages with discrete identification numbers is required for a random selection of containers to undergo RTR verification. The operating organization follows procedures to select containers for RTR verification.

B.3.a.10 Waste Acceptance and Verification Procedures upon Arrival of Shipment

Waste containers undergo verification upon arrival at the NNSS. The following section provides a description of verification methods available at the NNSS. When a nonconformance issue exists, a determination is made regarding the acceptability of the container, and appropriate action is taken based on the severity of the issue.

B.3.a.10.1 RWMC Paperwork Review

Rationale: Each shipment's paperwork is reviewed for completeness.

Method: The shipment is documented on a shipping/receiver log upon arrival at the RWMC. Operations personnel perform a completeness review of the generator's required shipping paperwork, which may include a bill of lading, uniform hazardous waste manifest or equivalent state-of-generation manifest, LDR form, original package storage and disposal request, and original waste certification statement. Paperwork review and inspection requirements are documented on a shipment checklist.

Failure Criteria: A shipment fails inspection if there is (1) missing paperwork, (2) a discrepancy in the number of containers in the shipment, and/or (3) incorrect paperwork.

B.3.a.10.2 RWMC Visual Examination

Rationale: Each container in the shipment is inspected in its entirety for damage, content leakage, complete marking and labeling, and intact TIDs as required. This is to ensure that the shipment (1) is received in good condition, (2) has the container(s) corresponding to the shipping papers, (3) has not been opened after physical screening is performed, and (4) is complete.

Method: When a container is off-loaded, markings and labels are inspected and compared with associated manifests. Container inspections are individually recorded on a waste package checklist. These checklists, along with the shipment checklist, are recorded and filed with the shipping paperwork

Failure Criteria: A container fails inspection if (1) there is evidence of leaking or breaching of the container, (2) the container number is incorrect, (3) there is incorrect marking or labeling, (4) marking or labeling is missing, (5) the TID is broken or missing, and/or (6) there is a discrepancy in the TID number.

B.3.a.10.3 RWMC RTR Examination

See Section B.3.a.8.1.5 for the rationale, method, and failure criteria for RTR.

B.3.a.11 Manifest Tracking and Recordkeeping

The generator contacts the operating organization prior to shipment of waste to arrange for waste verification and shipment. The generator is responsible for the identification and tracking of the waste shipment. Upon receipt of waste, each shipment is screened according to the above sections. Once a shipment is accepted, the following actions are performed:

1. Each copy of the manifest is signed and dated to certify that the LLMW covered by the manifest was received.
2. Any significant discrepancies are noted on each copy of the manifest.
3. One signed copy of the manifest is given to the transporter.
4. Within 30 days of delivery, a copy of the manifest is sent to the generator.
5. The manifest is retained at the facility for at least 3 years from date of delivery.

The following data are maintained in the RWMC operating record in accordance with the records inventory and disposition schedule:

1. Waste profile and supporting documentation
2. Shipping documentation
3. QA/QC data
4. Documentation from sampling events

Errors and omissions (e.g., transcription errors, typographical errors, errors in calculations) are corrected as information becomes available. These corrections are made in ink and initialed and dated by the person making the correction.

B.3.a.12 Sampling and Analysis

LLMW is sampled and analyzed by the test methods specified in “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods” (EPA SW-846) or approved equivalent methods. Analysis is performed by an accepted laboratory as discussed in Section B.3.a.12.4. The recommended sampling devices, EPA methods, parameters, and rationale for parameter selection for characterization and LDR requirements are identified in Tables 5 and 6.

Table 5. Sampling Devices

Material	Equipment
Liquid	Coliwasa, Dipper, or Weighted Bottle
Soil and Soil-Like Material	Thief, Trier, Scoop, Shovel, Auger, or Veihmeyer Soil Sampler

Table 6. EPA Methods, Parameters, and Rationale for Parameter Selection

EPA Method[1]	Parameter	Rationale for Parameter Selection
9040, 9041, or 9045	pH	Assign hazardous waste number and identify prohibited waste
ASTM D 93-79, D 93-80, D 3278-78, or 1030	Ignitability	Assign hazardous waste number and identify prohibited waste
9014, 9034	Reactivity	Assign hazardous waste number and identify prohibited waste
9095	Free liquids	Assign hazardous waste number and identify prohibited waste
1311[2]	TCLP	Assign hazardous waste number and verify compliance with LDR treatment standards
2540C	Total Suspended Solids	Determine whether LDR wastewater or non-wastewater treatment standards apply
6010, 6020, or 7000 series	TCLP metals	Assign hazardous waste number and verify compliance with LDR treatment standards
8000 series	Volatiles	Assign hazardous waste number and verify compliance with LDR treatment standards
8000 series	Semivolatiles	Assign hazardous waste number and verify compliance with LDR treatment standards
8000 series	Halogenated organic compounds (HOCs)[3]	Verify applicability of LDR requirements of soil
8082	PCBs	Identify prohibited items and meet *Toxic Substances Control Act* requirements

[1] Referenced methods are from Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846 unless otherwise noted. More current SW-846 methods may be substituted for any method.

[2] An alternative to Method 1311 is to perform total contaminant concentration analysis and assume all contaminants to be leachable using the TCLP method. For purposes of this requirement, the total results based on a dry weight basis shall be divided by a conversion factor of 20 to determine whether a TCLP limit has the possibility of being exceeded.

[3] As specified in 40 CFR 268.2(a) and 40 CFR 268, Appendix III.

For wastes with a treatment standard expressed as constituent concentrations, compliance with LDRs (**40 CFR 268.40**) can be shown by any appropriate method. If the treatment standard is expressed as constituent concentrations in waste extracts, TCLP analysis is required.

For parameters or methods not otherwise specified, the following are acceptable sources of testing methods (standard methods):

1. The most recently promulgated version of EPA SW-846
2. Other current EPA methods, as applicable to the matrix under evaluation
3. Standard Methods for the Examination of Water and Wastewater, American Public Health Association, American Water Works Association, and Water Environment Federation
4. Annual Book of American Society for Testing and Materials (ASTM) Standards
5. International Association of Official Analytical Chemists Methods of Analysis

Specific sampling procedures and techniques depend on both the nature of the waste and type of packaging. Waste samples are treated and preserved as necessary to protect the sample. Recommended treatment, preservation techniques, and holding times are stated in SW-846.

B.3.a.12.1 Sampling Equipment and Preservation

Table 5 lists waste forms and sample equipment used to sample referenced waste. Sample preservation follows EPA SW-846 protocol.

B.3.a.12.2 Sampling Methods

The appropriate personnel are responsible for arranging sampling and laboratory support. Samples are processed at laboratories qualified to perform analysis of waste samples (Section B.3.a.12.4). The operating organization determines proper sampling protocol (e.g., simple random, stratified simple random) for grab sample(s) based on the waste type and form. Table 6 lists the EPA methods, parameters, and the rationale for parameter selection.

Sampling typically includes the following:

1. Obtain a unique sample identification number and complete the sample tag before sampling.
2. Obtain a pre-cleaned sampling device and sample bottles.
3. For two-phase liquid waste, use a Coliwasa sampler or pipette; pour homogeneous liquids in small containers into a sample bottle.
4. For solid waste, use a scoop, trier, or hand auger to obtain a sample of the waste; for large containers of waste, composite several augers or scoops to ensure samples are representative.
5. Wipe the exterior surfaces of the sample bottles clean.
6. Attach sample label to sample bottles.
7. Complete the chain-of-custody forms.
8. Place samples in an appropriate receptacle for transfer to the laboratory; if appropriate, include equipment for temperature-sensitive samples to preserve the integrity of the sample as required by EPA methods.
9. Seal and mark the receptacle.
10. Transfer receptacle to the analytical laboratory to meet sample holding times.
11. Properly clean and decontaminate non-disposable sampling equipment or package for return to central sampling equipment decontamination area according to requirements.

B.3.a.12.3 Establishing QA and QC Procedures for Sampling

The operating organization maintains compliance with DOE O 414.1C, “Quality Assurance.” Sampling personnel prepare a permanent log of sampling activities. A log of sampling activities is kept in accordance with EPA SW-846, Chapter 9. Log entries include, as appropriate, date of collection, time of collection, location, batch number, sample number, tank number, chain-of-custody information, sampling method, container description, waste matrix, description of generating process, number and volume of samples, field observations, field measurements (e.g., percent lower explosive limit), laboratory destination, and signature. Log entries are made while sampling is performed. Logs or copies of logs are maintained by appropriate personnel after completion of sampling activities. A chain of custody accompanies samples at all times.

Compliance with applicable industrial hygiene and safety standards is mandatory during sampling activities. Transportation of samples is performed in accordance with applicable DOT requirements.

The following QA/QC elements are used to ensure that sampling activities result in acceptable laboratory data:

1. Sampling methods as defined by EPA SW-846, Chapter 9
2. Appropriate sample containers and equipment for specific waste streams
3. Samples numbered and labeled
4. Traceable labeling system
5. Field QA/QC samples
6. Equipment calibration
7. Chain of custody

B.3.a.12.4 Laboratories and Treatment Facilities

The U.S. Department of Energy Consolidated Accreditation Program (DOECAP) provides audits of commercial LLMW TSDFs and analytical laboratories. TSDFs and laboratories used by generators shall have a current DOECAP or equivalent audit.

DOECAP incorporates a national standard (statement of work/contracts) and reporting requirements consistent with user needs and regulatory requirements (International Standards Organization 17025 basis). Treatment facilities and laboratories providing support to DOE are required to be audited by DOECAP. DOECAP is a complex-wide consolidated audit program that uses a multi-checklist audit process. The checklists address the following areas:

1. Industrial and chemical safety
2. Environmental compliance/permitting
3. QA management systems
4. Radiological control
5. Transportation management
6. Sampling and analytical data quality
7. Waste operations

Each facility is audited annually to evaluate the effective implementation of the QA/QC program. QA and technical experts evaluate the facility through onsite observations and/or reviews of QA/QC documents, surveillances/inspections, audits, nonconformance issues, and corrective actions.

B.3.a.12.5 Evaluation of Analytical Results

Acquired data need to be scientifically sound, of known quality, and thoroughly documented. The operating organization is responsible to ensure that data assessment or evaluation is completed. Data are assessed to determine compliance with the following:

Precision – Precision is the agreement between collected samples (duplicates) for the same parameters, at the same location, and subjected to the same preparative and analytical techniques. Analytical precision is the agreement between individual portions taken from the same sample, for the same parameters, and subjected to the same preparative and analytical techniques.

Accuracy – Accuracy of the measurement system is evaluated by use of various kinds of QA samples, including, but not limited to, certified standards, in-house standards, and performance evaluation samples.

Representativeness – Representativeness addresses the degree to which data accurately and precisely represent a real characterization of the waste stream, parameter variation at a sampling point, sampling conditions, and the environmental condition at the time of sampling.

Completeness – Completeness is the amount of usable data obtained from a measurement system compared to the total amount of data requested.

Comparability – Comparability is the confidence with which one data set can be compared to another. This usually is accomplished by using the same methods for each data set.

If the data are found to be insufficient, the operating organization may require re-analysis, data validation, and/or re-sampling.

B.3.a.13 Acceptable Knowledge

Acceptable knowledge is a characterization technique that relies on the generator's knowledge of the physical and chemical properties of the materials and the waste generation processes. It includes knowledge of the fate of those materials during and subsequent to the process and the associated administrative controls. When collecting documentation on a waste stream, the operating organization must determine if the information provided by the generator is acceptable knowledge. Acceptable knowledge requirements are met using any one or combination of the following types of information:

1. Mass balance from a controlled process that has a specified input and output
2. SDS of chemical products
3. Test data from a surrogate sample
4. Analytical data on the waste or a waste from a similar process

In addition, acceptable knowledge requirements can be met using a combination of analytical data or screening results and one or more of the following:

1. Interview information
2. Logbooks
3. Procurement records

4. Qualified analytical data
5. Radiation work packages
6. Procedures and/or methods
7. Process flow charts
8. Inventory sheets
9. Vendor information
10. Mass balance from an uncontrolled process (e.g., spill cleanup)
11. Mass balance from a process with variable inputs and outputs (e.g., washing/cleaning methods)

Acceptable knowledge may be used for determining:

1. Hazardous waste constituents
2. Wastes that are listed under **40 CFR 261.31, 261.32,** and **261.33**
3. UHCs
4. Necessary confirmatory sampling
5. LDR compliance with technology-based standards

If the information is sufficient to quantify the constituents of regulatory concern and to determine waste characteristics as required by regulations and the NNSSWAC, the information is considered acceptable knowledge. If the information is not sufficient, sampling may be required. Waste must conform to requirements found in this WAP, the EPA codes found in Table 4, and the NNSSWAC.

B.3.a.14 Issue Resolution

Nonconformance issues identified during verification could result in a waste container that does not meet the NNSSWAC. If a possible nonconformance issue is identified, the following actions are taken to resolve the issue:

1. The operating organization compiles all information concerning the possible nonconformance issue(s).
2. The generator is notified and requested to supply additional information that could assist in the resolution of the concern(s). If the generator supplies information that resolves the concern(s), no further action is required.
3. The operating organization and the generator discuss the nonconformance issue(s) and identify the appropriate course of action to resolve the container/shipment in question.
4. The operating organization has the following options (more than one may be used): (1) suspend the waste stream, (2) suspend the generator’s entire waste shipping program, (3) issue a CAR, (4) have the generator issue an internal nonconformance, (5) increase physical screening frequencies, (6) ensure issue is included during the next scheduled generator facility evaluation, (7) schedule a facility evaluation, and (8) return waste container and/or shipment to a generator-specified facility.

5. Upon issuance of a CAR, the operating organization requests the generator to provide a CAP that clearly states the reason for the failure and describes the actions to be completed to prevent reoccurrence.
6. The operating organization reviews the CAP for adequacy.
7. Issues and their corresponding resolutions are recorded and tracked by the operating organization.
8. On resolution of the initial nonconformance issue, the operating organization requests that the generator provide a CAP that clearly states the reason for the failure and describes the actions to be completed to prevent reoccurrence.
9. The generator may request a reduction in verification of unaffected waste streams. This request must be accompanied by a justification that identifies why the waste stream(s) would not exhibit the same nonconformance issue.
10. The operating organization reviews the CAP and waste stream justification for adequacy. If the waste stream justification is accepted, the operating organization adjusts the frequency.

B.3.a.15 Reducing the Physical Screening Frequency

Physical screening percentages may be reduced based on the waste stream compliance with the waste profile, shipping documentation, and verification results. At no time will the frequency be reduced below 5 percent.

B.3.a.16 Frequency of Analysis

B.3.a.16.1 Facility Evaluations

Generators are evaluated according to the NNSSWAC. CARs may be issued for quality-affecting problems. CARs must be answered by a CAP identifying the root causes, corrective actions, and actions to preclude reoccurrence. Dependent upon the severity of the problem(s), NNSA/NFO may:

1. Allow continued shipment of all approved waste streams.
2. Suspend one or more waste streams from shipments.
3. Suspend the entire waste shipment program.

B.3.a.16.2 Waste Profiles

Generators perform an initial characterization or identification analysis prior to submitting a waste profile. The following are examples of when an analysis may be repeated:

1. If requested by the operating organization due to insufficient data
2. After 1 year (365 days) from waste profile approval (see Exhibit 5)
3. If the generating process has changed
4. Upon submission of a waste profile revision regarding characterization changes (if revision is submitted within 1 year of previous evaluation)
5. If inspection or analysis indicates the waste received does not match the waste profile and/or shipment documentation

If the generator has informed the operating organization of a change in the waste generation process or if the waste may not conform to the waste profile, the waste must be re-profiled and re-reviewed.

When a waste profile is re-evaluated, the operating organization could request the generator to do one or more of the following:

1. Verify that the current waste profile is accurate
2. Supply a new waste profile
3. Submit a sample for analysis
4. Cancel the waste profile

EXHIBIT 2. Approval Flow Diagrams

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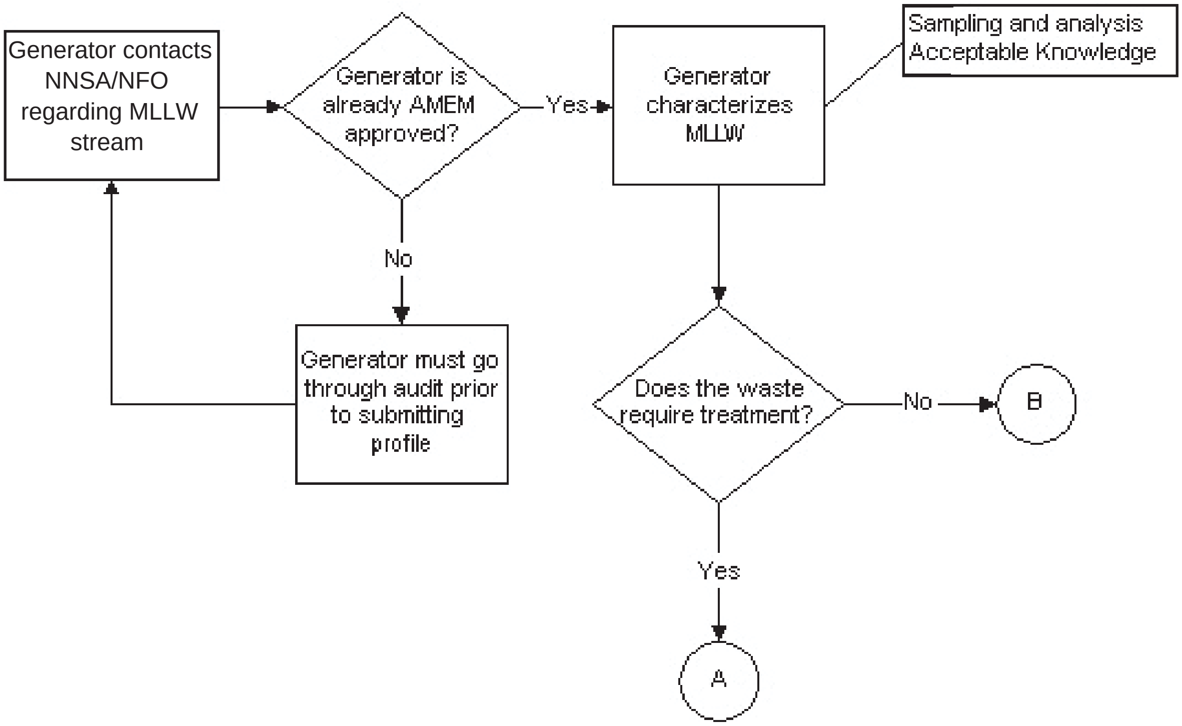
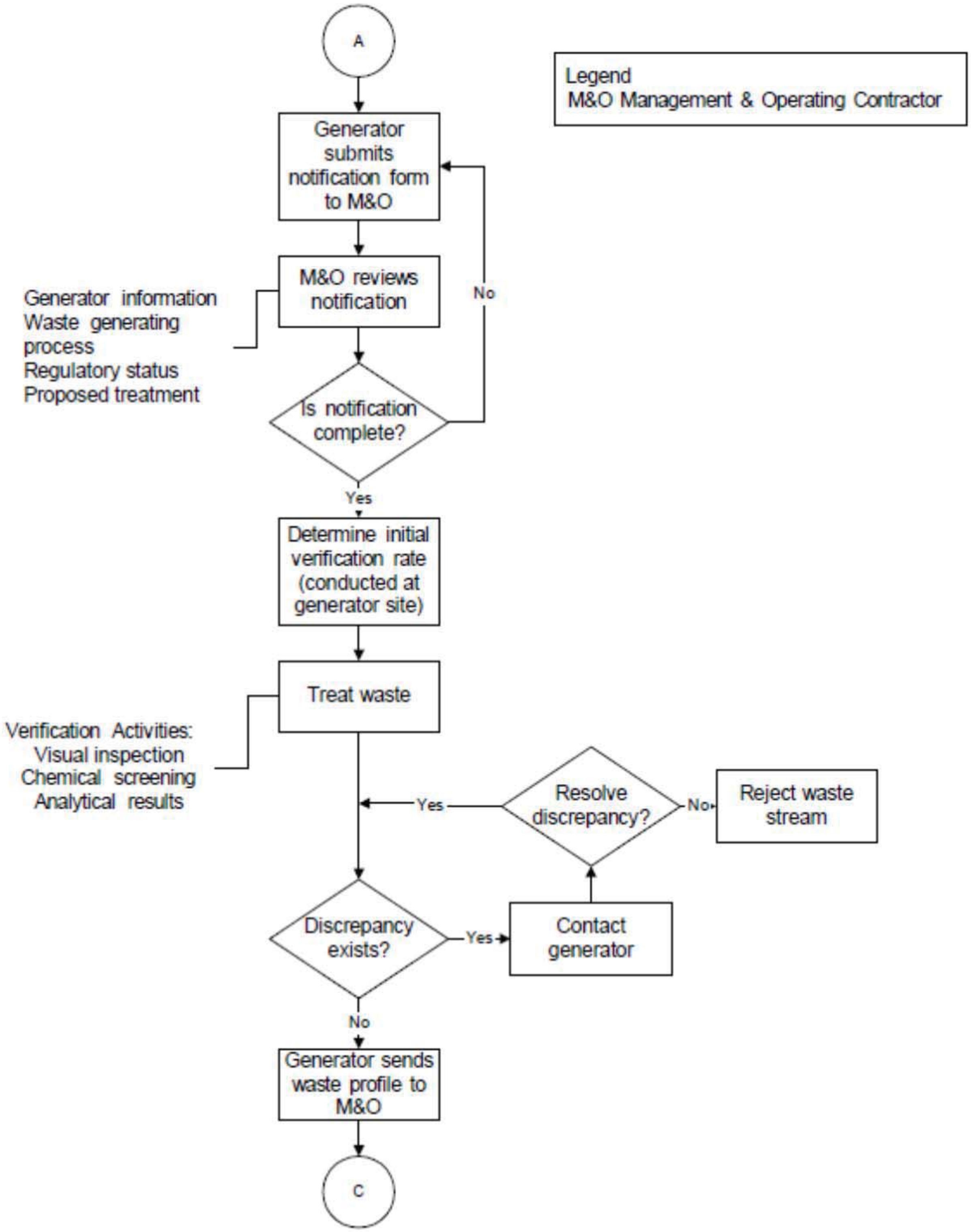
WASTE GENERATOR APPROVAL

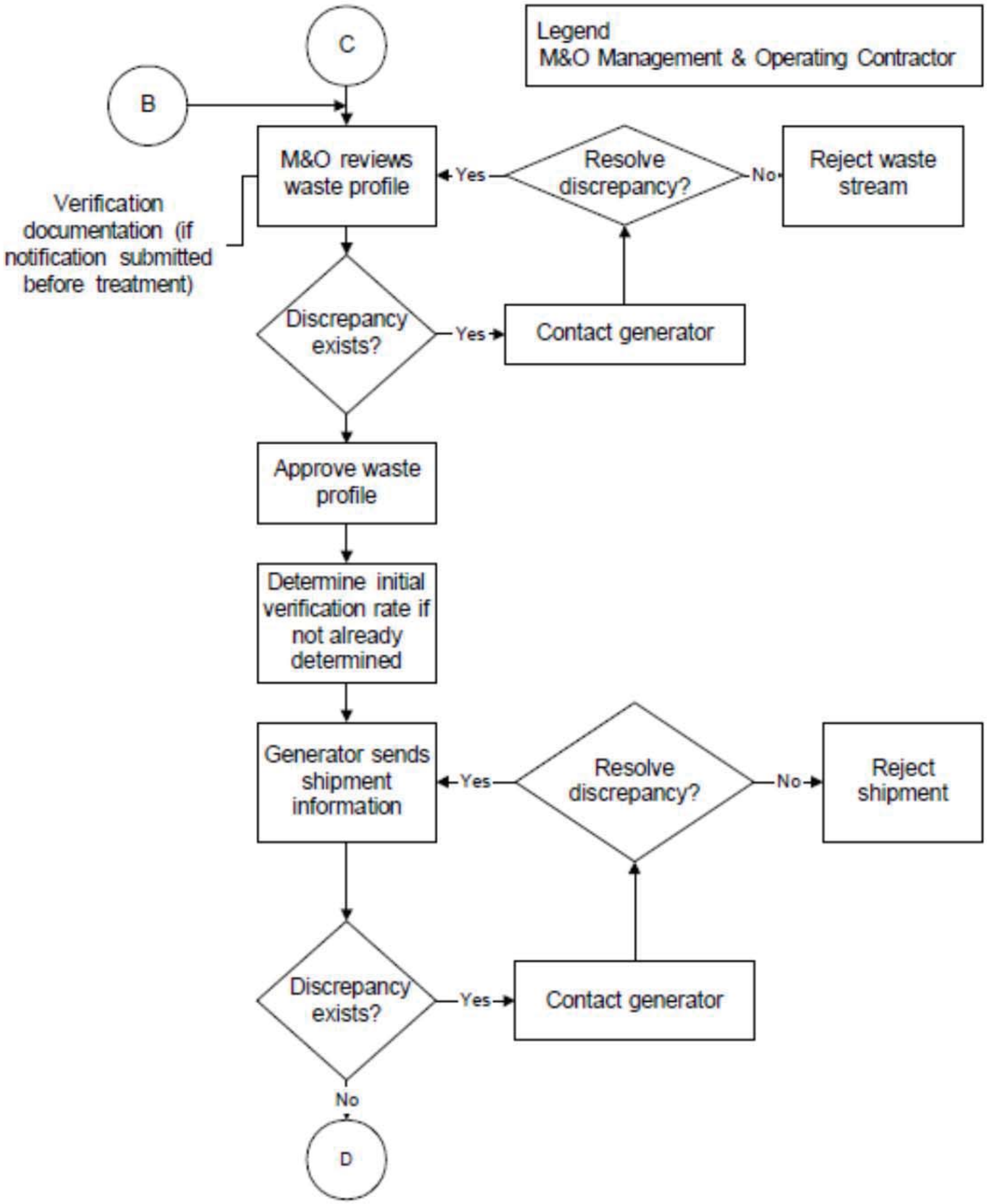
AMEM - Assistant Manager Environmental Management
NNSA/NFO - U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office
MLLW - Mixed Low-Level Waste



PRE-TREATMENT NOTIFICATION



POST-TREATMENT PROFILE



SHIPMENT VERIFICATION

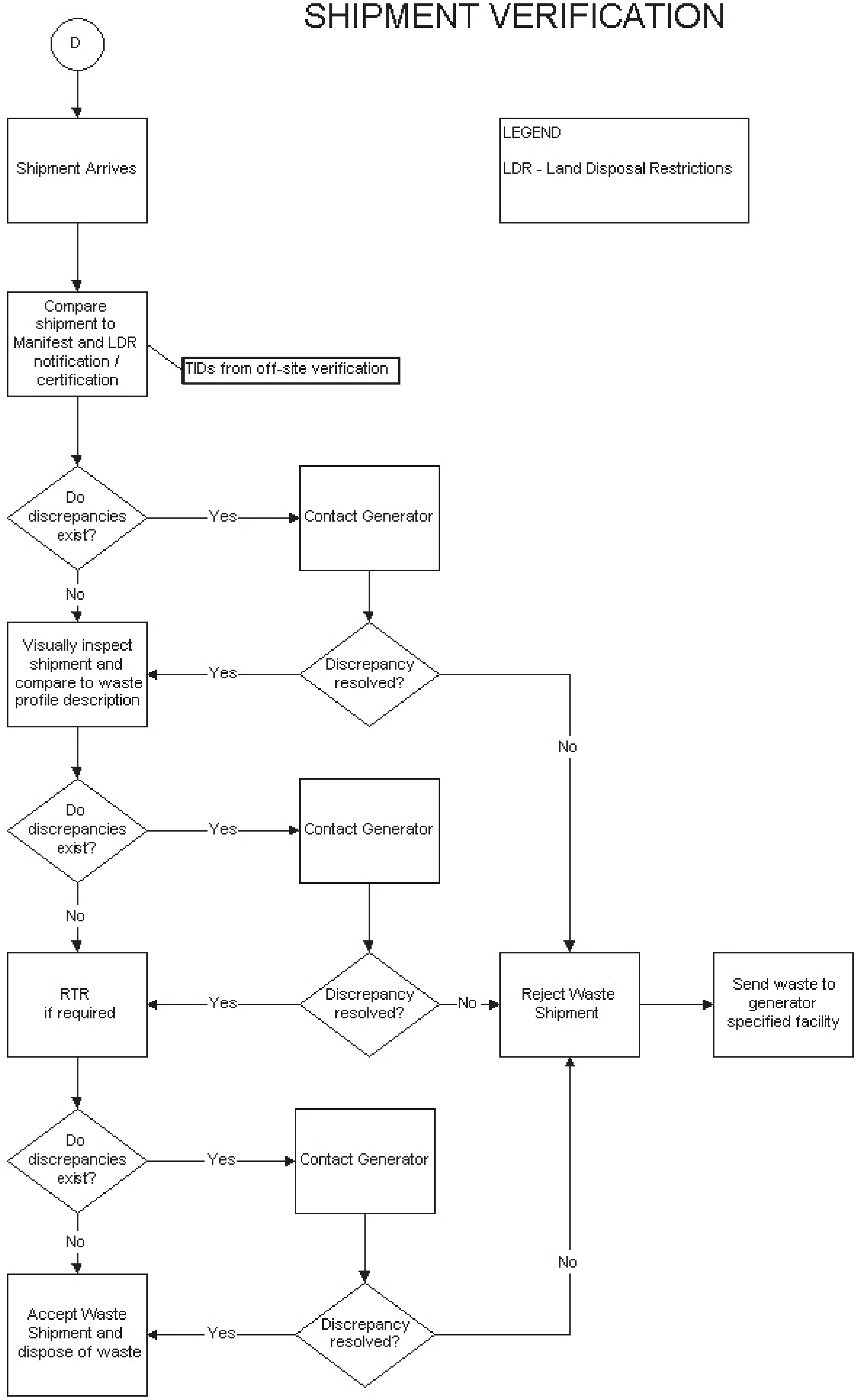


EXHIBIT 3. Pre-Treatment Notification Form for Mixed Waste Example

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A. Generator Information

1. Company name:
2. Facility address:
3. Generator facility:
4. Primary technical contact: email: Phone: Fax:
5. Waste certification official: email: Phone: Fax:

B. General Waste Stream Information

1. Waste stream name:
2. Waste stream identification number:
3. Waste generating process description:
4. Estimated volume after treatment: ☐ Inventory attached
5.

Container Size	Weight (lbs).	Dose rate (mR/hr @ 30 cm)

6. Regulatory status. Check all boxes below that describe the regulatory status of the waste stream as generated:
   - ☐ Federally regulated (RCRA) hazardous waste (40 CFR 261). List all EPA hazardous waste numbers and applicable regulatory subcategories
   - ☐ State regulated hazardous waste codes:

1. Waste composition. Describe the gross composition/component of the waste stream and all hazardous constituents that contribute to any waste codes or LDR treatment standards.

CAS Number	Chemical Constituent	Waste Component

8. Reportable radionuclides. List the radionuclides that could be reportable in the waste stream:

Isotope	Activity (Bq/m^3)

C. Proposed Treatment Information

1. Applicable LDR Treatment Standards:
2. Treatment standards: ☐ Concentration Based ☐ Technology Based
3. Proposed Treatment Facility:
   - ☐ Onsite — Generator procedures:
   - ☐ Commercial — Facility name:
     - Address:
     - EPA Identification number:
     - Permit number:
4. DOECAP audit number and date completed of the treatment facility:
5. Treatment process(es) or technology(ies):
6. Proposed final waste form:
   - ☐ Solidified/Stabilized ☐ Debris ☐ Macroencapsulated
   - ☐ Incinerator Ash ☐ Soil ☐ Other; describe:
7. ☐ Waste will contain sorbent.
   What kind? *Sorbents used must meet 40 CFR 264.314(e)(1) or (2).*
8. Schedule for treatment:
9. Training or PPE necessary for visual inspection of treatment/waste:

Technical Contact Signature: _______________ Date:

WCO Signature: __________________ Date:

EXHIBIT 4. Waste Stream Recommendation Form

NOT AVAILABLE FOR PUBLIC VIEWING

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EXHIBIT 5. Mixed Low-Level Waste and Non-Radioactive Hazardous Classified Waste/Matter Profile Annual Certification Example

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G.2 Mixed Low-Level Waste and Non-Radioactive Hazardous Classified Waste/Matter Profile Annual Certification Example

Waste Profile Number:
Waste Profile Revision No.: Expiration Date:
Facility: WCO:

The above profile is about to expire. The NNSSWAC requires generators to recertify MWPs and Non-Radioactive Hazardous Classified Waste/Matter profiles on an annual basis. No waste may be shipped under this profile after the expiration date unless it has been recertified or a new waste profile has been submitted and approved.

Please indicate your preference by checking the appropriate box below. If the waste stream has not changed significantly and the profile is still accurate, recertify by checking the third box below, providing the additional information requested, signing the certification statement, and returning this form to NNSA/NFO EMO. Upon approval, a letter will be sent which authorizes continued shipment of the waste stream for up to an additional year.

Check the appropriate box:

☐ This waste profile is no longer needed. Please cancel the waste profile.

☐ There have been significant changes to this waste stream. I understand that this waste stream cannot be shipped to the NNSS until a revised or new profile is approved. I will revise it or submit a new waste profile.

☐ I want to recertify the waste profile. I have reviewed the revision no. _______ and certify that it is current, complete, and accurate description of the waste stream and the methods employed to ensure that the waste meets the NNSSWAC.

If you checked the third box above, answer the following questions to confirm that the waste stream has not changed significantly. Significant changes will require a revision to the waste profile.

☐	No	☐	Yes	Has the generating process changed?
☐	No	☐	Yes	Have the methods used to perform radiological characterization changed?
☐	No	☐	Yes	Have the methods used to perform physical/chemical characterization changed?
☐	No	☐	Yes	Have any of the RCRA or state waste codes changed?
☐	No	☐	Yes	Has the LDR status (subcategories, treatment, etc.) changed?
☐	No	☐	Yes	Have there been any other changes to the waste stream that could affect management of the waste at NNSS?
☐	No	☐	Yes	Do you have any new waste analysis data that confirms or improves your waste characterization?

Provide the volume remaining in the waste stream:

If you checked any “Yes” boxes, please explain below and attach additional sheets as necessary.
Certification: I certify that, to the best of my knowledge, the information provided on this form and any attached documentation is accurate and complete.

WCO Signature: ______________________________ Date: __________

Print Name: ______________________________

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B.3.b Onsite-Generated LLMW Waste Analysis Plan

Onsite-generated LLMW received for storage is not required to be fully characterized or LDR compliant, may contain free liquids, and may be RCRA-characteristic waste. Typically, LLMW is generated at the NNSS from legacy facilities or is generated by routine processes. Some of these wastes are treated onsite to meet LDR standards by macro-encapsulation, which is regulated by the NDEP BFF. Other LLMW accepted for storage are treated and disposed offsite. In some cases, treated waste may be returned to the NNSS for disposal if the waste is classified or the radioactive content is too high to be disposed at a permitted offsite facility.

B.3.b.1 Waste Identification Parameters [40 CFR 264.13(b)(1)]

NNSA/NFO characterizes onsite-generated LLMW to determine its physical, chemical, and radiological properties and content. Characterization data to determine the presence of hazardous waste are developed following **40 CFR 261**. Data may be obtained from acceptable knowledge and/or sampling and analysis. Parameters are selected to determine compatibility, segregation, treatment/disposal, marking/labeling, and storage/handling requirements. Table 7 lists general hazardous waste analysis parameters for onsite-generated LLMW.

Table 7. EPA Methods, Parameters, and Rationale for Parameter Selection

EPA Method[1]	Parameter	Rationale for Parameter Selection
9040, 9041, or 9045	pH	Assign hazardous waste number and identify prohibited waste
ASTM D 93-79, D 93-80, D 3278-78, or 1030	Ignitability	Assign hazardous waste number and identify prohibited waste
9014, 9034	Reactivity	Assign hazardous waste number and identify prohibited waste
9095	Free liquids	Assign hazardous waste number and identify prohibited waste
1311[2]	TCLP	Assign hazardous waste number and verify compliance with LDR treatment standards
2540C	Total Suspended Solids	Determine whether LDR wastewater or non-wastewater treatment standards apply
6010, 6020, or 7000 series	TCLP metals analysis	Assign hazardous waste number and verify compliance with LDR treatment standards
8000 series	Volatiles analysis	Assign hazardous waste number and verify compliance with LDR treatment standards
8000 series	Semivolatiles analysis	Assign hazardous waste number and verify compliance with LDR treatment standards
8000 series	HOCs[3]	Verify applicability of LDR requirements of soil
8082	PCBs	Identify prohibited items and verify compliance with LDR treatment standards

1 Referenced methods are from Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, unless otherwise noted. More current SW-846 methods may be substituted for any method.

2 An alternative to Method 1311 is to perform total contaminant concentration analysis and assume all contaminants to be leachable using the TCLP method. For purposes of this requirement, the total results based on a dry weight basis shall be divided by a conversion factor of 20 to determine whether a TCLP limit has the possibility of being exceeded.

3 As specified in 40 CFR 268.2(a) and 40 CFR 268, Appendix III.

B.3.b.2 Test Methods [40 CFR 264.13(b)(2)]

EPA test methods employed for each waste stream depend upon the type of waste and the quality of the acceptable knowledge. Methods identified in Table 7 are not intended to be all inclusive. Other SW-846 EPA test methods or equivalent methods are used when appropriate.

B.3.b.3 Sampling Methods [40 CFR 264.13(b)(3)]

Sampling methods are dependent on the type and form of waste. Typical sampling devices are identified in Table 8. Sample techniques and methods focus on obtaining a representative sample of the waste.

Table 8. Sampling Devices

Material	Equipment
Liquid	Coliwasa, Dipper, or Weighted Bottle
Soil and Soil-like Material	Thief, Trier, Scoop, Shovel, Auger, or Veihmeyer Soil Sampler

Techniques

1. A grab sample is collected at a particular time and place to represent the composition of the source at that time and location. Grab samples are useful when a source is known to be homogeneous over time and location. Representativeness of a grab sample decreases as the variation increases.
2. Composite samples are non-discrete samples of more than one specific aliquot collected at various sampling locations and/or at different points in time. Analysis of this type of sample produces an average value over time and location.

Methods

1. Random sampling is appropriate when waste is completely homogeneous with regard to chemical properties and maintains homogeneity over time. In this case, a single sample collected at an arbitrary location and time theoretically generates an accurate and precise estimate of the waste's chemical properties.
2. Simple random sampling is appropriate when waste is randomly heterogeneous with regard to its chemical characteristics and that chemical heterogeneity is constant between batches. For this type of sampling, all units in the population are considered, and a suitable number of samples are selected from that population.
3. Stratified random sampling is appropriate when a batch of waste is known to be non-randomly heterogeneous in terms of its chemical properties and/or non-random chemical heterogeneity is known to exist between batches. In such cases, the population is stratified to isolate the known sources of non-random chemical heterogeneity. Stratification can occur over time or space, and a simple random sample is collected from each stratum.

B.3.b.4 Analytical Frequency [40 CFR 264.13(b)(4)]

Re-sampling and analysis of specific waste streams are necessary when:

1. There are changes to a process or the materials used in the process.
2. TSDF requirements change or the TSDF requests additional data.
3. There are requirements for periodic analysis of a waste stream.
4. There are changes in analytical methods.
5. There are changes in permit requirements.
6. Traceability of the waste analysis and/or acceptable knowledge of the waste can no longer be confirmed.

B.3.b.5 Specific Waste Management Methods for Ignitable, Reactive, or Incompatible Wastes

Waste handling, disposal, and storage areas within the RWMC are posted as No Smoking areas. Ignition sources related to welding or cutting (maintenance/construction activities) are not allowed without prior approval of the RWMC Facility Manager. In these situations, safety considerations such as assigning a fire watch, isolating the operations from active waste storage, and pre-planning are used to eliminate potential fire hazards. Fuel-burning equipment used in waste handling is fitted with spark arrestors and maintained to ensure engine fluids and fuel does not leak.

Reactive wastes are characterized to ensure compatibility with other combined wastes and compatibility with the waste container. Segregation can also be used when necessary to confine a reactive waste to a specific facility or area of the MWSU.

All wastes stored in the MWSU are in DOT-compliant, closed containers. When applicable, spill pallets are used to hold waste containers. Inspections of waste storage areas are discussed in Section B.5.

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B.4 Security [40 CFR 270.14(b)(4)]

The NNSS is bordered on three sides by 6,629 km^2 (2,560 mi^2) of federal land, which provides restricted and secure access for the NNSS. This restricted zone provides an additional buffer between the MWSU and other properties. Land administered by the BLM borders the fourth side of the NNSS.

In addition to the remote location of the NNSS, NNSA/NFO maintains a contractor security force of highly trained security personnel who are present at the NNSS 24 hours a day, 7 days a week, including holidays. These personnel monitor entry to and exit from the NNSS and provide security measures throughout the NNSS. The size and location of the NNSS with respect to public highways has made the construction of a facility boundary fence impractical. General security measures taken at the NNSS are maintained by a two-level system: (1) security stations at all authorized entrances to the NNSS with property line warning signs and surveillance patrolling; and (2) specific security measures taken at individual locations such as fencing, warning signs, and building security.

B.4.a NNSS Access

There are security stations at all authorized entrances to the NNSS. Only authorized and badged personnel are allowed access to the NNSS. Security personnel perform a visual and tactile inspection of each person's badge before entry to and exit from the NNSS.

Signs stating **No Trespassing by Order of the United States Department of Energy** are located along the public highways that border the NNSS. The signs are legible from a distance of 7.6 m (25 ft) and are spaced at regular intervals. In areas where the visibility of the sign may be obstructed, signs appear at more frequent intervals.

Security personnel also perform non-repetitive and random patrols of the NNSS boundaries and roads. Security personnel also check buildings, facilities, and vehicles on the NNSS on a 24-hour basis, including holidays.

B.4.b MWSU Access

All personnel entering the RWMC must log in at the main office (Building 5-07) before access is granted. The SIS Building, VERB, and DHP are located outside of the fenced area of the RWMC. These facilities are only accessible through the RWMC Facility Manager.

The TPCB and TP are located inside the fenced area of the RWMC. **Danger – Unauthorized Personnel Keep Out** signs visible from 7.6 m (25 ft) are posted along the fence. Entry to and exit from the active area of the RWMC is via a controlled gate or through Building 5-31, the Controlled Area Access Building (CAAB).

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B.5 General Inspection Schedule [40 CFR 270.14(b)(5)]

The inspection schedule addresses the requirements for environmental monitoring equipment, fire protection systems, safety and emergency equipment, security devices, and operating or structural equipment that are critical to prevent, detect, or respond to incidents that could adversely affect human health or the environment. Observations and descriptions of repairs or corrective actions are noted on the inspection forms. Completed inspection forms are filed at the RWMC as a record of inspection.

Weekly inspections include spill control materials, fences, gates, signage, container holding areas, run-on/runoff control, and general housekeeping. Table 9 provides a detailed list of inspection items and frequencies for the RWMC. A sample of a weekly inspection checklist is provided as Figure 7.

If an inspection reveals the deterioration or malfunction of equipment, containers, or structures, the problem is documented on the appropriate inspection checklist. Corrective actions are scheduled to ensure that problems do not lead to an incident that could adversely affect human health or the environment. When corrective actions are completed, they are noted on the next inspection checklist. When a hazard is imminent or already exists, corrective action is taken immediately.

Table 9. RWMC Inspection Schedule

Inspection	Description	Frequency
Waste Containers	Ensure that damage, deterioration, leaks, or spills are not present.	Weekly
General Areas	Ensure that general areas are free of spills, leaks, releases, trash, and debris.	Weekly/During waste handling operations
Fencing/Gates	Ensure that fences and gates are intact with no corrosion, breaches, or deterioration.	Weekly
Signs	Ensure that signs are posted in proper locations, are visible, and adequately communicate entry requirements.	Weekly
Run-on/Runoff Control	Ensure the integrity of berms and dikes (no erosion or sloughing) and the adequacy of stacking.	Weekly/When standing water is noticed during waste operations
Spill Control	Ensure that adequate supplies are present.	Weekly
Fire Extinguishers	Verify that hoses are in good condition and pressure gauges are in the appropriate range.	Monthly
Communication Equipment	Ensure that communication equipment is functioning properly.	Monthly/As necessary

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Figure 7. Sample Weekly Inspection Checklist

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CHECKLIST E
Area 5 Weekly Mixed Waste Storage Unit Permit Checklist
Page 1 of 3

NOTE: The checklist entry blocks follow the tour route for performing this inspection

General Permit Inspection Criteria	YES	NO
1. Last inspection within the prior calendar week.	☐	☐
2. Communication system available to facility personnel to signal an emergency.	☐	☐
3. Appropriate fire notification system been tested in the required time frame.	☐	☐
4. Portable fire extinguishers, fire control equipment, and decontamination equipment available.	☐	☐
5. Spill equipment accessible and has it been inspected.	☐	☐
6. Pallets used to store waste are noncombustible (e.g., metal, plastics compliant with NFPA or UFC requirements, materials approved by a Fire Protection Engineer for this application). †	☐	☐
Transuranic Waste (TRU) Pad Cover Building (TPCB)/TRU Pad Inspection Criteria	**YES**	**NO**
7. Danger-Unauthorized Personnel Keep Out signs posted at each entrance and in sufficient numbers to be seen from any approach visible from 25 feet (ft).	☐	☐
8. TRU Pad/TPCB waste handling, disposal, and storage areas posted as No Smoking areas.	☐	☐
9. Access gate locked when area is uninhabited and is fencing intact.	☐	☐
10. TRU pad free of cracks and gaps.	☐	☐
11. TRU pad berm free of cracks and gaps.	☐	☐
12. Area free of accumulation of precipitation.	☐	☐
13. Good housekeeping practices followed and the area is free of accumulated debris.	☐	☐
14. Containers being stored on the TRU pad (hazardous waste or mixed waste). If “NO”, the remaining questions in this section need not be answered.	☐	☐
15. Maximum amount of Mixed low-level waste (MLLW) stored at the TRU Pad/TPCB less than 17,690 cubic meters (m^3) (624,810 cubic feet [ft^3]).	☐	☐
16. 3-ft aisle space adequate to allow unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment.	☐	☐
17. Waste boxes or drums stored on the TRU Pad on metal pallets to prevent contact with accumulated precipitation.	☐	☐
18. Waste containers closed and free of damage or deterioration (e.g., severe rusting, apparent structural defects or signs of leakage).	☐	☐
19. MLLW containers of less than 450 liters (L) (119 gallons [gal]) marked for the hazardous characteristics of the waste and are container hazardous waste labels legible.	☐	☐
Onsite Waste Generation Area Inspection Criteria	**YES**	**NO**
20. Containers being stored in the Onsite Waste Generation Area (hazardous waste or mixed waste). If “No”, the remaining questions in this section need not be answered.	☐	☐
21. MLLW containers of less than 450 L (119 gal) or marked for the hazardous characteristics of the waste and are container hazardous waste labels legible.	☐	☐
22. Containers in storage that are pending offsite treatment to meet LDR [land disposal restriction] requirements where the accumulation start date is greater than 9 months old.	☐	☐
23. Containers are being staged for macro encapsulation, is the accumulation start date less than 90-days old.	☐	☐
24. 3-ft aisle space adequate to allow unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment.	☐	☐
25. Waste containers closed and free of damage or deterioration (e.g., severe rusting, apparent structural defects or signs of leakage).	☐	☐
26. Incompatible wastes segregated from one another.	☐	☐
27. Containers with liquids or suspect liquids stored on non-combustible spill pallets.	☐	☐

† = DSA/TSR Control

CHECKLIST E
Area 5 Weekly Mixed Waste Storage Unit Permit Checklist
Page 2 of 3

NOTE: The checklist entry blocks follow the tour route for performing this inspection

Waste Verification Holding Area	**YES**	**NO**
28. Material in the Waste Verification Holding Area requiring inspection. If "NO", remaining questions need not be answered.	☐	☐
29. Waste containers in the Waste Verification Holding Area closed and in good condition with no leakage or signs of deterioration.	☐	☐
30. Adequate space for personnel and equipment to respond to emergencies.	☐	☐
31. Waste containers in the Waste Verification Holding Area segregated within the area to maintain requirements for compatibility.	☐	☐
32. Waste containers in the Waste Verification Holding Area positioned in a manner to prevent rupture or leakage.	☐	☐
33. Containers in the Waste Verification Holding Area marked with the words "HAZARDOUS WASTE" and other identifying information.	☐	☐
34. Waste Verification Log Book entries equal the waste items actually held in the Waste Verification Holding Area.	☐	☐
35. Resource Conservation and Recovery Act (RCRA) hazardous waste containers in the Waste Verification Holding Area been held for less than 60 days.	☐	☐
Drum Holding Pad (DHP) Inspection Criteria	**YES**	**NO**
36. Danger-Unauthorized Personnel Keep Out signs posted at each entrance and in sufficient numbers to be seen from any approach visible from 25 ft.	☐	☐
37. DHP waste handling, disposal, and storage area posted as No Smoking areas.	☐	☐
38. Access gate locked when area is uninhabited and is fencing intact.	☐	☐
39. Area free of accumulation of precipitation.	☐	☐
40. Good housekeeping practices followed and the area is free of accumulated debris.	☐	☐
41. Containers being stored in the Drum Holding Pad (hazardous waste or mixed waste). If "NO", the remaining questions in this section need not be answered.	☐	☐
42. Maximum amount of LLMW stored at the DHP less than 131 m^3 (4,627 ft^3)	☐	☐
43. 3-ft aisle space adequate to allow unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment.	☐	☐
44. Containers closed and free of damage or deterioration (e.g., severe rusting, apparent structural defects or signs of leakage).	☐	☐
45. Waste boxes or drums are stored in the DHP on metal pallets to prevent contact with accumulated precipitation.	☐	☐
46. MLLW containers of less than 450 L (119 gal) marked for the hazardous characteristics of the waste and are container hazardous waste labels legible.	☐	☐
47. Containers with liquids or suspect liquids stored on non-combustible spill pallets.	☐	☐
Visual Examination and Repackaging Building (VERB) Inspection Criteria	**YES**	**NO**
48. Danger-Unauthorized Personnel Keep Out signs posted at each entrance and in sufficient numbers to be seen from any approach visible from 25 ft.	☐	☐
49. VERB waste handling, disposal, and storage area posted as No Smoking areas.	☐	☐
50. Access to the building locked when area is uninhabited.	☐	☐
51. Good housekeeping practices followed and the area is free of accumulated debris.	☐	☐

† = DSA/TSR Control

CHECKLIST E
Area 5 Weekly Mixed Waste Storage Unit Permit Checklist
Page 3 of 3

NOTE: The checklist entry blocks follow the tour route for performing this inspection

VERB Inspection Criteria (continued)	**YES**	**NO**
52. Containers being stored in the VERB (hazardous waste or mixed waste). If "NO", the remaining questions in this section need not be answered.	☐	☐
53. Maximum amount of LLMW stored at the VERB less than 240 m^3 (8,477 ft^3)	☐	☐
54. 3 ft aisle space adequate to allow unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment.	☐	☐
55. Waste containers closed and free of damage or deterioration (e.g., severe rusting, apparent structural defects or signs of leakage).	☐	☐
56. MLLW containers of less than 450 L (119 gal) marked for the hazardous characteristics of the waste and are container hazardous waste labels legible.	☐	☐
57. Containers with liquids or suspect liquids stored on non-combustible spill pallets.	☐	☐
Sprung Instant Structure (SIS) Building Inspection Criteria	**YES**	**NO**
58. Danger-Unauthorized Personnel Keep Out signs posted at each entrance and in sufficient numbers to be seen from any approach visible from 25 ft.	☐	☐
59. SIS waste handling, disposal, and storage area posted as No Smoking areas.	☐	☐
60. Access to the building locked when area is uninhabited.	☐	☐
61. Housekeeping practices followed and the area is free of accumulated debris.	☐	☐
62. Containers being stored in the SIS (hazardous waste or mixed waste). If "NO", remaining questions in this section need not be answered.	☐	☐
63. Maximum amount of LLMW stored at the SIS less than 365 m^3 (12,891 ft^3)	☐	☐
64. 3-ft aisle space adequate to allow unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment.	☐	☐
65. Waste containers closed and free of damage or deterioration (e.g., severe rusting, apparent structural defects or signs of leakage).	☐	☐
66. MLLW containers of less than 450 L (119 gal) marked for the hazardous characteristics of the waste and are container hazardous waste labels legible.	☐	☐
67. Containers with liquids or suspect liquids stored on non-combustible spill pallets.	☐	☐

Comments

LOW-LEVEL WASTE SPECIALIST

Name (printed)	Signature	Date/Time

LOW-LEVEL WASTE SUPERVISOR

Name (printed)	Signature	Date/Time

NUCLEAR FACILITY MANAGER

Name (printed)	Signature	Date/Time

† = DSA/TSR Control

B.6 Preparedness and Prevention [40 CFR 270.14(b)(7)]

RWMC emergency response activities are performed by the DOE contractor and/or subcontractor. Contractor emergency services located on the NNSS include the NNSS Fire Department and NNSS Occupational Medicine, and the Nye County Sheriff's Office provides law enforcement services. Verbal and written notification requirements to the appropriate federal and state agencies are performed by an NNSA/NFO representative.

DOE maintains Memorandums of Understanding with Nye County, the BLM, Creech Air Force Base, and the DOE Office of Secure Transportation for emergency activities. Las Vegas area hospitals that are notified include University Medical Center, Mountain View Hospital, Sunrise Hospital, and Mercy Flight for Life air ambulance service. NNSA/NFO also maintains an Agreement-in-Principle with the State of Nevada.

Because of the complexity of operations at the NNSS, facilities are required to maintain individual emergency response procedures. Exhibit 6 provides a copy of the Emergency Plan Implementing Procedure (EPIP). As required in **40 CFR 264.51**, any imminent or actual emergency requiring implementation of the EPIP is recorded in the operating record, and a written report is submitted to NDEP by NNSA/NFO within 15 days of the incident. The written report includes the following information:

1. Name, address, and telephone number of the owner or operator
2. Name, address, and telephone number of the facility
3. Date, time, and type of incident
4. Name and quantity of materials involved
5. Extent of injuries (if any)
6. An assessment of actual or potential hazards to human health or the environment (as applicable)
7. Estimated quantity and disposition of recovered material that resulted from the incident (see Section B.7, Contingency Plan **[40 CFR 270.14(b)(7)]**)

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B.7 Contingency Plan [40 CFR 270.14(b)(7)]

Exhibit 6 is a copy of EPIP-RWMC.001, "Radioactive Waste Management Complex Emergency Response Actions."

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EXHIBIT 6. EPIP-RWMC.001, "Radioactive Waste Management Complex Emergency Response Actions"

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B.8 MWSU Procedures to Prevent Hazards [40 CFR 270.14(b)(8)]

This section describes the procedures that are used at the MWSU to prevent hazards to human health, safety, and the environment. A description of the procedures, structures, and equipment used at the MWSU are summarized below.

B.8.a Hazards in Off-Loading Operations

Specific precautions taken during off-loading operations include preventative measures and monitoring activities to safely manage LLMW. Generators provide advanced notification of shipments to the NNSS to ensure that shipments are authorized and scheduled with the facility. Precautions taken during off-loading operations to prevent releases to the environment or MWSU personnel exposure to include the following:

1. Examination of required documents for each waste shipment to verify that all information is accurate and complete
2. Surveys of waste transport vehicles using appropriate portable radiation detection instruments and/or standard swipe survey techniques and surveys of vehicles and trailers before being released from the RWMC
3. Collection and analysis of swipe samples for radiological parameters from the exterior surfaces of selected containers
4. Use of container-handling equipment, including drum dollies, mobile cranes, or forklifts with drum lift attachments or slings; use of ramps if needed during off-loading and to conduct visual inspections of containers
5. Limiting personnel access during container-handling operations

B.8.b Waste Handling Areas Surface Water Run-On and Runoff

The TP and the DHP are the two MWSU facilities that are subject to run-on and/or runoff. The TP is bermed. Accumulated precipitation on the TP is allowed to evaporate. The DHP has a curbed concrete floor that collects water during precipitation events. Since the DHP does not have a drain, water is removed manually by RWMC personnel using brooms and squeegees.

B.8.c Contamination of Water Supplies

Contamination of water supplies by wastes stored at the MWSU is highly unlikely due to the following conditions:

1. There is no surface water near the MWSU.
2. The average annual potential evapotranspiration rate is approximately 11 times the average annual precipitation rate at the NNSS, leading to a net water deficit in surrounding soils.
3. The depth from the land surface to the ground water in the uppermost aquifer is approximately 255 m (835 ft).
4. Offsite-generated wastes containing free liquids are prohibited.
5. The nearest drinking water well (Well 5b) is located approximately 6.5 km (4.0 mi) from the RWMC.

6. The RWMC inspection program is designed to quickly discover safety or environmental hazards. The EPIP facilitates rapid response and cleanup of releases.

B.8.d Equipment Failure and Effects of Power Outages

Equipment failures and power outages will not affect MWSU operations, cause a release of LLMW, or present safety hazards for the following reasons:

1. Waste containers are moved and placed into storage by equipment. Failed equipment is replaced, or activities are delayed until the equipment is repaired.
2. Emergency communication equipment is inspected monthly to ensure adequate inventory and proper operation. Hand-held radios are tested daily for proper functioning.
3. Normal operations are limited to daylight hours.

B.8.e Undue Personnel Exposure to Typical LLMW

Waste stored at the MWSU is containerized, limiting the possibility of undue personnel exposure to LLMW. Personnel are trained in the proper procedures for handling LLMW, performing site operations, and responding to emergency situations. Frequent inspections of the facility and equipment minimize undue exposure, accidents, and injuries. Personnel working with LLMW are trained and aware of potential hazards. Health and safety plans and radiological work permits further reduce potential employee exposure.

B.8.f Aisle Space

Aisle space is maintained in MWSU facilities and outdoor storage areas to allow unobstructed movement of personnel and fire protection, spill control, and decontamination equipment.

B.8.g Releases to the Atmosphere

Releases to the atmosphere are minimized through the use of DOT-compliant packaging. All LLMW is packaged, shipped, handled, and stored in DOT-compliant containers. Broken containers are not accepted for storage unless repackaged. Onsite-generated wastes that contain free liquids are stored on spill pallets. Additionally, commercial motor carriers of inbound and outbound shipments are required to hold an EPA Identification Number for transporting hazardous waste.

B.9 Prevention of Reaction of Ignitable, Reactive, and Incompatible Waste [40 CFR 270.14(b)(9)]

Ignitable, corrosive, reactive, and incompatible wastes are not accepted for storage at the MWSU from offsite generators. Specific waste management methods for ignitable, reactive, or incompatible onsite-generated wastes are discussed in Section B.3.b.5.

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B.10 Traffic [40 CFR 270.14(b)(10)]

Offsite generators transport LLMW to the NNSS on U.S. Highway 95 to the Mercury Highway entrance to the NNSS. Major traffic flow into Area 5 is via the paved 5-01 Road. Direct access to the RWMC from the 5-01 Road is provided by a large paved parking lot and turnaround area.

Traffic volume on the 5-01 Road ranges from 40 to 60 vehicles per day, and the posted speed limit is 73 km per hour (45 mi per hour). Conventional stop and yield signs at major intersections are used to maintain traffic flow and control throughout the NNSS. Traffic regulations are enforced by the Nye County Sheriff.

The 5-01 Road consists of medium-sized gravel chips compacted into a solid mass (surfacing) that uses bituminous (asphaltic) oil as a binding agent. Oil and chip applications are applied as needed. Total thickness varies from 2.5 to 7.6 cm (1 to 3 in.) along the length of the road.

An engineered-base, load-bearing capacity cannot be definitively stated due to the 5-01 Road not conforming to pavement structural design standards. Laboratory testing of the 5-01 Road subgrade material (i.e., types of subgrade soils and basic engineering index properties) indicates that they provide relatively good support for pavements based on the American Association of State Highway and Transportation Officials classification system.

Subjective engineering evaluations of the 5-01 Road were performed in 1994 and 1999. These evaluations included visual observation of the entire road; pavement thickness measurements; evaluation of cracking, heaving, and other unconformities; and a review of the road’s history and maintenance. Based on engineering judgment, these evaluations indicate that the existing capacity is adequate to support existing and future waste shipments in conjunction with regular inspections, continued maintenance, and reduced speed limits.

Access to the VERB, DHP, and the SIS Building does not require transport vehicles to enter the active area of the RWMC. These storage facilities are located outside the gate adjacent to Building 5-31, the CAAB. Access to the TPCB and TP requires that transport vehicles proceed through the gate adjacent to the CAAB.

Figure 8 depicts the waste transportation routes to the MWSU facilities.

Vehicles transporting LLMW to the MWSU include tractor/trailers and enclosed vans. Commercial motor carriers are required to have an EPA Identification Number for transport of hazardous waste.

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Figure 8. Travel Routes for MWSU

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B.11 Facility Location [40 CFR 270.14(b)(11)]

B.11.a Seismic Standard

The southwestern United States, including Nevada, is tectonically active compared with other parts of the country (**40 CFR 264, Appendix VI**). Natural seismic risk is moderate in the NNSS region. The structural development and present structure of the region have been summarized by Carr et al. (1974), Barnes et al. (1982), and Hudson (1992). The mountains surrounding Frenchman Flat have had a complex structural history. There are numerous surface expressions of faults in the area (Figure 9).

The RWMC lies between two northeast-trending Quaternary fault zones, the Cane Spring fault zone (6.5 km [4 mi] northwest of the RWMC) and the Rock Valley fault zone (9.0 km [5.5 mi] south of the RWMC). The University of Nevada-Reno Seismology Laboratory database (1852 to 2005) lists 67 earthquakes with Richter magnitudes greater than 4.0 occurring in the southern half of the NNSS. Of these, 33 were coincident with an underground test, and seven occurred within a few days after an underground test, which, with one exception, had a yield greater than 1 megaton; the exception had a yield between 20 and 200 kilotons (DOE, 1994). Of the 67 earthquakes, 13 had Richter magnitudes between 5 and 6; and 2 had Richter magnitudes greater than 6 (the largest had a magnitude of 6.2).

No surface-cutting or Holocene faults have been identified within 915 m (3,000 ft) of the RWMC (Raytheon Services Nevada, 1994). Activities to identify and evaluate potential surface-cutting faults included (1) geomorphic mapping of waste disposal trench walls and pits at the RWMC, (2) video logging of one of the Greater Confinement Disposal boreholes, (3) lineament map preparation and field investigations, (4) trench excavations and mapping, (5) evaluation of previously drilled boreholes, and (6) large-scale (1:6,000) air photo analysis and mapping of surficial deposits.

Soil trenches 1 and 4 were excavated to evaluate a previously mapped scarp (Rawlinson, 1991) and a possible fault in the surface alluvium identified by the U.S. Geological Survey (USGS) (Carr et al., 1967) at drill site U-5l (Figure 9). Mapping of approximately 200 m (650 ft) of exposed walls in these trenches to a depth of 3 m (10 ft) did not identify surface-cutting faults associated with either the scarp or apparent fault in the surface alluvium. Additionally, a basalt flow or sill was intersected beneath 290 m (950 ft) of alluvium in drill holes UE-5i and UE-5k, located 2 km (1.2 mi) north and northeast of the RWMC, respectively (Figure 9). The age of the basalt, presumably from a local center within or near Frenchman Flat, is 8.6 million years (Turrin, 1993). Occurrence of the basalt at a similar depth in drill holes, which are 2 km (1.2 mi) apart and separated by the scarp, provides further evidence that the lineament is either not related to faulting or, if so, is not active or has had minimal displacement during the past 8.6 million years. The only lineament confirmed to be related to faulting and associated with surficial deposits is 3.6 km (2.2 mi) northwest of the RWMC in the longitudinal valley of the Massachusetts Mountains (Figure 9). The faulting is believed to be late Tertiary to early Quaternary based on bed attitude and faulting of conglomeratic alluvium presumably of this age.

In summary, no known surface-cutting faults that have had displacement during Holocene time are present within 915 m (3,000 ft) of the RWMC (**40 CFR 264.18**). Trench excavations and mapping, large-scale (1:6,000) air photo analysis, and surficial-deposit mapping were performed to evaluate a lineament located within 61 m (200 ft) of the RWMC. These investigations show that this lineament is not a surface-cutting fault or Holocene tectonic feature.

B.11.b Flood Plain

The MWSU is located outside the 100-year flood plain and is in compliance with **40 CFR 264.18(b)** and **270.14(b)(11)(iii)**. The southwest corner of the RWMC falls within a 100-year flood plain as illustrated in Figure 10. The RWMC is not subject to frequent flooding. The washes that drain toward the RWMC are normally dry and only flow during intense rainfall.

According to **40 CFR 270.14 (b)**, Flood Insurance Rate Maps (FIRMs) produced by the Federal Emergency Management Agency (FEMA) should be used to determine if a unit is within a 100-year flood hazard area (100-year flow depth greater than 0.30 m [1 ft]). When a FIRM has not been developed for an area, which is the case for Area 5, a flood hazard map must be developed using FEMA methods. A flood study using FEMA methods was completed and submitted to NDEP in February 1993 (Exhibit 7).

The overall watershed that could impact the RWMC is approximately 365 km^2 (140 mi^2) (Figure 2). This watershed was divided into 16 subbasins to best represent the hydrology of the study area. USGS topographic maps were used to divide the drainage area into subbasins ranging in size from 0.8 km^2 (0.3 mi^2) to 210 km^2 (81.3 mi^2). Barren Wash, Scarp Canyon, and Halfpint alluvial fans were delineated. These fans are characterized by incised channels in the upper parts of the fans decreasing to sheet flow in lower parts of the fans.

The 100-year flood hazard for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans was analyzed using FAN, a computer program developed by FEMA (1990). This program was used to delineate the flood hazard zones on the alluvial fans according to FEMA methods. The results of the alluvial fan analyses are shown in Figure 10.

FEMA designates alluvial fan flooding, shallow concentrated flow, and sheet flow areas with 100-year flood depths between 0.30 m (1 ft) and 0.90 m (3 ft) as Zone AO. FEMA further designates an associated flow velocity for alluvial fan flood hazards. The flood hazard analysis of the alluvial fans determined that the southwest corner of the RWMC is within the 100-year flood hazard (Zone AO) of the Barren Wash alluvial fan. This part of the RWMC does not include RCRA units covered in the NNSS RCRA Part B permit application.

The HEC-2 model developed by the U.S. Army Corps of Engineers to determine water surface elevations in channels was used to assess the flood hazard of shallow concentrated flow in a channel impacting the southwest corner of the RWMC. This analysis determined that flows exceed a depth of 0.30 m (1 ft) along the southwest corner of the RWMC, also placing this part of the RWMC in the 100-year flood hazard (Zone AO).

For the remaining subbasins that could impact the RWMC, flood hazard determinations were conducted assuming sheet flow conditions. The analysis, using FEMA methods for sheet flow, concluded that these sheet flow regions should be designated as Zone X. FEMA defines Zone X as areas outside the 100-year flood hazard and/or areas of 100-year shallow flooding (sheet flow) where average depths are less than 0.30 m (1 ft). A Zone X delineation does not mean that floods will not occur in this zone; therefore, flood hazard zone protection must be addressed.

Flow from the watersheds above the RWMC is diverted by flood control structures located on three upstream sides of the RWMC. These structures have been engineered to maintain a run-on control system capable of preventing flow into the active portion of the RWMC during peak discharge from a 25-year, 24-hour storm.

Figure 9. Map of Structural Pattern

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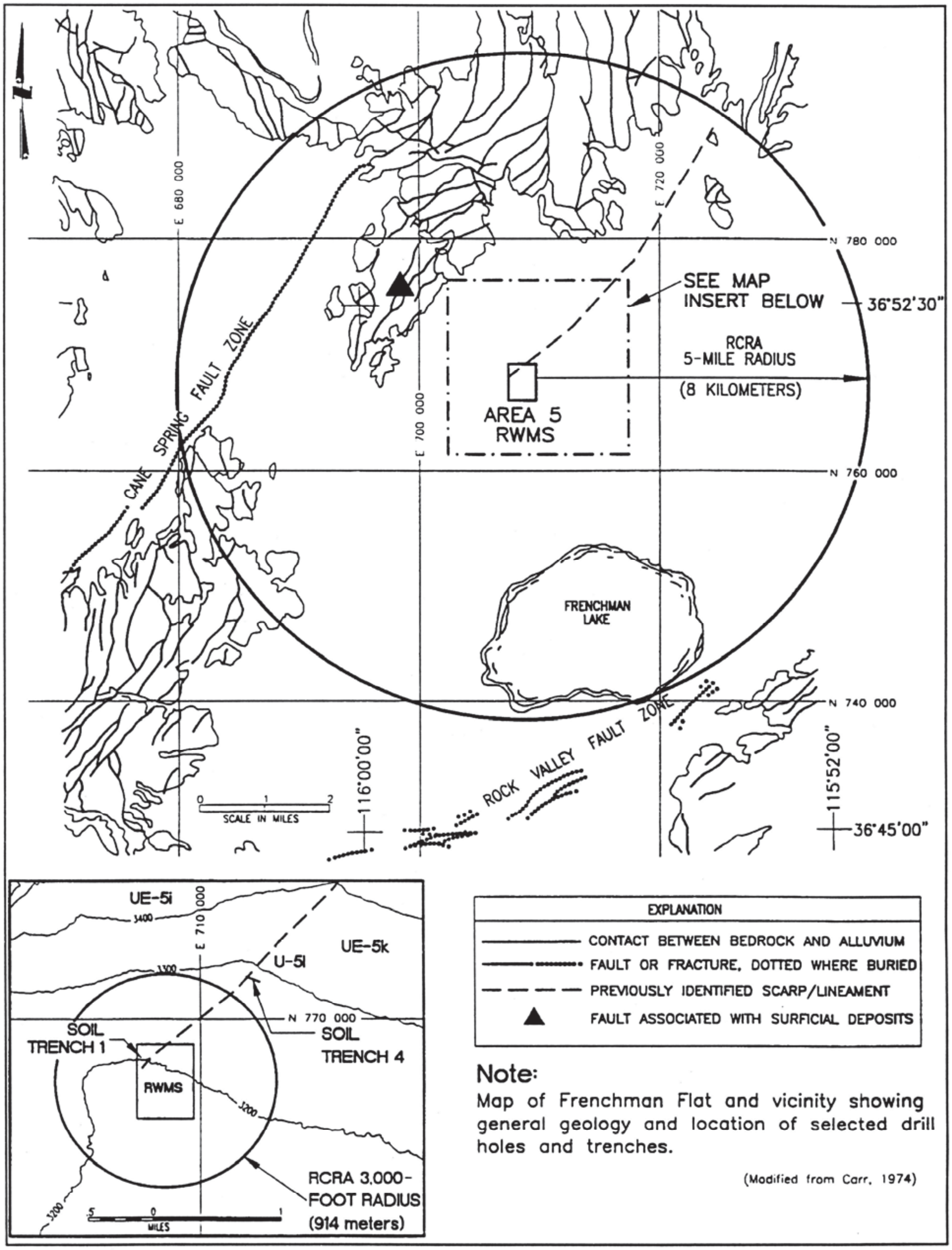

Map of Structural Pattern

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Figure 10. 100-Year Flood Zone Delineation

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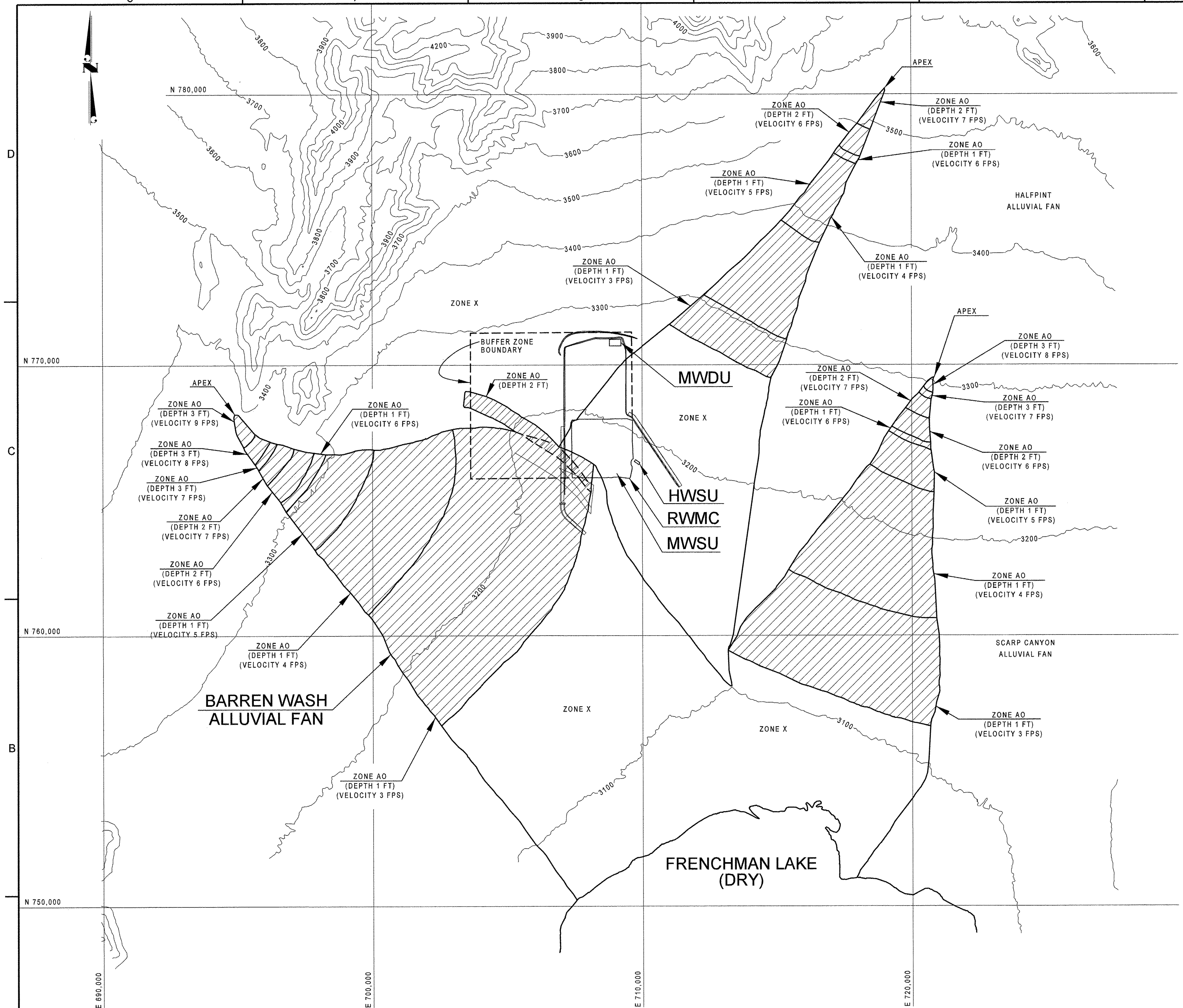

LEGEND

(solid line)	ALLUVIAL FAN BOUNDARY
(solid line)	BOUNDARY OF RADIOACTIVE WASTE MANAGEMENT COMPLEX (RWMC)
(dashed line)	BOUNDARY OF AREA PROPOSED FOR RWMC EXPANSION
(open box)	100-YEAR FLOOD ZONE OF SHALLOW CONCENTRATED FLOW
(hatched box)	AREA OF ALLUVIAL FAN 100-YEAR FLOOD ZONE
ZONE AO (DEPTH 2 FT)	SHALLOW CONCENTRATED FLOW 100-YEAR FLOOD ZONE DESIGNATION: FEMA FLOOD ZONE THAT CORRESPONDS TO AREAS OF 100-YEAR SHALLOW FLOODING WHERE AVERAGE DEPTHS ARE BETWEEN 1 AND 3 FEET (0.30M AND 0.91M).
ZONE AO (DEPTH 2 FT) (VELOCITY 5 FPS)	ALLUVIAL FAN 100-YEAR FLOOD ZONE DESIGNATION: FEMA FLOOD ZONE THAT CORRESPONDS TO AREAS OF 100-YEAR SHALLOW FLOODING WHERE AVERAGE DEPTHS ARE BETWEEN 1 AND 3 FEET (0.30M AND 0.91M). ANYWHERE THROUGHOUT THE ZONE THERE IS AN EQUALLY LIKELY CHANCE THAT A CHANNEL CAN OCCUR OF THE DESIGNATED DEPTH WITH A FLOW OF THE DESIGNATED VELOCITY.
ZONE X	FEMA FLOOD ZONE THAT CORRESPONDS TO AREAS OUTSIDE THE 100-YEAR FLOOD HAZARD AND TO AREAS OF 100 YEAR SHEETFLOW FLOODING WHERE AVERAGE DEPTHS ARE LESS THAN 1 FOOT (0.30M).

100-YEAR FLOOD ZONE DELINEATION

SCALE : 1" = 2000'

GRAPHIC SCALE

0 1000 2000 4000 6000 FEET

1" = 2000'

GS

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA FIELD OFFICE LAS VEGAS, NEVADA

NEVADA NATIONAL SECURITY SITE — AREA 05A

RWMC UTILITY INFRASTRUCTURE

100-YEAR FLOOD ZONE DELINEATION

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
S. Plumb 4-21-15	J. Sorzola 4/21/15	N/A	4/21/15	N/A

National Security Technologies LLC
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NEVADA OPERATIONS
P.O. BOX 98521 LAS VEGAS, NV 89193-8521

ENGINEERING NO. 01327

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EXHIBIT 7. Flood Assessment at the Area 5 Radioactive Waste Management Site DOE/Nevada Test Site, Nye County, Nevada

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FLOOD ASSESSMENT AT THE AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE DOE/Nevada Test Site, Nye County, Nevada

Prepared by Raytheon Services Nevada
Environmental Restoration and
Waste Management Division
1551 Hillshire Drive
Las Vegas, Nevada 89134

For the United States Department of Energy
Nevada Operations Office
Office of Assistant Manager for Environmental
Restoration and Waste Management
2753 South Highland Drive
Las Vegas, Nevada 89193

Under Raytheon Services Nevada
Contract DE-AC08-91NV10833

FLOOD ASSESSMENT

EXECUTIVE SUMMARY

A flood assessment at the Radioactive Waste Management Site (RWMS) and the Hazardous Waste Storage Unit (HWSU) in Area 5 of the Nevada Test Site (NTS) was performed to determine the 100-year flood hazard at these facilities. No previous flood studies of these facilities delineated the 100-year flood hazard. This current study was conducted to determine whether the RWMS and HWSU are located within a 100-year flood hazard as defined by the Federal Emergency Management Agency (FEMA), and to provide discharges for the design of flood protection.

The overall watershed which could impact the RWMS and HWSU is approximately 140-square miles. This watershed was divided into 16 subbasins to best represent the hydrology of the study area. United States Geologic Survey (USGS) topographic maps were used to divide the drainage area into subbasins ranging in size from 0.3-square miles to 81.3-square miles. Barren Wash, Scarp Canyon, and Halfpint alluvial fans were delineated. These fans are characterized by incised channels in the upper parts of the fans decreasing to sheetflow in lower parts of the fan.

The 2-year, 10-year, and 100-year discharges were determined using methods and guidelines provided in the Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Manual, 1990*. The methodology in the CCRFCD Manual was developed specifically for Southern Nevada by Clark County and the U.S. Army Corps of Engineers, Los Angeles District, and is the most current and region-specific approach to develop discharges. Flood studies conducted in Clark County following the methods provided in the CCRFCD Manual have been accepted by FEMA. The proximity of Area 5 to Clark County and their similar physical and climatic characteristics support the use of this region-specific method as the means of generating discharges for the study area.

As directed in CCRFCD Manual, the HEC-1 rainfall-runoff model developed by the U.S. Army Corps of Engineers was used to generate discharges for the RWMS and HWSU areas. Hydrologic models were developed for the 2-year, 10-year, and 100-year discharges. Point precipitation values used in this model were taken from NOAA Atlas 2, Volume VII. Field observations were made to determine the vegetation type and cover density, Manning roughness coefficient, slope, channel geometry, and concentration point locations. From this information, curve numbers (a method to quantify precipitation losses) and lag times for each of the subbasins were determined, routing parameters were applied, and discharges were calculated. Discharges developed in this hydrologic analysis were used in the subsequent analysis to define the 100-year flood hazard.

The 100-year flood hazard for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans was analyzed using FAN, a computer program developed by FEMA. This program was used to delineate the flood hazard zones on these alluvial fans in accordance with FEMA methodology. The FAN model requires information regarding apex location, fan boundaries, potential flow obstructions and diversions, fan surface slopes, Manning roughness coefficients, single-channel versus multiple-channel regions, and the 2-year, 10-year, and 100-year discharges from the hydrologic analysis. This information was gathered from studies of available topographic and surficial geologic maps and intensive field investigations. The results of the alluvial fan analyses are shown on the maps included in this document.

Part of the RWMS is located within the 100-year flood hazard on the Barren Wash Alluvial Fan. The southwest corner of the RWMS is within the Zone AO of the Barren Wash Alluvial Fan. (This part of the RWMS does not include RCRA units covered in the NTS RCRA Part B Permit Application.) FEMA designates alluvial fan flooding, shallow concentrated flow, and sheetflow areas with 100-year flood depths between 1 and 3 feet as Zone AO. FEMA further designates an associated flow velocity for alluvial fan flood hazards.

The HEC-2 model developed by the U.S. Army Corps of Engineers to determine water surface elevations in channels was used to assess the flood hazard of shallow concentrated flow in a channel impacting the southwest corner of the RWMS. This analysis determined that flows exceed a depth of 1 foot along the southwest corner of the RWMS, which places this part of the RWMS in the AO zone.

For the remaining subbasins that could impact the RWMS and HWSU, flood hazard determinations were conducted assuming sheetflow conditions. This analysis, using FEMA methodology for sheetflow, concluded that depths of flow during the 100-year flow event were less than 1 foot. Thus, the RWMS and the HWSU are not in a 100-year flood hazard as defined by FEMA.

Although the RWMS and HWSU facilities that are included in the RCRA Part B Permit Application are not within a 100-year flood hazard per FEMA definition (100-year flood depth at or greater than 1 foot), flow from a 100-year event could impact the facilities. Flood protection requirements are being evaluated.

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1.0 INTRODUCTION

1.1 Location

A flood assessment was conducted at the Radioactive Waste Management Site (RWMS) and the Hazardous Waste Storage Unit (HWSU) in Area 5 of the Nevada Test Site (NTS) in Nye County, Nevada (Figure 1). In this report, the RWMS includes the Transuranic (TRU) Radioactive pad, Mixed-Waste Disposal Unit, and Pit 3 within the RWMS. The study area encompasses portions of the Massachusetts Mountains, the Halfpint Range, and the drainages of Barren Wash and Scarp Canyon.

1.2 Purpose

Flood assessment is one of the subtasks related to surficial geology studies at and near the RWMS. Surficial geology studies respond primarily to requirements and guidelines for site characterization found in federal regulations. The principal federal regulations and criteria pertaining to flooding with which the RWMS must comply are:

- Executive Order 11988 (*Floodplain Management*),
- 10 CFR 61.50 (*Technical Requirements for Land Disposal Facilities*),
- 40 CFR 264.18 (*Location Standards for Hazardous Waste Management Facility*),
- 40 CFR 270.14 (*General Requirements for a Hazardous Waste Facility*), and
- Department of Energy (DOE)/Nevada-341, *Environmental Compliance Handbook, September 1990.*

The RWMS must also comply with Nevada Administrative Code 444.8456 (*Restrictions on Locations of Stationary Facilities for Management of Hazardous Waste; Exceptions*). These regulations prohibit the placement of a hazardous waste facility in a 100-year floodplain. This subtask focuses on the potential 100-year flood hazard on the RWMS. Although the flood assessment subtask does not evaluate the erosion hazard over a geologic time scale (10,000 years), as required under 40 CFR 191.13 (*Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste; Final Rule*), other subtasks are being conducted to gather information regarding erosion on the RWMS. These subtasks include detailed trench and surface mapping, alluvial structure, and seismic fault definitions.

1.3 Objective

The objective of this flood assessment was to determine the 100-year flood hazard on and near the Area 5 RWMS using the most site-specific and applicable approaches for the hydrologic and hydraulic analyses. This flood assessment was conducted to provide hydrologic and hydraulic information for flood protection design and to follow the criteria for flood hazard determination required by the Federal Emergency Management Agency (FEMA), as specified in 40 CFR 270.14.

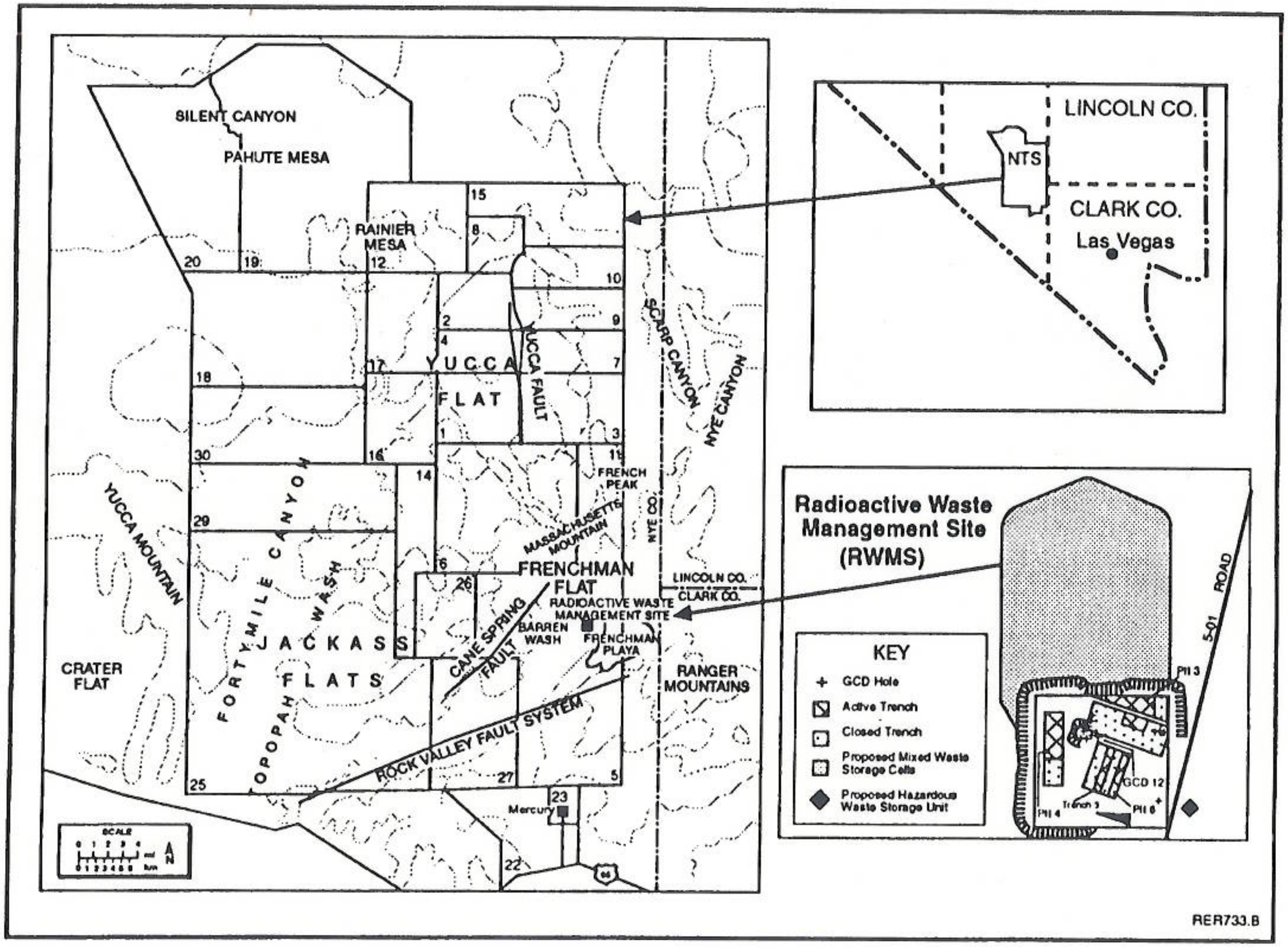


Figure 1. Location Map and Physiographic Features of the Nevada Test Site and the Area 5 Radioactive Waste Management Site

1.4 Previous Studies

Case *et al.*, (1984), French and Lombardo (1984), and Cox (1986) discussed the potential for flooding at the Area 5 RWMS. Raytheon Services Nevada (1991) reported results of a limited study on surface water at and near the RWMS using methods discussed in these previous studies. These studies used regional flow equations that were developed in the late 1970's and early 1980's. At the time of these studies, the Clark County Regional Flood Control District Manual (CCRFCD Manual) had not yet been completed and the regional equations were the best method available. Methodology in the CCRFCD Manual is now the accepted method in Clark County. The proximity of Area 5 to Clark County and their similar physical and climatic characteristics support the use of this region-specific method as the means of generating discharges for the study area. Also since these studies, FEMA has adopted a methodology to evaluate flood hazards on alluvial fans. For these reasons, a more detailed flood assessment was required using the most updated information and methods.

2.0 WATERSHED DESCRIPTION

2.1 Introduction

The 140-square-mile watershed that could impact the RWMS and HWSU was divided into 16 subbasins (Figures 2 and 3). (For more detailed watershed maps, see Sheets 1 and 2.) Concentration points for the flow from the 16 delineated subbasins were chosen to best represent the hydrology of the study area. The apexes of Barren Wash, Scarp Canyon, and Halfpint alluvial fans represent three of these concentration points. The other concentration points were difficult to define because they represented the confluence of large areas of shallow concentrated flow and/or sheetflow that could impact the RWMS. Concentration point locations were based on aerial photographs, topographic data, and field observations.

2.2 Apex Definitions

In this study, both a geologic definition and a FEMA definition for the apex of an alluvial fan are described. The geologic apex of an alluvial fan is the intersection of the mountain front and the piedmont plain (Figure 4). On many alluvial fans, a channel is entrenched into the upper, and possibly the middle part of the fan (Bull, 1964). Fans with entrenched channels have the active apex farther down the fan. FEMA defines the apex as the point below which the flowpath of the major stream that formed the fan becomes unpredictable and flooding of the fan can occur (FEMA, 1991). The FEMA definition was used in this study to determine the concentration points of flow at the active apex of the three alluvial fans within the study area: Barren Wash, Scarp Canyon, and Halfpint alluvial fans (see *Figure 3* and *Sheet* 2) for locations of these apexes).

2.3 Barren Wash Alluvial Fan

The Barren Wash watershed covers 81.3-square miles and is located northwest of the RWMS (*Figure 2* and *Sheet 1*). The wash drains to Frenchman Flat from an area that is bordered to the east by the Massachusetts Mountains, to the north by the CP Hogback, and to the west by the CP Hills. The watershed has been divided into two separate subbasins: Barren Wash 1 (BW1, 60.5-square miles) and Barren Wash 2 (BW2, 20.8-square miles).

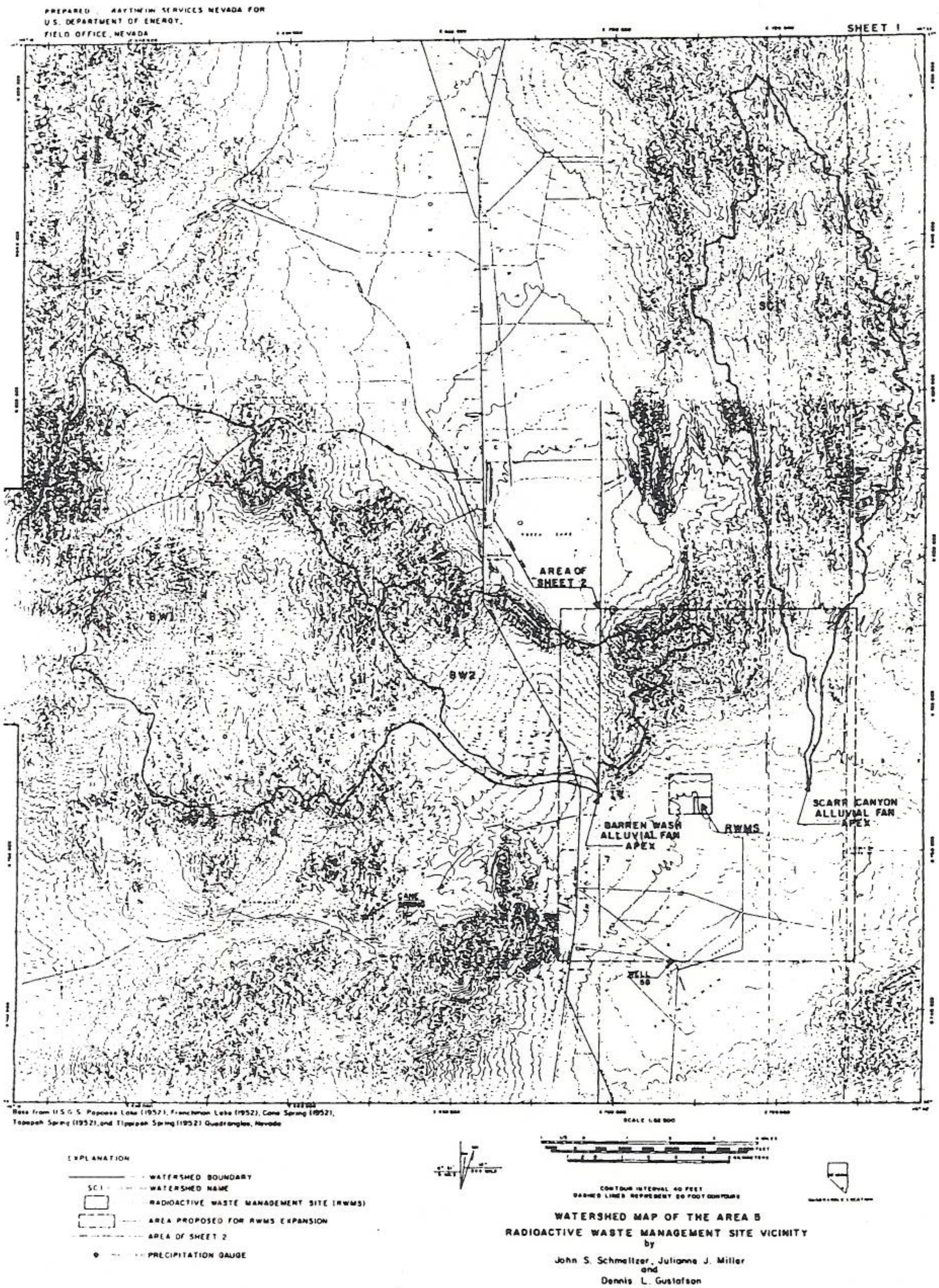
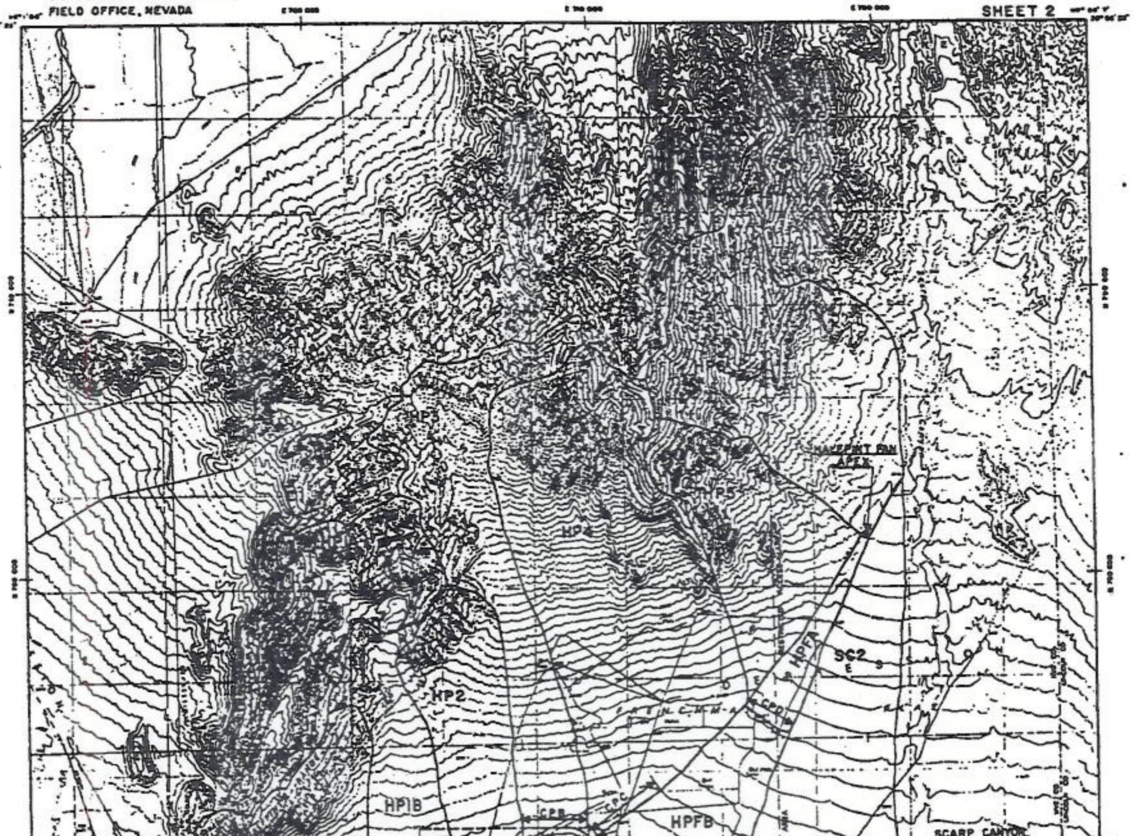


Figure 2. **Watershed Map of the Area 5 Radioactive Waste Management Site Vicinity (Sheet 1).** The overall watershed is divided into 16 subbasins; 13 are shown here, with the remainder shown on Figure 3 (Sheet 2).

PREPARED BY RAYTHEON SERVICES NEVADA FOR
U.S. DEPARTMENT OF ENERGY,
FIELD OFFICE, NEVADA

SHEET 2



Base from U.S.G.S. Plutonium Valley (1986), Frenchman Lake (1986) Yucca Lake (1986), and Cane Spring (1986) Quadrangles, Nevada

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET

QUADRANGLE LOCATION

EXPLANATION

- WATERSHED BOUNDARY
- SC2 — WATERSHED NAME
- RADIOACTIVE WASTE MANAGEMENT SITE (RWMS)
- BOUNDARY OF AREA PROPOSED FOR RWMS EXPANSION

WATERSHED MAP OF THE AREA 5
RADIOACTIVE WASTE MANAGEMENT SITE VICINITY
by
John S. Schmeltzer, Julianne J. Miller
and
Dennis L. Gustafson
1992

Figure 3. Watershed Map of the Area 5 Radioactive Waste Management Site Vicinity.

Profile

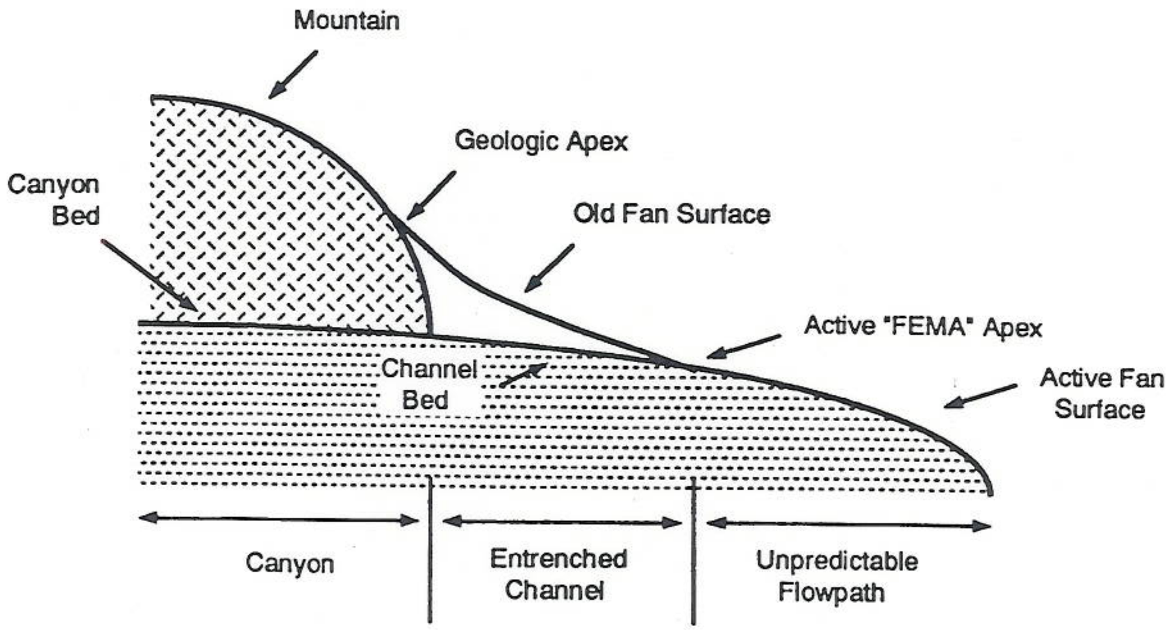


Figure 4. **Idealized Alluvial Fan Profile.** The geologic apex is the intersection of the mountain front and the piedmont plain. The active "FEMA" apex is the point below which the flow of the main channel becomes unpredictable.

The Barren Wash Alluvial Fan is the dominant landform in the watershed. The proximal part of the fan (the area on the alluvial fan near the apex) is deeply entrenched by a stream channel. Significant parts of the fan surface are covered by desert pavement with desert varnish, and vegetation covers 15 to 25 percent of the surface. Erosion is the primary geomorphological process occurring on the proximal part of the fan, as shown by scalloping of the fanhead trench.

Continued trench incision has shifted deposition to a distal part of the fan (the outermost area, or lower zone of the fan). The Barren Wash channel captures the channel draining from the Massachusetts Mountains 1A (MM1A) subbasin at the southwestern corner of the Massachusetts Mountains (*Figure 3* and *Sheet 2*). At this point a new, secondary fan is being formed which extends east toward the RWMS and south to Frenchman Flat. The RWMS is located on the lower-mid part of this secondary fan.

2.4 Scarp Canyon Alluvial Fan

The Scarp Canyon watershed, located northeast and east of the RWMS, covers about 40.9-square miles (*Figure 2* and *Sheet 1*). This watershed drains onto Scarp Canyon Alluvial Fan from an area that extends north to Carbonate Ridge (French and Lombardo, 1984), west to the Massachusetts Mountains, and east to Raysonde Butte. The watershed is divided into two subbasins: Scarp Canyon 1 (SC1, 39.4-square miles), the drainage area above the active apex; and Scarp Canyon 2 (SC2, 1.5-square miles), the area between the channel that drains SC1 and the eastern boundary of Halfpint Alluvial Fan (*Figure 3* and *Sheet 2*).

A large fanhead trench, ranging to a depth of 40 feet, cuts through a thin layer of alluvium and bedrock above the active apex. Below the active apex, the channel cuts through unconsolidated and calcrete-cemented alluvium. Parts of the fan surface are covered by desert pavement with desert varnish. Vegetation density is 15 to 25 percent over the fan surface.

The channel within the trench of Scarp Canyon is braided. Relatively flat interchannel bars and side terraces are approximately 1 to 5 feet above the streambeds, and covered by fine-grained sediment. High-water indicators are present on the bars and terraces several feet above the streambed. These indicators include large clasts and boulders, small logs and sticks, and uprooted Joshua trees found snagged in the vegetation. The vegetation also shows signs of being washed over by water. Concurrence of the high-water indicators with the fine-grained deposits suggests that these deposits are fluvial rather than eolian.

2.5 Halfpint Alluvial Fan

Halfpint Alluvial Fan, located northeast of the RWMS, develops from a channel that collects flow from the drainage area (HP6, 2.2-square miles) along the eastern front of the Halfpint Range (*Figure 3* and *Sheet 2*). The alluvial fan is divided into two separate subbasins: Halfpint Fan A (HPFA, 0.26-square miles) and Halfpint Fan B (HPFB, 1.61-square miles).

The channel located above the apex of the Halfpint Alluvial Fan is incised 2 to 3 feet in depth. The apex of the fan was located where the flowpath of the channel becomes unpredictable. Below the apex, a very braided channel system has developed. Relatively little desert pavement or desert varnish is found on this fan surface; vegetation cover density is approximately 20 percent. The RWMS is located in the lower-mid part of this fan.

2.6 Massachusetts Mountains/Halfpint Range Subbasins

The 13.6-square-mile watershed that drains from the Massachusetts Mountains/Halfpint Range toward the RWMS was divided into nine subbasins (*Figure 3* and *Sheet* 2). These subbasins include MM1A, MM1B, MM2, HP1A, HP1B, HP2, HP3, HP4, and HP5. The upper parts of these subbasins are located in bedrock consisting of several different tuffs. From a geomorphic viewpoint, the drainages in the lower regions extending into Frenchman Flat form coalescing alluvial fans along the mountain front. From a hydraulic engineering viewpoint, the flow system on these landforms are distributary-flow systems. Hjalmerson (1992) states that the ". . . major physiographic characteristics used to identify and categorize distributary-flow areas . . . include (1) vegetation density and soil color, (2) drainage texture, and (3) the random nature of channel links."

The proximal parts of these coalescing alluvial fans (geomorphic viewpoint) are characterized by channels incised 5 to 10 feet across the surface. Vegetation density on the fan surface is 20 to 35 percent. Undisturbed deposits covered by desert pavement with desert varnish are present.

Channel incisions, averaging 1 to 3 feet, decrease near the middle part of the fan. Debris flow deposits from the HP1A and HP1B subbasins in part compose the coalescing alluvial fans (geomorphic viewpoint). Channel depths decrease down gradient until sheetflow occurs.

Sheetflow, typical of areas of low relief and poorly established drainage systems, occurs on the distal parts of the coalescing alluvial fans (geomorphic viewpoint). The RWMS is located in the lower-mid parts of these coalescing alluvial fans where channel depths average less than 1 foot. Vegetation covers 20 to 30 percent of the fan surface. There are relatively few undisturbed areas of relic deposits covered by desert pavement with desert varnish.

3.0 HYDROLOGY

3.1 Methodology

Standard statistical methods to determine flood discharges for a specific return period are not applicable to a majority of the watersheds in the arid Southwest because most of the watersheds in this region are ungaged and do not have stream discharge information. Furthermore, arid watersheds that do have discharge data usually have a short period of record with many years of no flow. A study conducted by Hjalmarson and Thomas (1992) found that 20 years is the average recording period for stream gages located in Nevada, western Utah, western Arizona, and southeastern California.

In the arid Southwest, rainfall-runoff models are often used to estimate flood discharges. In this flood assessment, rainfall-runoff models were developed using the HEC-1 computer program developed by the U.S. Army Corps of Engineers (COE) (1990). The CCRFCD Manual lists the HEC-1 computer program as an acceptable tool to estimate discharges and to generate hydrographs for watersheds within Clark County. Methods in the CCRFCD Manual were used to produce the input parameters required for the HEC-1 computer program. Other jurisdictions in the arid Southwest, such as Maricopa County (central Arizona), Pima County (southern Arizona), and San Bernardino County (southern California), use similar approaches to estimate flood discharges.

The hydrologic approach described in the CCRFCD Manual was developed for Clark County from studies conducted by WRC Engineering and the COE. The methods described in the CCRFCD Manual were considered the best approach for estimating discharges for the flood assessment of the RWMS and vicinity for these reasons:

a. The physical setting and flood-producing storms for the RWMS and vicinity are similar to those of Clark County;

b. The eastern boundary of the study area is adjacent to the Clark County line;

c. Local and federal agencies (e.g., FEMA) accept the methods in the CCRFCD Manual; and,

d. Clark County is the nearest local jurisdiction with a hydrologic method based on region-specific information.

The Soil Conservation Service (SCS) unit hydrograph option in the HEC-1 computer program was used in the hydrologic models. The SCS unit hydrograph is widely used in rainfall-runoff models and is recommended as an option in the CCRFCD Manual. The input parameters required to run the HEC-1 computer model using the SCS unit hydrograph option are:

- precipitation parameters (depth of precipitation, storm duration and time distribution, and depth-area ratios);
- drainage area (total drainage area and subbasins);
- precipitation losses (curve numbers);
- lag time for each basin; and,
- channel routing parameters.

The procedure used to obtain these parameters generally followed the methods described in the CCRFCD Manual. The following sections provide an overview of how these parameters were determined and substantiate any deviations from the methods provided in the CCRFCD Manual. A detailed description of how these parameters are determined is in the CCRFCD Manual.

3.1.1 *Precipitation*

Rainfall events that cause flooding on the NTS and in southern Nevada are usually convectional storms. According to Christenson and Spahr (1980), the probable flood-generating storm in the NTS area would be from summer convectional storms. These flood-producing storms are normally characterized as short-duration (6 hours or less), high-intensity storms over a localized area. Methods regarding precipitation parameters in the CCRFCD Manual assume that summer convectional storms are the likely precipitation event to produce flooding in Clark County. In an analysis of precipitation records for southern Nevada, WRC Engineering and the COE determined that a 6-hour rainfall should be the design storm. A 6-hour mass curve (intensity of rainfall per 15-minute intervals over the 6-hour design storm) was developed and a relationship between precipitation depth and storm size (depth-area ratios) was determined. These parameters are discussed below in more detail.

a. Point Precipitation Values

As specified in the CCRFCD Manual, the design depths of precipitation for the 6-hour storm were taken from NOAA Atlas 2, Volume VII (1973) and are listed in Table 1.

Table 1. Six-Hour Storm Point Precipitation Values and Correction Factors (CCRFCD Manual, 1990). Correction factors used to adjust precipitation values for design depths of precipitation for the six-hour storm.

	NOAA Values (inches)	Correction Factor	Corrected Point Rainfall (inches)
2-Year, 6-Hour	0.70	1.00	0.70
10-Year, 6-Hour	1.10	1.24	1.36
100-Year, 6-Hour	1.60	1.43	2.43

The 100-year, 6-hour point precipitation value of 1.6-inches (NOAA Atlas 2, Volume VII, 1973) compares well with the 1.8-inch value generated from a figure developed by French (1983) for the Cane Springs precipitation gauge (Figure 5). A preliminary value of 2.6-inches for the 100-year, 24-hour storm taken from a statistical analysis of the rainfall data at Well 5b (*Figure 5*) by Reynolds Electrical & Engineering Co., Inc., (personal communication, Barker, 1992) compares well with the value listed in NOAA Atlas 2, Volume VII (1973). Locations of these gauges are shown on *Figure 3* and *Sheet 1*.

The CCRFCD Manual requires that the point precipitation values listed in NOAA Atlas 2, Volume VII (1973) be used to determine point precipitation; however, the CCRFCD Manual specifies that rainfall events above the 2-year storm be adjusted. *Table 1* shows the correction factors listed in the CCRFCD Manual. These correction factors were identified from studies conducted by WRC Engineering and COE for Clark County (CCRFCD Manual, 1990) based on available rainfall data, primarily from the Las Vegas Valley; these factors may not be applicable for the RWMS study area.

French (1983) hypothesized that the southern part of Nevada can be divided into three precipitation zones: an excess zone, a transition zone, and a deficient zone (Figure 6). French (1983) indicates that the Las Vegas Valley is located in the excess zone, and the NTS is located in the transition zone. He further hypothesizes that the excess zone is a result of storms tracking up the Colorado River Valley, and the influence of the river on precipitation values lessens with distance away from the Colorado River Valley. The precipitation analysis by French (1983) and Barker (1992) support this hypothesis and suggest that the noncorrected precipitation values for the RWMS study area are more applicable than using the precipitation correction factors specified in the CCRFCD Manual. Hydrologic models in this flood assessment used the nonadjusted values in NOAA Atlas 2, Volume VII (1973); however, a discharge model was developed using the adjustment factors specified in the CCRFCD Manual to compare with the hydrologic models developed without the adjustment factors. The results of this comparison are discussed in Section 3.4, *Hydrology Discussion*.

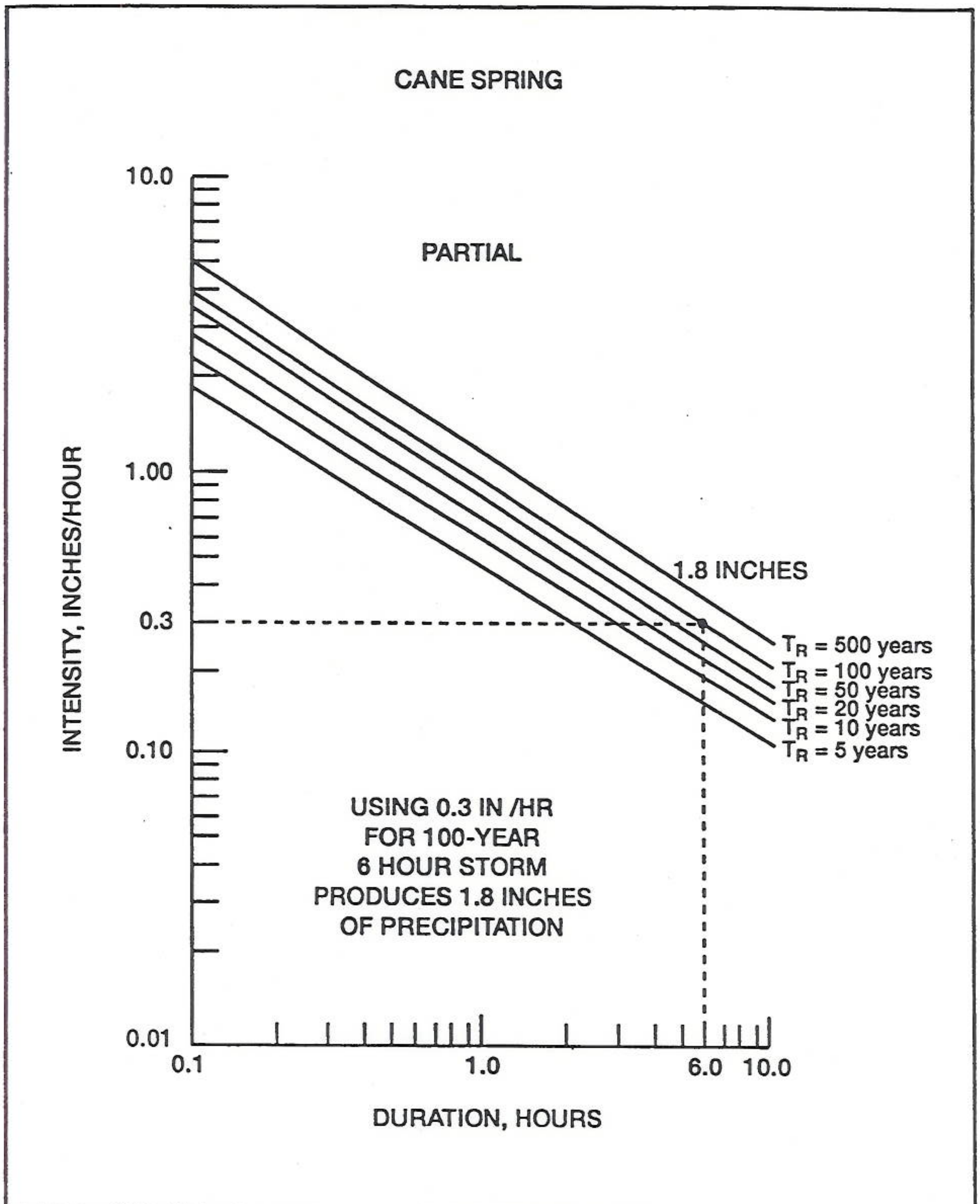


Figure 5. Intensity Duration Relationships for Various Return Periods, Cane Springs, Nevada Test Site, Nevada (modified from French, 1983). The 100-year, 6-hour point precipitation value of 1.6 inches compares well with the value from French, 1983.

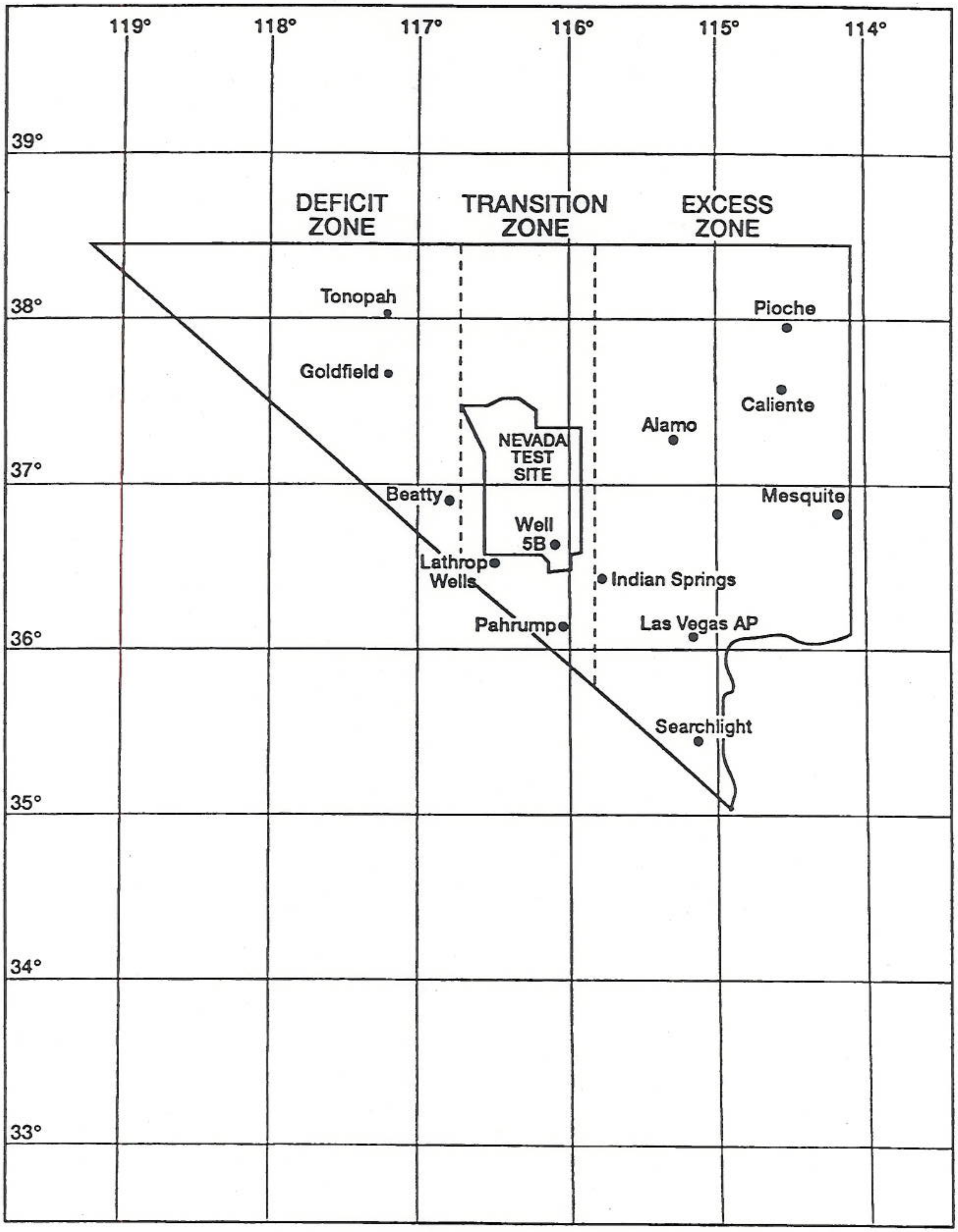


Figure 6. Hypothesized Zones of Precipitation in Southern Nevada (modified from French, 1983). The NTS is located in the transition zone of precipitation.

b. Storm Duration and Time Distribution

Clark County has adopted two 6-hour storm distribution tables to be used to generate discharges (CCRFCD Manual, 1990). The two storm distributions defined in this manual are for areas less than or larger than 10 square miles. These storm distributions were used for the subbasins in the hydrologic models for the RWMS. A mass curve of the two storm distributions is shown in Figure 7.

c. Depth-Area Ratios

During a flood-producing storm, usually a convectional storm in this region, point precipitation values probably would not apply to an entire drainage basin. Depth-area ratios have been developed for arid regions which reduce the point precipitation value for a watershed as a function of area. Clark County uses the depth-area ratios that were developed by the COE for Clark County and vicinity (Table 2). These depth-area ratios are a modification of ratios developed by Zehr (1984) on arid watersheds in Arizona and New Mexico. Ratios in the CCRFCD Manual were used in the hydrologic model for the RWMS.

3.1.2 *Drainage Areas*

The area of each drainage basin defined in the hydrologic model was delineated using 7.5- and 15-minute United States Geological Survey (USGS) topographic quadrangle maps of the area (*Figures* 2 and *3*; *Sheets 1* and 2), along with 1:6,000 orthophotos with a 10-foot contour interval that were developed for the area. Basin delineations were verified by field observations and study of color and infrared aerial photos. The area of each subbasin was determined using a planimeter. The drainage area, and the other watershed parameters for each subbasin used in the HEC-1 model, are listed in Table 3. The USGS topographic maps used to define the drainage area are:

15-minute Topographic Quadrangles (USGS):

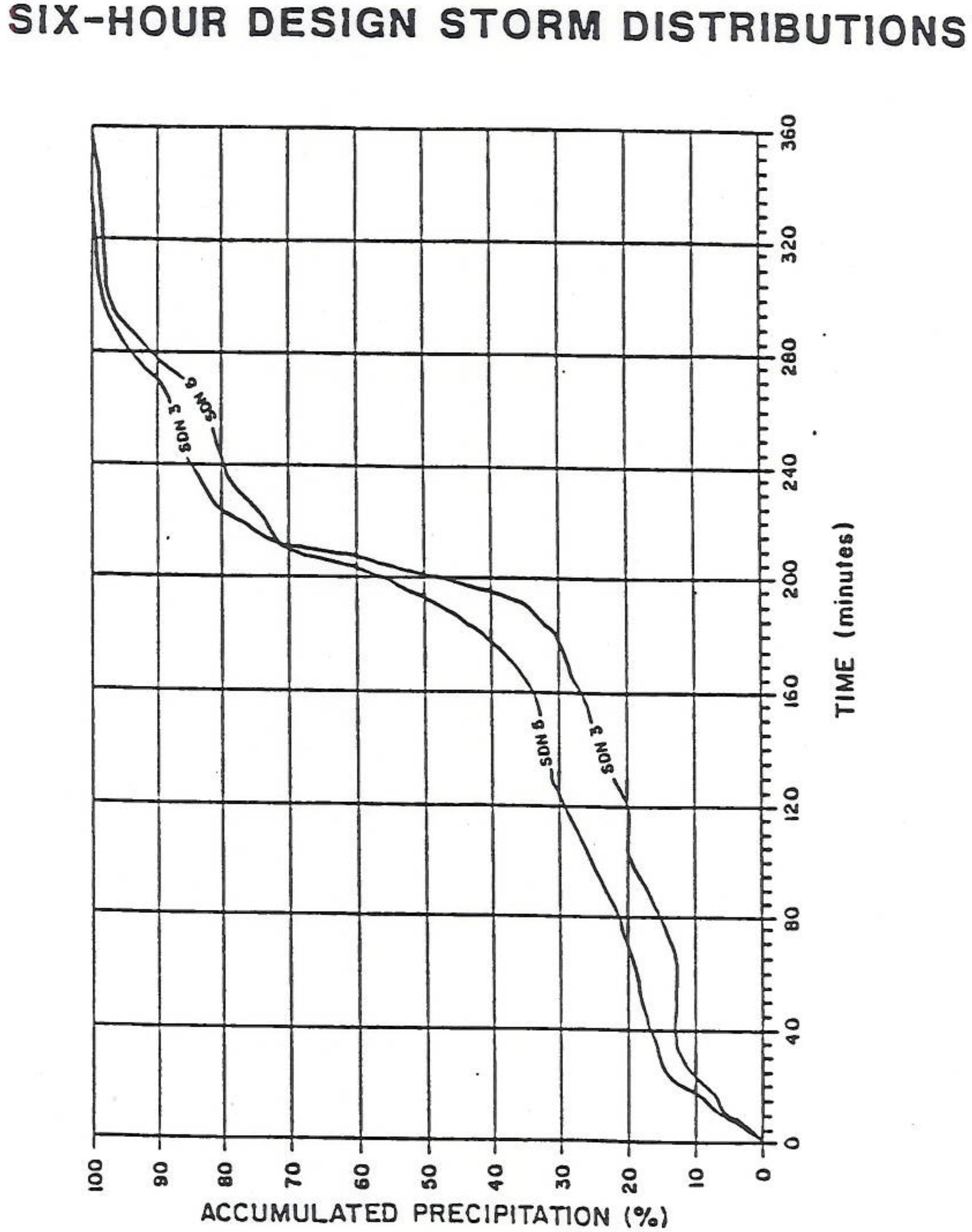
- Papoose Lake (1952)
- Frenchman Lake (1952)
- Cane Spring (1952)
- Topopah Spring (1952)
- Tippipah Spring (1952)

7.5-minute Topographic Quadrangles (USGS):

- Plutonium Valley (1986)
- Frenchman Lake (1986)
- Yucca Lake (1986)
- Cane Spring (1986)

3.1.3 *Precipitation Losses*

Precipitation losses were determined using the SCS curve number methodology and the applicable table (Table 4) found in the CCRFCD Manual. The following information is required to determine a curve number for a specific subbasin:



Notes:

1. For drainage areas less than 10 square miles in size, use SDN 3.
2. For drainage areas equal to or greater than 10 square miles in size, use SDN 5.

Figure 7. Storm Distributions (CCRFCD Manual, 1990 [reference USACE, Los Angeles District, 1988]). Storm distribution curves are selected based on drainage basin size.

Table 2. Six-Hour Precipitation Depth-Area Reduction Factors (CCRFCD Manual, 1990). Depth-area ratios reduce the point precipitation value for a watershed as a function of area.

Drainage Area (mi^2)	Reduction Factor	100-Year (in.)	10-Year (in.)	2-Year (in.)
0.01	1.00	2.43	1.36	0.70
1	0.97	2.36	1.32	0.68
10	0.86	2.09	1.17	0.60
20	0.79	1.92	1.07	0.55
30	0.74	1.80	1.01	0.52
50	0.68	1.65	0.92	0.48
100	0.60	1.46	0.82	0.42

Table 3. Watershed Parameters. Watershed parameters were delineated using topographic maps, aerial photos, and field investigations.

Watershed Name	Basin Area (mi^2)	Curve Numbers AMC I	Curve Numbers AMC II	Curve Numbers AMC III	Lag Time (hrs)
MM1A	0.9	63	80	90	0.31
BW1	60.5	67	83	93	2.10
BW2	20.8	63	80	90	0.90
MM1B	2.1	59	77	87	0.48
MM2	1.4	62	79	89	0.47
HP1A	0.8	70	85	95	0.48
HP1B	1.0	60	78	88	0.51
HP2	1.2	60	78	88	0.51
HP3	1.7	66	82	92	0.59
HP4	3.3	62	79	89	0.52
HP5	1.2	62	79	89	0.30
HP6	2.2	63	80	90	0.55
HPFA	0.3	59	77	87	0.33
HPFB	1.6	59	77	87	0.44
SC1	39.4	66	82	92	2.10
SC2	1.5	59	77	87	0.48

Table 4. **Runoff Curve Numbers (Semiarid Rangelands[1]) [CCRFCD Drainage Manual, 1990 {reference SCS TR-55, USDA, June 1986}].** Hydrologic soil group, vegetation type, and percent of ground cover determine curve numbers.

Cover Description		Curve Numbers for Hydrologic Soil Group			
Cover Type	**Hydrologic Condition[2]**	**A[3]**	**B**	**C**	**D**
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element	Poor	--	80	87	93
	Fair	--	71	81	89
	Good	--	62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	Poor	--	66	74	79
	Fair	--	48	57	63
	Good	--	30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory	Poor	--	75	85	89
	Fair	--	58	73	80
	Good	--	41	61	71
Sagebrush with grass understory	Poor	--	67	80	85
	Fair	--	51	63	70
	Good	--	35	47	55
Desert shrub—major plants include saltbush, greasewood, creosote bush, blackbrush, bursage, palo verde, mesquite, and cactus	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1] Average runoff condition, and $I_a = 0.2S$.

[2] *Poor:* < 30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.

[3] Curve numbers for Group A have been developed only for desert shrub.

- hydrologic soil group;
- vegetation type; and
- percent vegetation cover.

The following procedures were used to obtain this information:

1. The percent of bedrock and alluvium was determined for each subbasin using aerial photos and geologic and topographic maps. Bedrock areas of the subbasins were assigned as hydrologic soil group D. This soil group has high runoff potential and applies to areas with shallow soils or exposed bedrock. The alluvium is mostly sand and was assigned as hydrologic

soil group B based on the preliminary surficial map by Rawlinson (1991), Romney (1973), and extensive field investigation conducted by the authors.

2. The cover type for the subbasins was determined to be desert shrub based on descriptions given in *Table 4*, field investigation, and study of aerial color and infrared photos.

3. The hydrologic condition was determined to be poor based on 30 ground surveys conducted on the alluvium (*Table 4*). Ground cover ranged between 5 and 30 percent. Results of these surveys were assumed to be representative of all subbasins. This assumption was verified by study of aerial photos and field investigations. Because of the very steep slopes and minimal or nonexistent soil, bedrock areas have less vegetation than alluvial areas; therefore, the hydrologic condition of the bedrock areas was also classified as poor.

According to the CCRFCD Manual, curve numbers for precipitation losses should be determined assuming an antecedent moisture condition of II (AMC-II). Antecedent moisture condition is dependent on the antecedent rainfall. The antecedent rainfall is the amount of rainfall between 5 and 30 days preceding a flood-producing storm. AMC-I assumes the soil is dry, and AMC-III assumes the soil is near or at saturation; AMC-II is halfway between AMC-I and AMC-III. The CCRFCD Manual designates AMC-II because data required to determine the antecedent moisture condition for an entire area are not quantifiable.

Assuming AMC-II, curve numbers for the alluvium and bedrock were 77 and 88, respectively. The curve number for each subbasin was determined by taking the weighted average between the percentage of alluvium and bedrock present in each subbasin. Curve numbers for each subbasin for AMC-I, AMC-II, and AMC-III are listed in *Table 3*. Hydrologic models in this study developed to estimate the 2-year and 10-year discharges assumed the antecedent moisture conditions were AMC-II. The 100-year hydrologic models developed for this study assumed conditions ranging between AMC-II and AMC-III. The results from all the models and the justification for varying the curve numbers per antecedent moisture conditions are addressed in Section 3.4, *Hydrology Discussion*.

3.1.4 *Lag Time*

In the SCS unit hydrograph method, only 1 input parameter, the lag time, is required. The CCRFCD Manual uses the lag time equation from the U.S. Bureau of Reclamation (Cudworth, 1989) for subbasins greater than 1-square mile:

$$TLag = 20K_n\left(\frac{LL_c}{S^{1/2}}\right)^{1/3}$$

where:

TLag = the lag time (hours) between the center of mass of rainfall excess and the peak of the unit hydrograph.

K_n = the Manning roughness factor (dimensionless) for the basin channels.

L = the length of the longest watercourse (miles) within the subbasin.

L_c = the length along the longest watercourse (miles) measured upstream to a point opposite the centroid of the basin.

S = the average slope of the longest watercourse (feet per mile).

As indicated in the CCRFCD Manual, K_n is subjective. Therefore, criteria listed in Table 604 in the CCRFCD Manual (Table 5) are recommended and were used for this study. Characteristics of the subbasins fell halfway between the "n" value description for 0.03 and 0.05. Parameters used to determine the lag time are listed in Table 6. The L and S values for each subbasin were determined using a map wheel on the watershed maps (*Sheets 1* and *2*). The L_c value was determined using a planimeter to find the centroid of each subbasin. A point on the longest watercourse of each subbasin which was closest to the respective centroid was selected.

3.1.5 *Channel Routing*

The Muskingum routing method was used for routing reaches. This routing method requires three parameters: x, K, and the integer step. The weighting factor (x) expresses the amount of attenuation of the flood wave within the reach (Dunne and Leopold, 1978), and was determined using criteria cited by Cudworth (1989). The Muskingum coefficient (K) accounts for the translation of the peak flow for the entire channel reach. This storage constant K is directly related to the length and the average velocity of the reach. The average channel velocity is determined using the Manning Equation. The Manning roughness coefficient was chosen based on field observations. Channel geometry was determined through field measurements. (The integer step and routing reach were determined so that the total travel time through the reach would be equal to K.) Only three reaches were routed in the models. Table 7 lists the routing parameters for these reaches.

Transmission losses for the routing reaches are ignored in the models. Variability of infiltration rates along a channel reach can be extensive; thus, these losses over an entire reach are difficult to quantify. Ignoring these losses adds another conservative assumption into the model.

3.2 Hydrologic Models

Seven hydrologic models were developed using the HEC-1 computer program to determine discharges for this flood assessment (Table 8). All the models have the same hydrologic parameters, with the exception of point precipitation values and curve numbers. The differences between the models are explained in each model description (*Table 8*). Output from the seven hydrologic models are located in Appendix A.

3.2.1 *Model Layout*

The overall watershed that could impact the RWMS was divided into 16 subbasins to provide discharges at key concentration points. Figure 8 is a schematic showing how the subbasins were connected in the HEC-1 models. The model layout was the same for all models.

Table 5. Lag Equation Roughness Factors (CCRFCD Manual, 1990 [reference USACE, Los Angeles District, 1982]). Characteristics of the subbasins fell halfway between the 0.030 and 0.50 "n" values.

Watershed Characteristics	Roughness Factor, K_n
Urbanized Areas: Water courses in the drainage area consist of street, storm sewer, and improved channels.	0.015
Natural Areas: Water courses in the drainage area are well defined, unimproved channels or washes. Watershed has minimal vegetation.	0.030
Natural Areas: Water courses in the drainage area are not well defined, and consist of many small rills and braided wash areas. Runoff from area combines slowly into channels. Includes mountainous channels with large boulders and flow restrictions.	0.050

Table 6. Lag Time Parameters. Parameters used to calculate lag times.

Watershed Name	L (mi)	Lc (mi)	S (ft/mi)	Kn	Lag Time (hrs)
MM1A	0.87	0.64	97.7	0.04	0.31
BW1	18.60	11.50	143.0	0.04	2.07
BW2	6.50	3.10	251.5	0.04	0.87
MM1B	2.46	0.72	71.9	0.04	0.48
MM2	2.16	1.33	215.3	0.04	0.47
HP1A	1.33	0.83	503.8	0.04	0.30
HP1B	2.54	1.33	173.2	0.04	0.51
HP2	2.58	1.55	242.2	0.04	0.51
HP3	3.79	2.27	459.1	0.04	0.59
HP4	3.18	1.70	415.1	0.04	0.52
HP5	1.48	0.64	378.4	0.04	0.30
HP6	3.37	1.74	332.3	0.04	0.55
HPFA	1.44	0.53	121.5	0.04	0.33
HPFB	2.08	0.80	103.4	0.04	0.44
SC1	18.10	10.60	106.1	0.04	2.10
SC2	2.69	0.85	119.0	0.04	0.48

NOTE:

$$TLag = 20K_n\left(\frac{LL_c}{S^{1/2}}\right)$$

where:

TLag = the lag time (hours) between the center of mass of rainfall excess and the peak of the unit hydrograph.

K_n = the Manning roughness factor (dimensionless) for the basin channels.

L = the length of the longest watercourse (miles) within the subbasin.

L_c = the length along the longest watercourse (miles) measured upstream to a point opposite the centroid of the basin.

S = the average slope of the longest watercourse (feet per mile).

Table 7. Routing Parameters. The Muskingum routing method was used for routing reaches.

Reach name	Integer Step	Storage Constant (K)	Weighting Factor (X)
HP1A to CPA	9	0.43	0.2
HP6 to CPD	5	0.27	0.2
CPD to CPE	8	0.39	0.2

NOTE:

Integer Step: The integer step is the number of subreaches for the Muskingum routing.

Storage Constant (K): The Muskingum "K" coefficient is the travel time (hours) through the reach.

Weighting Factor (X): The weighting factor expresses the amount of attentuation of the flood wave within the reach.

Table 8. Hydrologic Models. Hydrologic models were developed for the 2-year, 10-year, and 100-year flood events.

100-Year Hydrologic Model	
RWMS.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers were developed assuming AMC-II.
RWMSCN.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers for all basins were increased by 5 to account for an AMC greater than II.
RWMSW.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers for all basins were increased by 10 to account for AMC-III.
RWMSC.OUT	Clark County correction factors were used in conjunction with the point precipitation values taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUTassuming AMC-II.
10-Year Hydrologic Model	
RWMS10.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUTassuming AMC-II.
RWMS10C.OUT	Clark County correction factors were used in conjunction with the point precipitation values taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUTassuming AMC-II.
2-Year Hydrologic Model	
RWMS2.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUTassuming AMC-II. No correction factor to the 2-year point precipitation values from the NOAA Atlas 2, Volume VII, is required by the CCRFCD Manual.

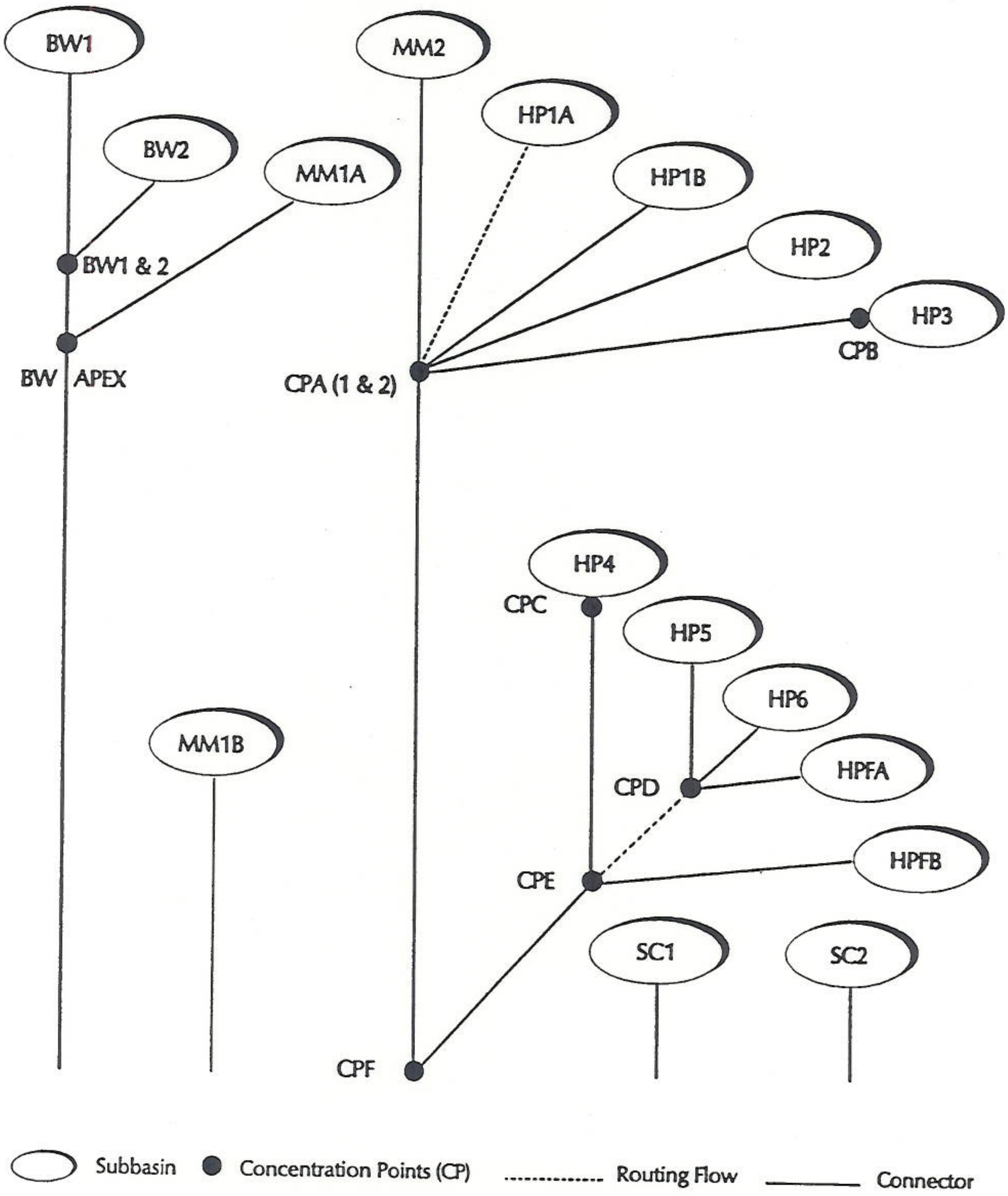


Figure 8. Schematic Diagram of Stream Network. This diagram shows how the 16 subbasins were combined in the HEC-1 models.

Conservative assumptions which simplified the model layout were made regarding routing and combining subbasins. For example, subbasins BW1, BW2, and MM1A within the HEC-1 models were considered to combine at the same point (*Figure 8*), but MM1A actually combines with the Barren Wash subbasins (BW1 and BW2) approximately 2,000 feet downstream. The HEC-1 models demonstrated little attenuation and translation of peak flows through this short reach; therefore, combining these basins without routing simplified the model and provided an additional conservative assumption to the model. Also, subbasins were combined along the perimeter of the RWMS without routing. First, flows from Concentration Point A (CPA1) were combined with flows from CPB; then flows from CPC and CPE were combined; and finally flows from CPA (1 and 2), CPC, and CPE were combined at CPF (*Figure 8*). CPF is located downstream from the RWMS. Again, the attenuation and translation of the peak flows as modeled using HEC-1 were minimal and, by combining the subbasins as shown on *Figure 8*, the models were simplified and conservative.

Another conservative assumption pertaining to subbasin HPFB was made in the model layout for a part of this subbasin that drains directly towards CPE. Difficulty in determining the percentage of discharge that could reach the RWMS from this subbasin led to the assumption that the entire subbasin would drain towards the RWMS.

Figure 8 shows flow from BW Apex, MM1B, SC1, and SC2 not connected to the major concentration points. Flow from BW Apex was not connected because flow from this drainage does not currently impact the RWMS; however, channel avulsions can potentially occur during a flood, thus directing flow towards the RWMS. This potential is addressed in Section 4.2, *Results and Discussion of Flood Hazard Determination*. Subbasin MM1B encompasses the Barren Wash Alluvial Fan, and flow that falls directly onto the fan would not drain towards the RWMS.

Subbasin SC1 is the Scarp Canyon watershed. The concentration point for this watershed is the apex of the Scarp Canyon alluvial fan. Flow from this watershed does not impact the RWMS, as shown in the Section 4.2, *Results and Discussion of Flood Hazard Determination*. Subbasin SC2 is a portion of the nonactive fan surface composed of sediments deposited by the Scarp Canyon channel. Because the channel has become entrenched and has extended the active apex approximately 2.5 miles down the existing fan surface, runoff from this surface would be sheetflow and, as indicated by the topography (*Figure 3* and *Sheet 2*), drains away from the RWMS.

3.2.2 *Concentration Points*

The concentration point locations were determined to provide discharges at the most appropriate location for the hydraulic analysis (*Figures 3* and *4* and *Sheets 1* and *2*). Concentration points were selected for sheetflow locations and at the active apexes of the alluvial fans. In the case of sheetflow, with the exception of CPC and CPD, the concentration points were spread across the area of potential flood impact with the RWMS. CPC was selected where all water from subbasin HP4 would be funneled southwest between subbasins HP4 and HPFB towards the RWMS. CPD was selected where water from subbasins HP5, HP6, and HPFA would be concentrated together before being routed to CPE.

3.3 Hydrology Results

Discharges of key concentration points from the seven models used in this analysis are listed in Table 9.

Table 9. Discharges From HEC-1 Models at Key Concentration Points

Concentration Point	DA (mi^2)	100-Year Discharges (cfs)				10-Year Discharges (cfs)		2-Year Discharges (cfs)
		RWMS.OUT	RWMSCN.OUT	RWMSW.OUT	RWMSC.OUT	RWMS10.OUT	RWMS10C.OUT	RWMS2.OUT
BWAPX*	82.20	1,848	3,513	6,018	5,498	510	1,083	22
CPA1	4.40	459	786	1,229	1,297	130	278	15
CPA2	6.10	659	1,126	1,757	1,827	187	399	23
CPB	1.70	263	420	624	661	87	170	14
CPC	3.30	360	626	984	1,060	88	210	8
CPD	3.70	333	570	884	945	90	199	10
CPE	8.60	603	1,180	1,819	1,898	168	335	9
CPF	14.70	878	1,462	2,396	2,462	301	576	25
SC1APX**	39.40	1,251	2,178	3,498	3,438	356	769	15

*Barren Wash Apex
**Scarp Canyon Apex

NOTE: Discharge outputs are from the HEC-1 model and do not incorporate significant figures.

Discharges from the models RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT (2-year, 10-year, and 100-year discharges, respectively) were used in the analysis to determine the flood hazard zones for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans. Discharges from RWMSW.OUT were used to evaluate the 100-year sheetflow and shallow concentrated flow that could impact the RWMS. Justification for choosing these models is discussed in the following section.

3.4 Hydrology Discussion

Although only three models were used in the flood assessment, a total of seven models were developed and evaluated in this study. A two-step approach was used to select the appropriate models for the 2-year, 10-year, and 100-year discharges. The following paragraphs provide a description of this approach.

The first step focused on the hydrologic model (HEC-1) for the 2-year flood. In arid regions, such as the RWMS location, it is common that no flow will occur in washes for several years; therefore, the 2-year model-generated discharges for the subbasins should be close to zero. The 2-year discharges from RWMS2.OUT (*Table 9*) were low, less than 25 cubic feet per second. These discharges from RWMS2.OUT appear reasonable so no other model was developed for the 2-year flood.

To verify the model-generated discharges for the 10-year and 100-year floods, another step was required. This step compared the skew coefficient developed from model-generated discharges and the regional skew coefficient (Water Resource Council [WRC] 17B, 1981). If the hydrologic models are producing reasonable discharges, then the skew coefficient from these models should be close to the regional skew coefficient.

A major assumption in using skew coefficients is that the relationship between discharge and return period must follow a Log-Pearson Type III (LPIII) probability distribution, as specified in WRC (1981). The FEMA FAN computer program (1990) contains a subroutine that calculates skew coefficients using a least-square fit and a LPIII probability distribution. This program calculated skew coefficients for specific concentration points using model-generated discharges. This program requires discharges for a minimum of three return periods to calculate the skew coefficient. (In this analysis the 2-year, 10-year, and 100-year model-generated discharges were entered into the FAN program.)

WRC (1981) contains a map which shows the regional skew coefficients for the country (Figure 9). According to the information on this map, the skew coefficient for washes on the NTS should be near zero. A zero skew coefficient means that if discharge versus probability were plotted on log-probability paper, then the flood frequency curve would plot as a log-normal distribution (a straight line). Preliminary results from a study by the USGS using stream gage data gathered after 1981 also support a zero skew for this region (Hjalmarson [personal communication], 1992).

The first three models that were evaluated using the skew comparison approach were RWMS2.OUT, RWMS10.OUT, and RWMS.OUT (Model Set 1). These models were developed using the noncorrected precipitation values from NOAA Atlas 2, Volume VII (1973) and followed the methods in CCRFCD Manual for the remaining input parameters. Discharges at the apexes of the Barren Wash, Halfpint, and Scarp Canyon alluvial fans were evaluated. Discharges at these apexes were entered into the FAN program to determine the skew coefficients. The skew coefficients, as shown in Table 10, were negative and were not close to zero. The discharges

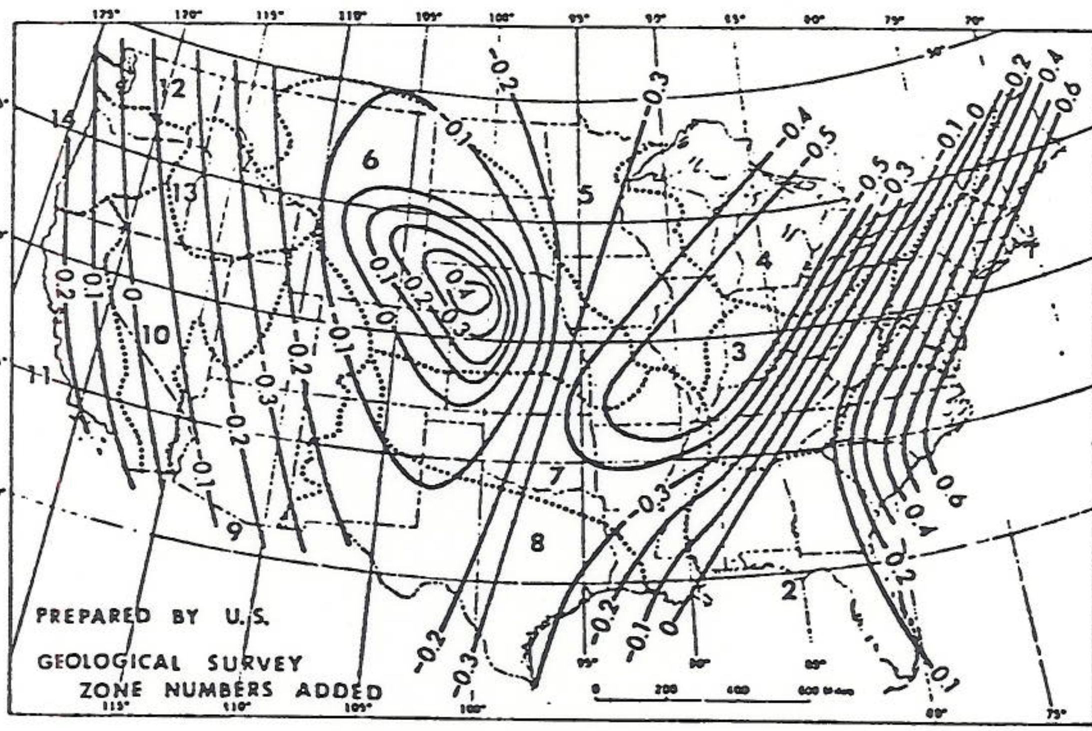


Figure 9. **Generalized U.S. Skew Coefficients (WRC [1981]).** The Nevada Test Site is located in an area with a zero skew coefficient value.

Table 10. Skew Coeffieicnts From Different Model Sets. Model Set 3 generated skew coefficients closest to zero for the three apexes.

Apex Locations	Model Set 1	Model Set 2	Model Set 3	Model Set 4
Barren Wash	−1.2	−0.6	−0.1	−1.2
Scarp Canyon	−1.2	−0.7	−0.3	−1.3
Halfpint	−1.1	−0.4	0.1	−1.0

Return Period	Model Set 1	Model Set 2	Model Set 3	Model Set 4
2–Year Model	RWMS2.OUT	RWMS2.OUT	RWMS2.OUT	RWMS2.OUT
10–Year Model	RWMS10.OUT	RWMS10.OUT	RWMS10.OUT	RWMS10C.OUT
100–Year Model	RWMS.OUT	RWMSCN.OUT	RWMSW.OUT	RWMSC.OUT

in this set must be adjusted to move the skew coefficients closer to zero. The 2–year model (RWMS.OUT2) was determined to generate reasonable results; therefore, adjustment must occur either to the 10–year, 100–year or both models.

The 10–year and 100–year hydrologic models could be modified by adjusting the curve numbers, depth of precipitation, or lag times. Of these three parameters, curve numbers have the widest variability because they are dependent on antecedent moisture conditions, as indicated in *Table 3.* Curve numbers for the subbasin in this study (*Table 3*) can range in the 50's and 60's under dry soil conditions (AMC–I) to the high 80's and low 90's (AMC–III) for saturated conditions. The CCRFCD Manual assumes AMC–II because antecedent moisture conditions for a drainage basin are impossible to quantify and a standard approach is required in Clark County to assure consistent analysis and design in drainage facilities and structures. The assumption of AMC–II may be reasonable for the 2–year flood event, as reflected in RWMS2.OUT, but may not be for the 10–year and 100–year flood events. For 10–year floods or greater, the antecedent moisture condition as well as rainfall may contribute to flooding.

Precipitation depth and lag times are not as variable. Variation from the precipitation depths in NOAA Atlas 2, Volume VII is not supportable because analysis of precipitation data in the study area (French, 1983; and Barker [personal communication], 1992) do not vary substantially from the values in NOAA Atlas 2, Volume VII, and any variation to precipitation data would be difficult to support. Variability in lag time is limited because three of the four parameters (L, L_c, and S) are measured from a topographic map, and significant variations in the K_n are not defensible using the methods described in the CCRFCD Manual (*Table* 5). Therefore, the curve numbers in the models were considered the most reasonable parameter to modify.

Modification of curve numbers in the 100–year model were evaluated first. Two additional 100–year models were created from the original 100–year model (RWMS.OUT): RWMSCN.OUT and RWMSW.OUT. In RWMSCN. OUT, curve numbers were 5 greater than the original model, and in RWMSW.OUT, curve numbers were 10 greater than the original model. Increasing the curve numbers by 5 assumes an antecedent moisture condition between AMC–II and AMC–III; increasing the curve numbers by 10 assumes AMC–III.

Using these models, two additional model sets were developed with these two models: Model Set 2 (RWMS2.OUT, RWMS10.OUT, and RWMSCN.OUT) and Model Set 3 (RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT). The 2-year, 10-year, and 100-year discharges for each model set were entered into the FAN program. The skew coefficients of the apexes of the three fans were closer to zero (*Table 10*). Model Set 3 generated skew coefficients closest to zero for the three apexes. These models from Model Set 3 were used to define the 100-year flood hazards in this flood assessment.

The 10-year model was not modified because an increase in the curve numbers would require a corresponding increase in the curve numbers for the 100-year model to maintain a zero skew. Assuming AMC-III (saturated conditions), the discharges generated from RWMSW.OUT are at their upper limit; therefore, an increase in curve numbers for the 10-year model would result in a negative skew.

Additional HEC-1 models were developed using the precipitation correction factors in the CCRFCD Manual required to the 10-year and 100-year precipitation depths (*Table 1)*. Two additional models were necessary: RWMS10C.OUT and RWMSC.OUT. The skew coefficient using discharges from the models RWMS2.OUT, RWMS10C.OUT, and RWMSC.OUT (Model Set 4) were calculated and are listed in *Table 10.*

Adjusting the curve numbers for the 100-year event and not using precipitation correction factors varies from the methods given in the CCRFCD Manual, but the 100-year discharges generated using this approach (RWMSW.OUT) are comparable to 100-year discharges from the model (RWMSC.OUT). Plus, the skew coefficients calculated using RWMSW.OUT for the 100-year discharges (Model Set 3) are closer to zero than the model following CCRFCD Manual criteria (Model Set 4). For these reasons, Model Set 3 was used in this flood assessment instead of Model Set 4.

As a result of this two-step approach to determine the appropriate hydrologic models, seven models were developed but only three models (RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT) were used in determining the flood hazard of the RWMS and HWSU facilities.

4.0 HYDRAULICS AND FLOOD HAZARD DETERMINATION

The RWMS and HWSU are located in an arid region where traditional approaches to define flood hazards (e.g., the hydraulic model HEC-2, which assumes a stable and fixed channel geometry) may not be appropriate for all types of flooding. Potential flooding of the RWMS and HWSU can occur as alluvial fan flooding, shallow concentrated flow, and sheetflow. FEMA has developed methodology to determine the 100-year flood hazards from these types of flooding. FEMA methodology was used to delineate the flood hazards impacting the RWMS and HWSU per 40 CFR 270.14. This section provides:

- a brief description of the FEMA methodology used to evaluate alluvial fan flooding, shallow concentrated flow, and sheetflow;
- the results and discussion of the flood hazard evaluation; and
- flood hazard maps.

4.1 Hydraulics and Flood Hazard Determination Methodology

4.1.1 FEMA Alluvial Fan Methodology

Flooding from the Barren Wash, Scarp Canyon, and Halfpint alluvial fans could impact these facilities. Hydraulic processes on alluvial fans are different than in riverine channels. Alluvial fan flooding, as described by FEMA (1991), ". . . is characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flowpaths." Channel geometry and direction on alluvial fans can change in direct response to a flood discharge. Field investigations and study of topographic maps and aerial photos of the Barren Wash, Scarp Canyon, and Halfpint alluvial fans support this description because flowpaths are unpredictable, soil development is weak, and evidence of recent erosion and deposition is present.

FEMA (1991) states that if flowpaths below the active apex cannot be predicted (which is the case for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans), the FEMA Alluvial Fan Methodology must be applied to evaluate the 100-year flood hazard. This methodology, which is a modification of the method proposed by Dawdy (1979), relates probability of discharges at the apex to probability of channel depths and flow velocities that occur on the alluvial fan.

According to Dawdy (1979), flood flow from the apex of a typical alluvial fan does not spread evenly over the fan surface, but is instead confined to a surface or channel that carries the flood waters from the apex to the toe of the fan (Figure 10). The active apex is selected at the point where the flowpath becomes unpredictable, and flow is no more likely to follow an existing channel than create a new path. In the upper region of an alluvial fan, flow is confined to a single channel where the depth and width of the channel is a function of the flow itself. In general, flow occurs at critical depth and velocity as a result of steep slopes associated with this upper region. As slopes decrease towards the mid and distal parts of the fans, channel bifurcation can occur resulting in a multiple-channel region. Dawdy (1979) did not incorporate a multiple-channel region into his methodology. FEMA (1985, 1991) modified the Dawdy methodology to address multiple-channel regions of alluvial fans.

Key assumptions of the FEMA Alluvial Fan Methodology follow (French, 1989):

1. The location of the flood event channel on the fan surface is random. Furthermore, the probability of the channel passing through any given point on a contour is uniform.

2. Flow occurs in flow-formed channels. Well-defined channels result from the subsequent erosion from this process.

    a. Incised channels do not exist previous to the first flow event.

    b. Existing channel capacity is not adequate to convey the flow, and overbank flooding occurs.

3. The width and depth of the channel is a function of discharge.

4. Transmission losses are not considered.

5. On-fan precipitation is not considered.

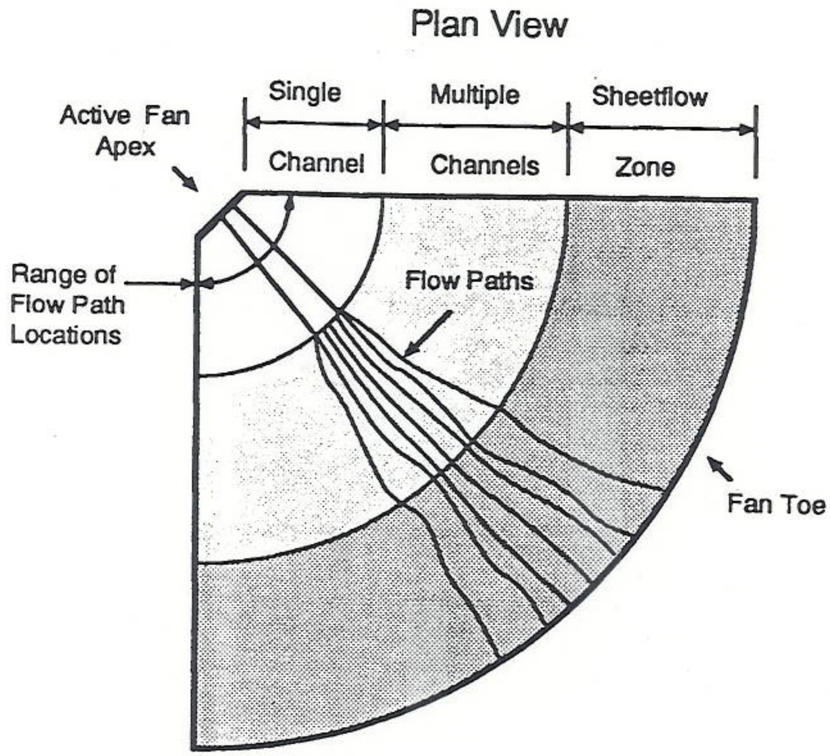


Figure 10. Alluvial Fan Plan View (modified from French, 1989). Plan view of an idealized alluvial fan showing the single channel, multiple channel, and sheetflow regions.

6. The alluvial fan is active; e.g., net deposition is occurring in both time and space and avulsions (the migration of channel from one location to another during a single event) are occurring.

7. Flood discharge frequency distribution must be available at the apex of the alluvial fan.

Field observations, a study of topographic and geologic maps, aerial photographs, and examination of historic records were made during the flood assessment of these alluvial fans. Sources of flooding were defined, an apex selected, active fan boundaries delineated, entrenched reaches of channels located and measured, and locations of barriers to flow determined.

The methodology used for defining flood hazards on alluvial fans incorporates FEMA's computer model, FAN (1990). Delineation of the 100-year flood hazard using the FEMA FAN Model requires the following parameters and assumptions:

- Discharge information
- Apex location
- Fan boundaries and dimensions
- Potential flow obstructions and/or diversions
- Multiple channel region parameters:
  - Manning roughness coefficient
  - Slope

The FAN model requires that at least three discharges of different return periods be used to define the flood hazard zones. The 2-year, 10-year, and 100-year flood discharges for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans were taken from the HEC-1 models labeled RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT, respectively (*Table 9*). Discharges calculated by the HEC-1 models for CPBWAPEX or CPBW1&BW2 (*Figure 8*), whichever were greater, were used as the discharges at the apex of the Barren Wash Alluvial Fan in the FAN model. Discharges used in the FAN model for Scarp Canyon were taken from the HEC-1 models at the active apex of Scarp Canyon (Subbasin SC2). Discharges for Halfpint Alluvial Fan were taken from CPE as calculated within the HEC-1 model, and were assumed to have originated from the fan apex. All approaches for selecting discharges at the apexes are considered to be conservative.

Apex locations and fan boundaries were determined from aerial photographs; available topographic, geologic, and surficial maps; and field investigations. Apexes were located using the FEMA definition for an active apex. Location of the apexes for Barren Wash, Scarp Canyon, and Halfpint alluvial fans are shown in Figure 11 and Sheet 3.

Potential flow obstructions and diversions such as roads, buildings and other structures which can prevent flooding in some areas and increase flooding in others must be designated. In this flood assessment, all barriers such as Mercury Highway, 5-01 road, all secondary roads, the nonengineered berms surrounding the RWMS perimeter, and all disturbed areas diverting flow away from the RWMS were ignored. Quantification of the diversion would be difficult. Assuming that all flow can reach the RWMS produces a more conservative flood analysis.

A Manning roughness coefficient of 0.030 was used for the multiple-channel regions of all three fans. The Manning roughness coefficient for the multiple-channel regions of the fan were

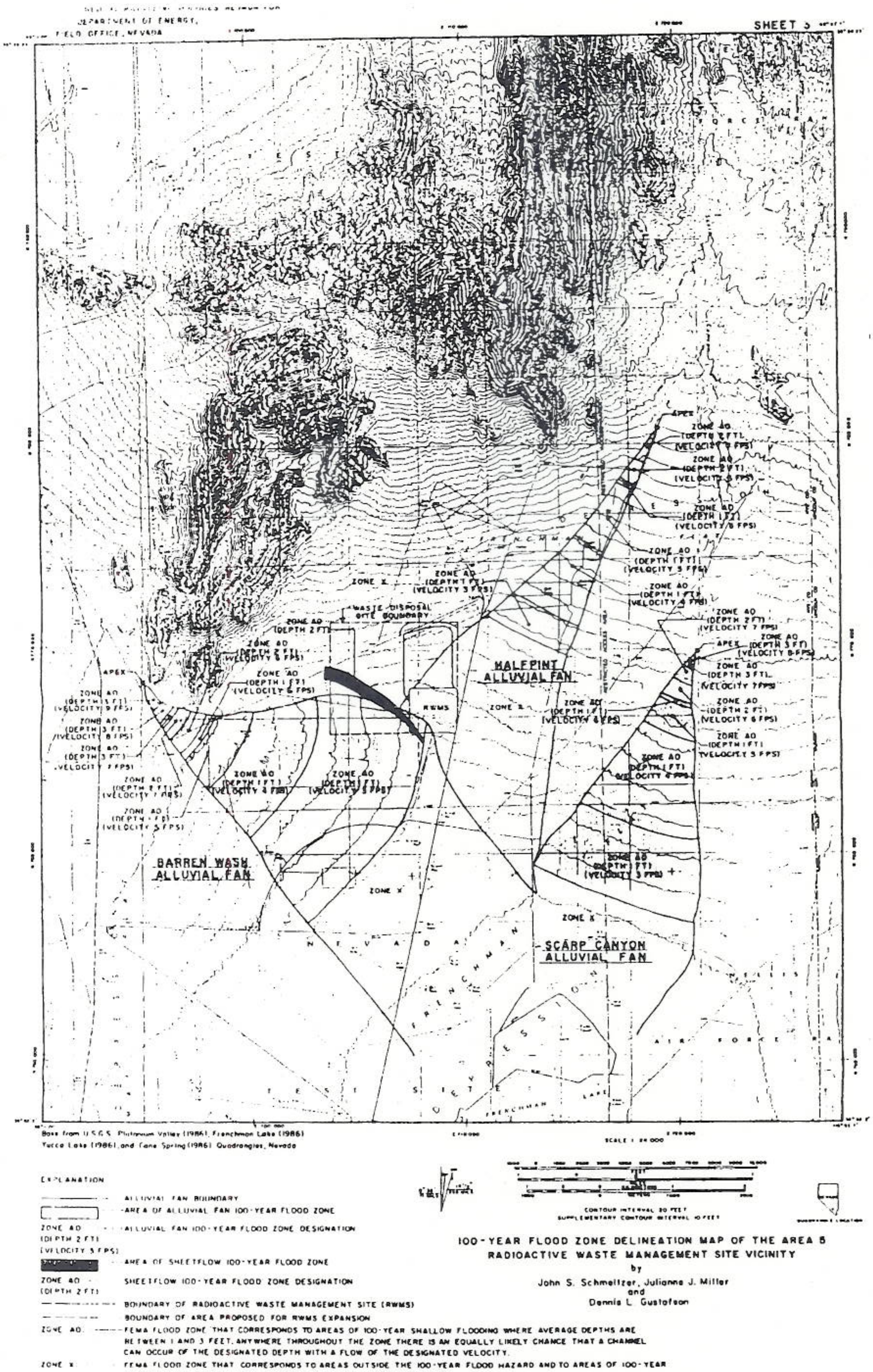


Figure 11. 100-Year Flood Zone Delineation Map of the Area 5 Radioactive Waste Management Site Vicinity (Sheet 3)

determined from field observations, and confirmed using the descriptions and values found in tables developed by Chow (1959). Slope of the fans for the multiple-channel region parameters were determined from the 1:6,000 orthophotos with a 10-foot contour interval.

4.1.2 Shallow Concentrated Flow

For subbasins MM2 and HP1B, a defined natural drainage exists that traverses the southwest corner of the RWMS. Field investigation of the geomorphology and a study of aerial photos suggest that shallow concentrated flow occurs through this reach and that standard hydraulic analysis may be appropriate. The 100-year flood hazard elevation of this drainage was estimated using the HEC-2 computer program (COE, 1990), a standard hydraulic method. HEC-2 is a hydraulic model developed by the COE and is used by FEMA to delineate flood hazards of channelized flow. The input requirements of the HEC-2 model include channel cross section information; distances between cross sections; and Manning roughness coefficient. Cross section information and distances were taken from a 1:4,800 topographic map with a 5-foot contour interval (Appendix C contains HEC-2 output, work map and cross sections) in conjunction with field observations and measurements. As in the alluvial fan analysis, Manning roughness coefficients were estimated from field observations, and confirmed using the descriptions and values found in tables developed by Chow (1959).

4.1.3 Sheetflow

According to FEMA (1991), sheetflow

> . . . is the broad, relatively unconfined downslope movement of water across sloping terrain that results from . . . a channel that crosses a drainage divide, . . . and overflow from a perched channel onto . . . plains of lower elevations . . . . [Sheetflow] is typical in areas of low topographic relief and poorly established drainage systems . . . . Shallow flooding is often characterized by poorly defined channels and highly unpredictable flow direction because of low relief or shifting channels and debris loads. Where such conditions exist, the entire area susceptible to this unpredictable flow should be delineated as an area of equal risk. Small-scale topographic relief that is not evident on existing topographic mapping and that might lead to "islands" of one flood hazard zone within larger areas of another should be ignored.

This definition of sheetflow describes the distributary-flow system (hydraulic engineering viewpoint) areas that drain from the Halfpint Range towards the RWMS. With current elevation information (10-foot contour interval) on available orthophotos, a detailed assessment of the flood hazard was not possible because of the inability to distinguish channels and nonchannel regions; therefore, per FEMA (1991) the 100-year flood hazard of this area was analyzed assuming that the entire area is prone to flooding and is delineated as an area of equal risk. Geomorphologic evidence gathered from analysis of color and infrared aerial photos and field observations supports this assumption because these areas have weak soil development and relatively few areas of relic deposits covered by desert pavement with desert varnish.

4.2 Results and Discussion of Flood Hazard Determination

Using the methods described in the previous section, the 100-year flood hazard areas were defined on the topographic maps (*Figure 11* and *Sheet 3*). Zone AO and Zone X were used to denote the flood hazards in the vicinity of the RWMS.

FEMA designates alluvial fan, shallow concentrated flow, and sheetflow areas with a 100-year flood depth of greater than 1 foot as a Zone AO. FEMA (1990) defines Zone AO as the area of 100-year shallow flooding where average depths are between 1 and 3 feet. For alluvial fans, anywhere throughout the zone there is a probability of 0.01 that a channel can occur at the designated depth with flow at the designated velocity. Zone X, shown on *Figure 11* and *Sheet 3* and Figure 12 and Sheet 4, represents areas outside the 100-year flood hazard and/or areas of the 100-year shallow flooding (sheetflow or shallow concentrated flow) where average depths are less than 1 foot. A Zone X delineation does not mean that floods will not occur within this zone. For this reason, flood hazard protection must be addressed.

4.2.1 Alluvial Fan Flooding

The 100-year flood hazard zones for the Barren Wash, Scarp Canyon, and the Halfpint fans are shown on *Figure 11* and *Sheet 3*. The 100-year flood hazard for the RWMS and its immediate vicinity is also shown on an 1:6,000 orthophoto (*Figure 12* and *Sheet 4*).

Using the FEMA Fan Methodology, the southwest corner of the RWMS is within the 100-year flood hazard zone, designated as Zone AO; depth 1 foot; velocity 3 feet per second, of the Barren Wash Alluvial Fan. The part of the RWMS that is located within Zone AO of this alluvial fan is not included in the RCRA Part B Permit Application for the Area 5 RWMS because it is not used for storage or disposal of hazardous, mixed, or radioactive waste. This designation means that the southwest corner of the RWMS has a probability of 0.01 (a 100-year event) to be impacted by channelized flow averaging 1 foot of depth and having a velocity of 3 feet per second. The HWSU is not within the 100-year flood hazard of the Barren Wash Alluvial Fan.

Neither the RWMS nor the HWSU are located within the 100-year flood hazard of the Halfpint Alluvial Fan (100-year flow depths 1 foot or greater), but are located in the Zone X area of the Halfpint Alluvial Fan (100-year flow depths less than 1 foot). This study determined that 100-year flow from the Scarp Canyon Alluvial Fan does not impact the RWMS or HWSU. Appendix B contains the output of the FAN model results.

The review of field data; topographic, geologic, and surficial maps; and aerial photographs does not invalidate the assumptions of the FEMA Alluvial Fan Methodology. However, other methods for determining flood hazards in arid regions are currently being developed. At the time of the writing of this report, none of these other methods have been adopted by FEMA; therefore, the FEMA methods were the only methods used. For example, French (1992) argues that the FEMA assumption of an uniform probability of a channel being formed on any given contour may not be valid. As a result of analyzing channel orientation of over 90 alluvial fans in the United States, French found that fanhead channels tend to form along or near the centerline of alluvial fans (an imaginary line which bisects the alluvial fan from the apex to the toe of the alluvial fan). In his study, French modified the FEMA Alluvial Fan Methodology to incorporate this tendency. Using French's approach, the flood hazard potential from the Barren Wash Alluvial Fan is less than the potential determined from the FEMA methodology because the RWMS is located adjacent to the north boundary of the fan.

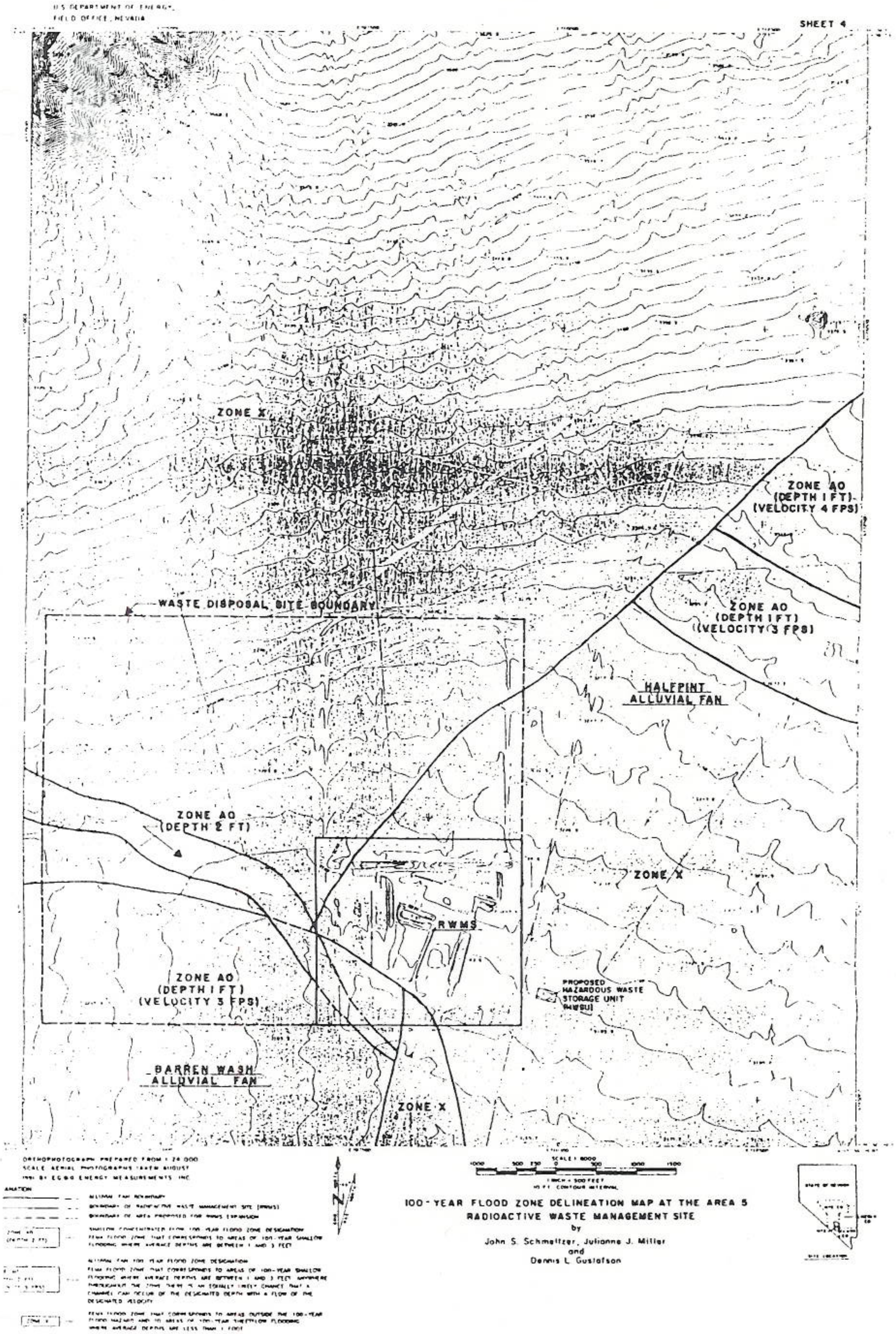


Figure 12. Orthophoto With Fans (Sheet 4)

4.2.2 Shallow Concentrated Flooding

Results of the HEC-2 analysis for the watercourses draining subbasins MM2 and HP1A&B estimated the 100-year flow depths at 2 feet. The southwest corner of the site is also located within the 100-year flood hazard of this drainage, and is designated as Zone AO; depth 2 feet (*Figure 11* and *Sheet 3*). Again, this portion of the RWMS is not used for disposal of waste and is not included in the RCRA Part B Permit Application for the Area 5 RWMS. Appendix C contains the output of the HEC-2 model, the workmap, and cross sections used to analyze this drainage.

4.2.3 Sheetflow

FEMA (1991) usually describes areas that experience sheetflow as Zone X (an area of flooding with depths less than 1 foot). Calculations to determine the average 100-year depths for sheetflow areas support this assertion. Calculated depths within the proposed RWMS boundary and the HWSU were all less than 1 foot. These facilities are not in a 100-year flood hazard from flow draining from the Massachusetts Mountains/Halfpint Range. Appendix D contains the calculations used to estimate the depth of flow in sheetflow regions.

Several measures were taken to assure that this flood assessment would be as conservative as reasonable. Discharges were calculated using a "state-of-the-art" approach for this region (i.e., CCRFCD Manual). All flow barriers such as roads, structures and existing nonengineered dikes were ignored to assume that all flow could reach the RWMS. The entire area was assumed to be prone to flooding and was delineated as an area of equal risk because of the inability to distinguish channels from the available topographic maps.

A Zone X designation is somewhat misleading. Although FEMA requires flood protection only for areas listed as Zone AO, a flood hazard must still be recognized within a Zone X. The sheetflow region to the north of the RWMS contains channels which range in depth up to 3 feet. FEMA (1991) states that discharge in sheetflow regions must be spread equally over the entire surface area. To the north of the RWMS, this results in average flow depths of less than 1 foot, and thus the designation of Zone X. Field observations of channels within this region indicate that flows greater than 1 foot could occur in these channels during a 100-year flood. Any type of flood protection design criteria must address the potential of channelized flow for this area.

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HEC-1 MODEL OUTPUT

FILENAME: RWMSCN.OUT

(100-YEAR MODEL)

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*              VERSION 4.0              *
*                                       *
* RUN DATE  01/29/1993  TIME  21:56:35  *
*                                       *
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*                                       *
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*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
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X     X  X        X                X
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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

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 1     ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMS.DAT
 2     ID   100-YEAR 6-HOUR STORM 1.6 INCHES
 3     ID   POINT RAINFALL VALUES FORM NOAA ATLAS 2 VOL VII
 4     ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
 5     ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
 6     ID   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
 7     ID   LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
 8     ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
 9     ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
       *DIAGRAM
10     IT      3       0       0     300
11     IO      5
12     IN      5
13     JD    1.6     .01
       * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
14     PC      0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
15     PC   13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
16     PC   19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
17     PC   25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
18     PC   49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
19     PC   86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
20     PC   98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
21     PC   99.8    99.9   100.0
22     JD   1.55       1
23     JD   1.38    9.99
       * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
24     JD   1.38   10.01
25     PC      0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
26     PC   18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
27     PC   25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
28     PC   32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
29     PC   56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
30     PC   81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
31     PC   97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
32     PC   99.7    99.9   100.0
33     JD   1.26      20
34     JD   1.18      30
35     JD   1.09      50
36     JD    .96     100

37     KK   MM1A
38     KM   Basin runoff calculation for Mass. Mountains 1A
39     BA     .9
40     LS             80
41     UD    .31

42     KK    BW1
43     KM    Basin runoff calculation for Barren Wash 1
44     BA   60.5
45     LS             83
46     UD    2.1
```

```
KK     BW2
KM     Basin runoff calculation for Barren Wash 2
BA    20.8
LS              80
UD      .9

KK   BW1&2
KM   Combined BW1 and BW2
HC      2

KK BW APX
KM  Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
HC      2

KK    MM1B
KM    Basin runoff calulation for Mass. Mountains 1B
*  Flow was not combined with BW APX because flow from this watershed
*  will not directly impact RWMS wereas a channel migration at the apex
*  could impact the RWMS
BA    2.1
LS              77
UD     .48

KK    MM2
KM    Basin runoff calculation for Mass. Mountains 2
BA    1.4
LS              79
UD     .47

KK    HP1A
KM    Basin runoff calculation for Half Pint Range 1A
BA      .8
LS              85
UD     .48

KK   RTCPA
KM   Route Flow from HP1A to CPA
RM      9      .43      .2

KK    HP1B
KM    Basin runoff calculation for Half Pint Range 1B
BA    1.0
LS              78
UD     .51

KK    HP2
KM    Basin runoff calculation for Half Pint Range 2
BA    1.2
LS              78
UD     .51

KK    CPA1
KM    Combine MM2, routed HP1A, HP1B, HP2
HC      4

KK     HP3
KM     (CPB) Basin runoff calculation for Half Pint Range 3
BA     1.7
LS              82
UD     .59

KK    CPA2
KM    Combine HP3 with flow from CPA1
HC      2

KK     HP4
KM     (CPC) Basin runoff calculation for Half Pint Range 4
BA     3.3
LS              79
UD     .52

KK     HP5
KM     Basin runoff calculation for Half Pint Range 5
BA     1.2
LS              79
UD      .3

KK     HP6
KM     Basin runoff calculation for Half Pint Range 6
BA     2.2
LS              80
UD     .55

KK   RTCPD
KM    Route HP6 to CPD
RM      5      .27      .2
```

```
KK     HPFA
KM      Basin runoff calculation for Half Pint Range FA
BA       .3
LS                 77
UD      .33

KK      CPD
KM      Combine HP5, routed HP6, and HPFA
HC        3

KK    RTCPE
KM      Route flow from CPD to CPE
RM        8      .39       .2

KK     HPFB
KM      Basin runoff calculation for Half Pint Range FB
BA      1.6
LS                 77
UD      .44

KK      CPE
KM     Combine HP4 (CPC) with routed flow from CPD, and HPFB
HC        3

KK      CPF
KM     Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
HC        2

KK      SC1
KM      Basin runoff calculation for Scarp Canyon 1
* Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
BA     39.4
LS                 82
UD      2.1

KK      SC2
KM      Basin runoff calculation for Scarp Canyon 2
BA      1.5
LS                 77
UD      .48
ZZ
```

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

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

   37        MM1A
                .
                .
   42           .         BW1
                .           .
                .           .
   47           .           .         BW2
                .           .           .
                .           .           .
   52           .       BW1&2............
                .           .
                .           .
   55      BW APX............
                .
                .
   58           .        MM1B
                .           .
                .           .
   63           .           .         MM2
                .           .           .
                .           .           .
   68           .           .           .        HP1A
                .           .           .           V
                .           .           .           V
   73           .           .           .       RTCPA
                .           .           .           .
                .           .           .           .
   76           .           .           .           .        HP1B
                .           .           .           .           .
                .           .           .           .           .
   81           .           .           .           .           .         HP2
                .           .           .           .           .           .
                .           .           .           .           .           .
   86           .           .        CPA1....................................
                .           .           .
                .           .           .
   89           .           .           .         HP3
                .           .           .           .
                .           .           .           .
   94           .           .        CPA2............
                .           .           .
                .           .           .
   97           .           .           .         HP4
                .           .           .           .
                .           .           .           .
  102           .           .           .           .         HP5
                .           .           .           .           .
                .           .           .           .           .
  107           .           .           .           .           .         HP6
                .           .           .           .           .           V
                .           .           .           .           .           V
  112           .           .           .           .           .       RTCPD
                .           .           .           .           .           .
                .           .           .           .           .           .
  115           .           .           .           .           .           .        HPFA
                .           .           .           .           .           .           .
                .           .           .           .           .           .           .
  120           .           .           .           .         CPD........................
                .           .           .           .           V
                .           .           .           .           V
  123           .           .           .           .       RTCPE
                .           .           .           .           .
                .           .           .           .           .
  126           .           .           .           .           .        HPFB
                .           .           .           .           .           .
                .           .           .           .           .           .
  131           .           .           .         CPE........................
                .           .           .           .
                .           .           .           .
  134           .           .         CPF............
                .           .           .
                .           .           .
  137           .           .           .         SC1
                .           .           .           .
                .           .           .           .
  142           .           .           .           .         SC2

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****************************************                    ****************************************
*                                       *                    *                                      *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                    *  U.S. ARMY CORPS OF ENGINEERS        *
*           SEPTEMBER 1990              *                    *  HYDROLOGIC ENGINEERING CENTER       *
*            VERSION 4.0                *                    *       609 SECOND STREET              *
*                                       *                    *    DAVIS, CALIFORNIA 95616           *
* RUN DATE  01/29/1993  TIME  21:56:35  *                    *       (916) 756-1104                 *
*                                       *                    *                                      *
*****************************************                    ****************************************


                       FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMS.DAT
                       100-YEAR 6-HOUR STORM 1.6 INCHES
                       POINT RAINFALL VALUES FORM NOAA ATLAS 2 VOL VII
                       DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                       CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
                       CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
                       LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
                       DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                       THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

   IT           HYDROGRAPH TIME DATA
                       NMIN          3  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1   0  ENDING DATE
                     NDTIME       1457  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .05 HOURS
                      TOTAL TIME BASE   14.95 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

 13 JD          INDEX STORM NO. 1
                       STRM       1.60  PRECIPITATION DEPTH
                       TRDA        .01  TRANSPOSITION DRAINAGE AREA

 14 PI           PRECIPITATION PATTERN
                    1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                     .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                     .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                     .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                     .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                     .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                    1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                    2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                     .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                     .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                     .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                     .06       .06       .06       .14       .18       .00       .02       .06       .06       .06

 22 JD          INDEX STORM NO. 2
                       STRM       1.55  PRECIPITATION DEPTH
                       TRDA       1.00  TRANSPOSITION DRAINAGE AREA

  0 PI           PRECIPITATION PATTERN
                    1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                     .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                     .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                     .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                     .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                     .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                    1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                    2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                     .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                     .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                     .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                     .06       .06       .06       .14       .18       .00       .02       .06       .06       .06
```

23 JD INDEX STORM NO. 3

STRM 1.38 PRECIPITATION DEPTH

TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

24 JD INDEX STORM NO. 4

STRM 1.38 PRECIPITATION DEPTH

TRDA 10.01 TRANSPOSITION DRAINAGE AREA

25 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

33 JD INDEX STORM NO. 5

STRM 1.26 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 6

STRM 1.18 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 7

STRM 1.09 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 8

STRM .96 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	174.	3.80	30.	12.	12.	.90		
+	HYDROGRAPH AT	BW1	1786.	6.35	961.	405.	405.	60.50		
+	HYDROGRAPH AT	BW2	1016.	5.40	389.	156.	156.	20.80		
+	2 COMBINED AT	BW1&2	1848.	5.95	1003.	421.	421.	81.30		
+	2 COMBINED AT	BW APX	1841.	5.95	1004.	421.	421.	82.20		
+	HYDROGRAPH AT	MM1B	200.	4.05	47.	19.	19.	2.10		
+	HYDROGRAPH AT	MM2	184.	4.00	41.	16.	16.	1.40		
+	HYDROGRAPH AT	HP1A	200.	3.95	42.	17.	17.	.80		
+	ROUTED TO	RTCPA	190.	4.40	42.	17.	17.	.80		
+	HYDROGRAPH AT	HP1B	116.	4.05	27.	11.	11.	1.00		
+	HYDROGRAPH AT	HP2	136.	4.05	32.	13.	13.	1.20		
+	4 COMBINED AT	CPA1	459.	4.15	120.	48.	48.	4.40		
+	HYDROGRAPH AT	HP3	263.	4.10	64.	26.	26.	1.70		
+	2 COMBINED AT	CPA2	659.	4.15	170.	68.	68.	6.10		
+	HYDROGRAPH AT	HP4	360.	4.05	86.	35.	35.	3.30		
+	HYDROGRAPH AT	HP5	206.	3.80	36.	14.	14.	1.20		
+	HYDROGRAPH AT	HP6	277.	4.10	67.	27.	27.	2.20		
+	ROUTED TO	RTCPD	268.	4.35	67.	27.	27.	2.20		
+	HYDROGRAPH AT	HPFA	41.	3.85	8.	3.	3.	.30		
+	3 COMBINED AT	CPD	333.	4.25	99.	40.	40.	3.70		
+	ROUTED TO	RTCPE	326.	4.65	99.	40.	40.	3.70		
+	HYDROGRAPH AT	HPFB	167.	4.00	37.	15.	15.	1.60		
+	3 COMBINED AT	CPE	603.	4.20	191.	77.	77.	8.60		
+	2 COMBINED AT	CPF	878.	5.15	301.	121.	121.	14.70		
+	HYDROGRAPH AT	SC1	1251.	6.35	673.	283.	283.	39.40		
+	HYDROGRAPH AT	SC2	151.	4.05	35.	14.	14.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS.OUT

(100-YEAR MODEL)

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*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*           SEPTEMBER 1990              *
*             VERSION 4.0               *
*                                       *
* RUN DATE  01/29/1993  TIME  21:59:18  *
*                                       *
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*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*        609 SECOND STREET              *
*     DAVIS, CALIFORNIA 95616           *
*        (916) 756-1104                 *
*                                       *
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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
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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

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ID     FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMSCN.DAT
ID     100-YEAR 6-HOUR STORM 1.6 INCHES
ID     POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
ID     DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
ID     CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MODEL (CCRFCD, 1990)
ID     CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
ID     LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
ID     DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
ID     THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
ID     ADJUSTED CURVE NUMBERS BY 5 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR EV
*DIAGRAM
IT        3        0        0      300
IO        5
IN        5
JD      1.6      .01
* RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
PC        0        2      5.7      7.0      8.7     10.8     12.4     13.0     13.0     13.0
PC     13.0     13.0     13.0     13.3     14.0     14.2     14.8     15.8     17.2     18.1
PC     19.0     19.7     19.9     20.0     20.1     20.4     21.4     22.9     24.1     24.9
PC     25.1     25.6     27.0     27.8     28.1     28.3     29.5     32.2     35.2     40.9
PC     49.9     59.0     71.0     74.4     78.1     81.2     81.9     83.5     85.1     85.6
PC     86.0     86.8     87.6     88.8     91.0     92.6     93.7     95.0     97.0     97.6
PC     98.2     98.5     98.7     98.9     99.0     99.3     99.3     99.4     99.5     99.8
PC     99.8     99.9    100.0
JD     1.55        1
JD     1.38     9.99
* CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
JD     1.38    10.01
PC        0      2.0      5.9      8.0     11.0     14.4     15.0     16.0     16.8     17.1
PC     18.0     18.2     18.7     19.0     19.7     20.2     21.0     22.0     23.0     24.1
PC     25.0     25.9     26.5     28.0     29.0     30.0     30.5     30.9     31.0     31.7
PC     32.1     32.7     33.3     34.6     36.1     38.1     40.8     43.0     47.7     51.4
PC     56.1     63.0     71.0     72.0     73.1     75.2     77.9     79.0     79.5     80.4
PC     81.0     82.0     82.6     84.0     85.9     88.9     91.0     93.8     96.6     97.0
PC     97.4     97.9     98.1     98.3     98.5     98.9     99.0     99.2     99.3     99.6
PC     99.7     99.9    100.0
JD     1.26       20
JD     1.18       30
JD     1.09       50
JD      .96      100

KK     MM1A
KM     Basin runoff calculation for Mass. Mountains 1A
BA       .9
LS                 85
UD      .31

KK      BW1
KM      Basin runoff calculation for Barren Wash 1
BA     60.5
LS                 88
UD      2.1
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```
KK     BW2
KM      Basin runoff calculation for Barren Wash 2
BA     20.8
LS               85
UD        .9

KK    BW1&2
KM    Combined BW1 and BW2
HC        2

KK   BW APX
KM    Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
HC        2

KK     MM1B
KM     Basin runoff calulation for Mass. Mountains 1B
*    Flow was not combined with BW APX because flow from this watershed
*    will not directly impact RWMS wereas a channel migration at the apex
*    could impact the RWMS
BA      2.1
LS               82
UD      .48

KK      MM2
KM     Basin runoff calculation for Mass. Mountains 2
BA      1.4
LS               84
UD      .47

KK     HP1A
KM     Basin runoff calculation for Half Pint Range 1A
BA       .8
LS               90
UD      .48

KK    RTCPA
KM    Route Flow from HP1A to CPA
RM        9     .43      .2

KK     HP1B
KM     Basin runoff calculation for Half Pint Range 1B
BA      1.0
LS               83
UD      .51

KK      HP2
KM     Basin runoff calculation for Half Pint Range 2
BA     1.2
LS               83
UD      .51

KK     CPA1
KM     Combine MM2, routed HP1A, HP1B, HP2
HC        4

KK      HP3
KM      (CPB) Basin runoff calculation for Half Pint Range 3
BA      1.7
LS               87
UD      .59

KK     CPA2
KM     Combine HP3 with flow from CPA1
HC        2

KK      HP4
KM      (CPC) Basin runoff calculation for Half Pint Range 4
BA      3.3
LS               84
UD      .52

KK      HP5
KM      Basin runoff calculation for Half Pint Range 5
BA      1.2
LS               84
UD       .3

KK      HP6
KM      Basin runoff calculation for Half Pint Range 6
BA      2.2
LS               85
UD      .55

KK    RTCPD
KM     Route HP6 to CPD
RM        5     .27      .2
```

```
KK    HPFA
KM     Basin runoff calculation for Half Pint Range FA
BA     .3
LS              82
UD     .33

KK     CPD
KM     Combine HP5, routed HP6, and HPFA
HC      3

KK   RTCPE
KM     Route flow from CPD to CPE
RM      8     .39       .2

KK    HPFB
KM     Basin runoff calculation for Half Pint Range FB
BA     1.6
LS              82
UD     .44

KK     CPE
KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
HC      3

KK     CPF
KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
HC      2

KK     SC1
KM     Basin runoff calculation for Scarp Canyon 1
* Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
BA    39.4
LS              87
UD     2.1

KK     SC2
KM     Basin runoff calculation for Scarp Canyon 2
BA     1.5
LS              82
UD     .48
ZZ
```

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

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

  38         MM1A
                .
                .
  43            .         BW1
                .           .
                .           .
  48            .           .         BW2
                .           .           .
                .           .           .
  53            .       BW1&2............
                .           .
                .           .
  56       BW APX............
                .
                .
  59            .        MM1B
                .           .
                .           .
  64            .           .         MM2
                .           .           .
                .           .           .
  69            .           .           .        HP1A
                .           .           .           V
                .           .           .           V
  74            .           .           .       RTCPA
                .           .           .           .
                .           .           .           .
  77            .           .           .           .        HP1B
                .           .           .           .           .
                .           .           .           .           .
  82            .           .           .           .           .         HP2
                .           .           .           .           .           .
                .           .           .           .           .           .
  87            .           .        CPA1....................................
                .           .           .
                .           .           .
  90            .           .           .         HP3
                .           .           .           .
                .           .           .           .
  95            .           .        CPA2............
                .           .           .
                .           .           .
  98            .           .           .         HP4
                .           .           .           .
                .           .           .           .
 103            .           .           .           .         HP5
                .           .           .           .           .
                .           .           .           .           .
 108            .           .           .           .           .         HP6
                .           .           .           .           .           V
                .           .           .           .           .           V
 113            .           .           .           .           .       RTCPD
                .           .           .           .           .           .
                .           .           .           .           .           .
 116            .           .           .           .           .           .        HPFA
                .           .           .           .           .           .           .
                .           .           .           .           .           .           .
 121            .           .           .           .         CPD........................
                .           .           .           .           V
                .           .           .           .           V
 124            .           .           .           .       RTCPE
                .           .           .           .           .
                .           .           .           .           .
 127            .           .           .           .           .        HPFB
                .           .           .           .           .           .
                .           .           .           .           .           .
 132            .           .           .         CPE........................
                .           .           .           .
                .           .           .           .
 135            .           .         CPF............
                .           .           .
                .           .           .
 138            .           .           .         SC1
                .           .           .           .
                .           .           .           .
 143            .           .           .           .         SC2

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE   (HEC-1)   *
*           SEPTEMBER 1990              *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  21:59:18 *
*                                       *
*****************************************

*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER       *
*         609 SECOND STREET             *
*      DAVIS, CALIFORNIA 95616          *
*          (916) 756-1104               *
*                                       *
*****************************************


                   FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMSCN.DAT
                   100-YEAR 6-HOUR STORM 1.6 INCHES
                   POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
                   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MODEL (CCRFCD, 1990)
                   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
                   LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
                   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
                   ADJUSTED CURVE NUMBERS BY 5 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR EV

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

    IT         HYDROGRAPH TIME DATA
                      NMIN           3  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1    0  ENDING DATE
                    NDTIME        1457  ENDING TIME
                     ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL     .05 HOURS
                     TOTAL TIME BASE   14.95 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

 14 JD         INDEX STORM NO. 1
                      STRM        1.60  PRECIPITATION DEPTH
                      TRDA         .01  TRANSPOSITION DRAINAGE AREA

 15 PI          PRECIPITATION PATTERN
                   1.20       1.54       2.22       1.26        .78       1.02       1.10       1.26       1.06        .96
                    .36        .24        .00        .00        .00        .00        .00        .00        .00        .00
                    .18        .26        .42        .22        .12        .36        .44        .60        .76        .84
                    .54        .54        .54        .46        .42        .12        .10        .06        .06        .06
                    .18        .32        .60        .80        .90        .72        .64        .48        .24        .12
                    .30        .48        .84        .60        .48        .18        .16        .12        .52        .72
                   1.62       1.68       1.80       2.88       3.42       5.40       5.42       5.46       6.62       7.20
                   2.04       2.10       2.22       1.98       1.86        .42        .60        .96        .96        .96
                    .30        .28        .24        .40        .48        .48        .56        .72       1.12       1.32
                    .96        .86        .66        .74        .78       1.20        .92        .36        .36        .36
                    .18        .16        .12        .12        .12        .06        .10        .18        .06        .00
                    .06        .06        .06        .14        .18        .00        .02        .06        .06        .06

 23 JD         INDEX STORM NO. 2
                      STRM        1.55  PRECIPITATION DEPTH
                      TRDA        1.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
                   1.20       1.54       2.22       1.26        .78       1.02       1.10       1.26       1.06        .96
                    .36        .24        .00        .00        .00        .00        .00        .00        .00        .00
                    .18        .26        .42        .22        .12        .36        .44        .60        .76        .84
                    .54        .54        .54        .46        .42        .12        .10        .06        .06        .06
                    .18        .32        .60        .80        .90        .72        .64        .48        .24        .12
                    .30        .48        .84        .60        .48        .18        .16        .12        .52        .72
                   1.62       1.68       1.80       2.88       3.42       5.40       5.42       5.46       6.62       7.20
                   2.04       2.10       2.22       1.98       1.86        .42        .60        .96        .96        .96
                    .30        .28        .24        .40        .48        .48        .56        .72       1.12       1.32
                    .96        .86        .66        .74        .78       1.20        .92        .36        .36        .36
                    .18        .16        .12        .12        .12        .06        .10        .18        .06        .00
                    .06        .06        .06        .14        .18        .00        .02        .06        .06        .06
```

```
24 JD         INDEX STORM NO. 3
                    STRM       1.38  PRECIPITATION DEPTH
                    TRDA       9.99  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
                  1.20    1.54    2.22    1.26     .78    1.02    1.10    1.26    1.06     .96
                   .36     .24     .00     .00     .00     .00     .00     .00     .00     .00
                   .18     .26     .42     .22     .12     .36     .44     .60     .76     .84
                   .54     .54     .54     .46     .42     .12     .10     .06     .06     .06
                   .18     .32     .60     .80     .90     .72     .64     .48     .24     .12
                   .30     .48     .84     .60     .48     .18     .16     .12     .52     .72
                  1.62    1.68    1.80    2.88    3.42    5.40    5.42    5.46    6.62    7.20
                  2.04    2.10    2.22    1.98    1.86     .42     .60     .96     .96     .96
                   .30     .28     .24     .40     .48     .48     .56     .72    1.12    1.32
                   .96     .86     .66     .74     .78    1.20     .92     .36     .36     .36
                   .18     .16     .12     .12     .12     .06     .10     .18     .06     .00
                   .06     .06     .06     .14     .18     .00     .02     .06     .06     .06

25 JD         INDEX STORM NO. 4
                    STRM       1.38  PRECIPITATION DEPTH
                    TRDA      10.01  TRANSPOSITION DRAINAGE AREA

26 PI            PRECIPITATION PATTERN
                  1.20    1.58    2.34    1.62    1.26    1.80    1.88    2.04     .92     .36
                   .60     .56     .48     .28     .18     .54     .40     .12     .24     .30
                   .18     .26     .42     .34     .30     .48     .52     .60     .60     .60
                   .66     .62     .54     .54     .54     .36     .54     .90     .70     .60
                   .60     .50     .30     .26     .24     .06     .18     .42     .30     .24
                   .36     .36     .36     .64     .78     .90    1.00    1.20    1.48    1.62
                  1.32    1.82    2.82    2.42    2.22    2.82    3.26    4.14    4.58    4.80
                   .60     .62     .66    1.06    1.26    1.62    1.30     .66     .42     .30
                   .54     .48     .36     .52     .60     .36     .52     .84    1.04    1.14
                  1.80    1.62    1.26    1.54    1.68    1.68    1.20     .24     .24     .24
                   .30     .24     .12     .12     .12     .12     .16     .24     .12     .06
                   .12     .10     .06     .14     .18     .06     .08     .12     .08     .06

34 JD         INDEX STORM NO. 5
                    STRM       1.26  PRECIPITATION DEPTH
                    TRDA      20.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
                  1.20    1.58    2.34    1.62    1.26    1.80    1.88    2.04     .92     .36
                   .60     .56     .48     .28     .18     .54     .40     .12     .24     .30
                   .18     .26     .42     .34     .30     .48     .52     .60     .60     .60
                   .66     .62     .54     .54     .54     .36     .54     .90     .70     .60
                   .60     .50     .30     .26     .24     .06     .18     .42     .30     .24
                   .36     .36     .36     .64     .78     .90    1.00    1.20    1.48    1.62
                  1.32    1.82    2.82    2.42    2.22    2.82    3.26    4.14    4.58    4.80
                   .60     .62     .66    1.06    1.26    1.62    1.30     .66     .42     .30
                   .54     .48     .36     .52     .60     .36     .52     .84    1.04    1.14
                  1.80    1.62    1.26    1.54    1.68    1.68    1.20     .24     .24     .24
                   .30     .24     .12     .12     .12     .12     .16     .24     .12     .06
                   .12     .10     .06     .14     .18     .06     .08     .12     .08     .06

35 JD         INDEX STORM NO. 6
                    STRM       1.18  PRECIPITATION DEPTH
                    TRDA      30.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
                  1.20    1.58    2.34    1.62    1.26    1.80    1.88    2.04     .92     .36
                   .60     .56     .48     .28     .18     .54     .40     .12     .24     .30
                   .18     .26     .42     .34     .30     .48     .52     .60     .60     .60
                   .66     .62     .54     .54     .54     .36     .54     .90     .70     .60
                   .60     .50     .30     .26     .24     .06     .18     .42     .30     .24
                   .36     .36     .36     .64     .78     .90    1.00    1.20    1.48    1.62
                  1.32    1.82    2.82    2.42    2.22    2.82    3.26    4.14    4.58    4.80
                   .60     .62     .66    1.06    1.26    1.62    1.30     .66     .42     .30
                   .54     .48     .36     .52     .60     .36     .52     .84    1.04    1.14
                  1.80    1.62    1.26    1.54    1.68    1.68    1.20     .24     .24     .24
                   .30     .24     .12     .12     .12     .12     .16     .24     .12     .06
                   .12     .10     .06     .14     .18     .06     .08     .12     .08     .06

36 JD         INDEX STORM NO. 7
                    STRM       1.09  PRECIPITATION DEPTH
                    TRDA      50.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
                  1.20    1.58    2.34    1.62    1.26    1.80    1.88    2.04     .92     .36
                   .60     .56     .48     .28     .18     .54     .40     .12     .24     .30
                   .18     .26     .42     .34     .30     .48     .52     .60     .60     .60
                   .66     .62     .54     .54     .54     .36     .54     .90     .70     .60
                   .60     .50     .30     .26     .24     .06     .18     .42     .30     .24
                   .36     .36     .36     .64     .78     .90    1.00    1.20    1.48    1.62
                  1.32    1.82    2.82    2.42    2.22    2.82    3.26    4.14    4.58    4.80
                   .60     .62     .66    1.06    1.26    1.62    1.30     .66     .42     .30
                   .54     .48     .36     .52     .60     .36     .52     .84    1.04    1.14
                  1.80    1.62    1.26    1.54    1.68    1.68    1.20     .24     .24     .24
                   .30     .24     .12     .12     .12     .12     .16     .24     .12     .06
                   .12     .10     .06     .14     .18     .06     .08     .12     .08     .06
```

37 JD INDEX STORM NO. 8

STRM .96 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	284.	3.75	47.	19.	19.	.90		
+	HYDROGRAPH AT	BW1	3190.	6.15	1762.	745.	745.	60.50		
+	HYDROGRAPH AT	BW2	1645.	4.40	678.	273.	273.	20.80		
+	2 COMBINED AT	BW1&2	3513.	5.75	1943.	817.	817.	81.30		
+	2 COMBINED AT	BW APX	3506.	5.75	1948.	819.	819.	82.20		
+	HYDROGRAPH AT	MM1B	361.	4.00	78.	31.	31.	2.10		
+	HYDROGRAPH AT	MM2	311.	3.95	65.	26.	26.	1.40		
+	HYDROGRAPH AT	HP1A	300.	3.95	62.	25.	25.	.80		
+	ROUTED TO	RTCPA	284.	4.35	62.	25.	25.	.80		
+	HYDROGRAPH AT	HP1B	200.	4.00	44.	18.	18.	1.00		
+	HYDROGRAPH AT	HP2	235.	4.00	52.	21.	21.	1.20		
+	4 COMBINED AT	CPA1	786.	4.10	194.	78.	78.	4.40		
+	HYDROGRAPH AT	HP3	420.	4.10	99.	40.	40.	1.70		
+	2 COMBINED AT	CPA2	1126.	4.10	274.	110.	110.	6.10		
+	HYDROGRAPH AT	HP4	626.	4.00	139.	56.	56.	3.30		
+	HYDROGRAPH AT	HP5	345.	3.75	56.	23.	23.	1.20		
+	HYDROGRAPH AT	HP6	465.	4.05	106.	42.	42.	2.20		
+	ROUTED TO	RTCPD	449.	4.30	106.	42.	42.	2.20		
+	HYDROGRAPH AT	HPFA	71.	3.80	12.	5.	5.	.30		
+	3 COMBINED AT	CPD	570.	4.20	161.	64.	64.	3.70		
+	ROUTED TO	RTCPE	558.	4.55	161.	64.	64.	3.70		
+	HYDROGRAPH AT	HPFB	299.	3.95	61.	25.	25.	1.60		
+	3 COMBINED AT	CPE	1108.	4.15	319.	128.	128.	8.60		
+	2 COMBINED AT	CPF	1462.	4.10	513.	206.	206.	14.70		
+	HYDROGRAPH AT	SC1	2178.	6.15	1201.	508.	508.	39.40		
+	HYDROGRAPH AT	SC2	269.	4.00	58.	23.	23.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMSW.OUT

(100-YEAR MODEL)

```
*****************************************                    ***************************************
*                                       *                    *                                     *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                    *  U.S. ARMY CORPS OF ENGINEERS       *
*          SEPTEMBER 1990               *                    *  HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0                 *                    *        609 SECOND STREET            *
*                                       *                    *     DAVIS, CALIFORNIA 95616         *
*  RUN DATE  01/29/1993  TIME  22:01:21 *                    *        (916) 756-1104               *
*                                       *                    *                                     *
*****************************************                    ***************************************
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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
     1     ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMSW.DAT
     2     ID   100-YEAR 6-HOUR STORM 1.6 INCHES
     3     ID   POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
     4     ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
     5     ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MAUAL (CCRFCD, 1990)
     6     ID   CURVE NUMBER DETERMINED USING TABLE 602 IN CCRFCD, 1990
     7     ID   LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
     8     ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
     9     ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
    10     ID   ADJUSTED CURVE NUMBERS BY 10 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR E
           *DIAGRAM
    11     IT       3       0       0     300
    12     IO       5
    13     IN       5
    14     JD     1.6     .01
           * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
    15     PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
    16     PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
    17     PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
    18     PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
    19     PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
    20     PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
    21     PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
    22     PC    99.8    99.9   100.0
    23     JD    1.55       1
    24     JD    1.38    9.99
           * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
    25     JD    1.38   10.01
    26     PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
    27     PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
    28     PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
    29     PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
    30     PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
    31     PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
    32     PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
    33     PC    99.7    99.9   100.0
    34     JD    1.26      20
    35     JD    1.18      30
    36     JD    1.09      50
    37     JD     .96     100

    38     KK    MM1A
    39     KM   Basin runoff calculation for Mass. Mountains 1A
    40     BA      .9
    41     LS              90
    42     UD     .31

    43     KK     BW1
    44     KM     Basin runoff calculation for Barren Wash 1
    45     BA    60.5
    46     LS              93
    47     UD     2.1
```

```
KK    BW2
KM    Basin runoff calculation for Barren Wash 2
BA   20.8
LS             90
UD     .9

KK   BW1&2
KM   Combined BW1 and BW2
HC      2

KK   BW APX
KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
HC      2

KK    MM1B
KM    Basin runoff calulation for Mass. Mountains 1B
*    Flow was not combined with BW APX because flow from this watershed
*    will not directly impact RWMS wereas a channel migration at the apex
*    could impact the RWMS
BA    2.1
LS             87
UD    .48

KK    MM2
KM    Basin runoff calculation for Mass. Mountains 2
BA    1.4
LS             89
UD    .47

KK    HP1A
KM    Basin runoff calculation for Half Pint Range 1A
BA     .8
LS             95
UD    .48

KK   RTCPA
KM   Route Flow from HP1A to CPA
RM      9     .43       .2

KK    HP1B
KM    Basin runoff calculation for Half Pint Range 1B
BA    1.0
LS             88
UD    .51

KK    HP2
KM    Basin runoff calculation for Half Pint Range 2
BA    1.2
LS             88
UD    .51

KK    CPA1
KM    Combine MM2, routed HP1A, HP1B, HP2
HC      4

KK     HP3
KM     (CPB) Basin runoff calculation for Half Pint Range 3
BA     1.7
LS             92
UD     .59

KK    CPA2
KM    Combine HP3 with flow from CPA1
HC      2

KK     HP4
KM     (CPC) Basin runoff calculation for Half Pint Range 4
BA     3.3
LS             89
UD     .52

KK     HP5
KM     Basin runoff calculation for Half Pint Range 5
BA     1.2
LS             89
UD      .3

KK     HP6
KM     Basin runoff calculation for Half Pint Range 6
BA     2.2
LS             90
UD     .55

KK   RTCPD
KM    Route HP6 to CPD
RM      5     .27       .2
```

```
KK    HPFA
KM     Basin runoff calculation for Half Pint Range FA
BA      .3
LS              87
UD     .33

KK     CPD
KM     Combine HP5, routed HP6, and HPFA
HC      3

KK   RTCPE
KM     Route flow from CPD to CPE
RM      8      .39       .2

KK     HPFB
KM     Basin runoff calculation for Half Pint Range FB
BA     1.6
LS              87
UD     .44

KK     CPE
KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
HC      3

KK     CPF
KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
HC      2

KK     SC1
KM     Basin runoff calculation for Scarp Canyon 1
* Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
BA    39.4
LS              92
UD     2.1

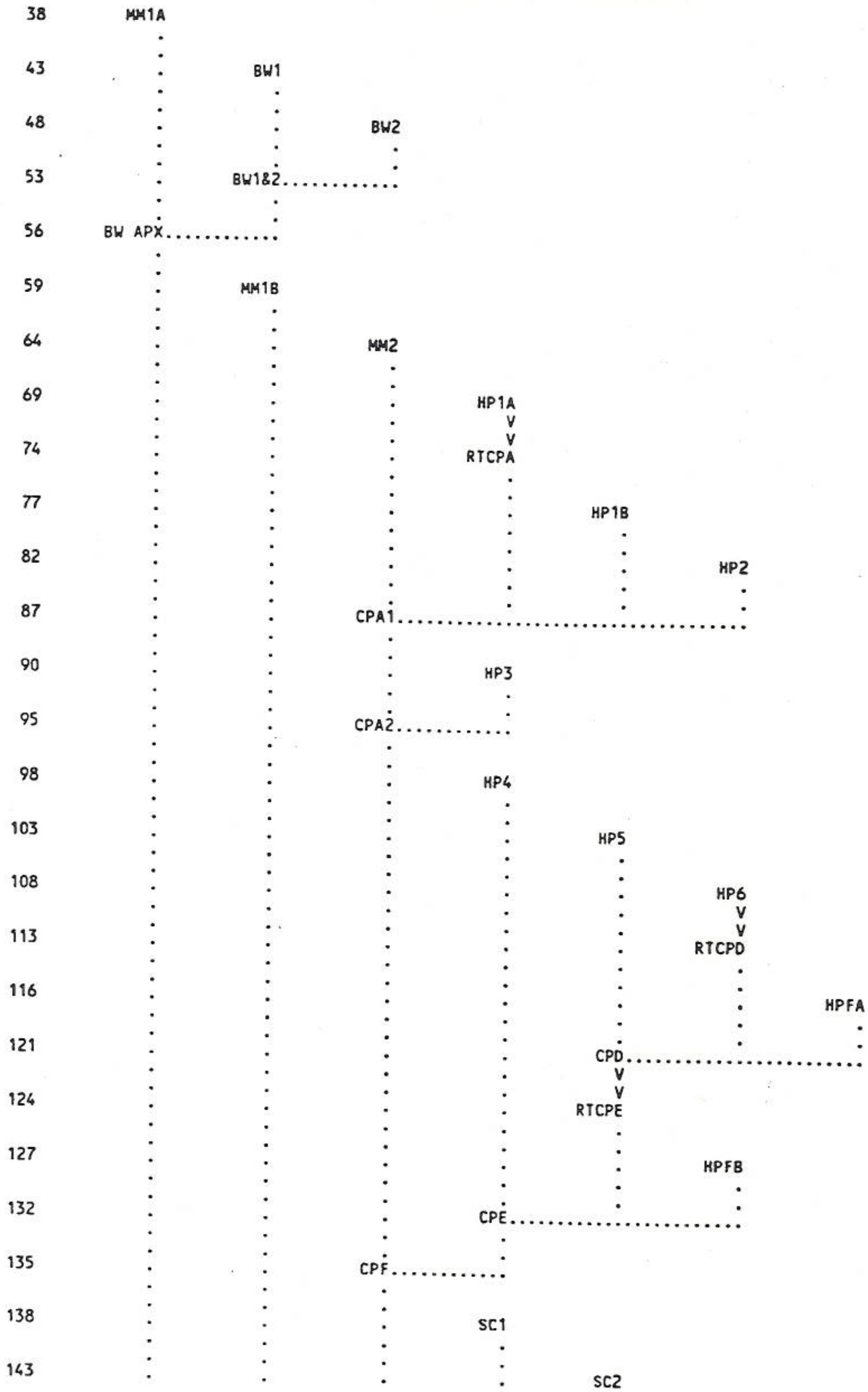
KK     SC2
KM     Basin runoff calculation for Scarp Canyon 2
BA     1.5
LS              87
UD     .48
ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.

(V) ROUTING (--->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************                         ****************************************
*                                       *                         *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                         *   U.S. ARMY CORPS OF ENGINEERS      *
*            SEPTEMBER 1990             *                         *   HYDROLOGIC ENGINEERING CENTER     *
*              VERSION 4.0              *                         *        609 SECOND STREET           *
*                                       *                         *     DAVIS, CALIFORNIA 95616        *
*  RUN DATE  01/29/1993  TIME  22:01:21 *                         *         (916) 756-1104             *
*                                       *                         *                                      *
*****************************************                         ****************************************


                          FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMSW.DAT
                          100-YEAR 6-HOUR STORM 1.6 INCHES
                          POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
                          DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                          CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MAUAL (CCRFCD, 1990)
                          CURVE NUMBER DETERMINED USING TABLE 602 IN CCRFCD, 1990
                          LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
                          DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                          THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
                          ADJUSTED CURVE NUMBERS BY 10 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR E

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

    IT            HYDROGRAPH TIME DATA
                         NMIN          3  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1   0  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      1   0  ENDING DATE
                       NDTIME       1457  ENDING TIME
                        ICENT         19  CENTURY MARK

                   COMPUTATION INTERVAL    .05 HOURS
                        TOTAL TIME BASE  14.95 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

  14 JD            INDEX STORM NO. 1
                         STRM       1.60  PRECIPITATION DEPTH
                         TRDA        .01  TRANSPOSITION DRAINAGE AREA

  15 PI              PRECIPITATION PATTERN
                       1.20     1.54     2.22     1.26      .78     1.02     1.10     1.26     1.06      .96
                        .36      .24      .00      .00      .00      .00      .00      .00      .00      .00
                        .18      .26      .42      .22      .12      .36      .44      .60      .76      .84
                        .54      .54      .54      .46      .42      .12      .10      .06      .06      .06
                        .18      .32      .60      .80      .90      .72      .64      .48      .24      .12
                        .30      .48      .84      .60      .48      .18      .16      .12      .52      .72
                       1.62     1.68     1.80     2.88     3.42     5.40     5.42     5.46     6.62     7.20
                       2.04     2.10     2.22     1.98     1.86      .42      .60      .96      .96      .96
                        .30      .28      .24      .40      .48      .48      .56      .72     1.12     1.32
                        .96      .86      .66      .74      .78     1.20      .92      .36      .36      .36
                        .18      .16      .12      .12      .12      .06      .10      .18      .06      .00
                        .06      .06      .06      .14      .18      .00      .02      .06      .06      .06

  23 JD            INDEX STORM NO. 2
                         STRM       1.55  PRECIPITATION DEPTH
                         TRDA       1.00  TRANSPOSITION DRAINAGE AREA

   0 PI              PRECIPITATION PATTERN
                       1.20     1.54     2.22     1.26      .78     1.02     1.10     1.26     1.06      .96
                        .36      .24      .00      .00      .00      .00      .00      .00      .00      .00
                        .18      .26      .42      .22      .12      .36      .44      .60      .76      .84
                        .54      .54      .54      .46      .42      .12      .10      .06      .06      .06
                        .18      .32      .60      .80      .90      .72      .64      .48      .24      .12
                        .30      .48      .84      .60      .48      .18      .16      .12      .52      .72
                       1.62     1.68     1.80     2.88     3.42     5.40     5.42     5.46     6.62     7.20
                       2.04     2.10     2.22     1.98     1.86      .42      .60      .96      .96      .96
                        .30      .28      .24      .40      .48      .48      .56      .72     1.12     1.32
                        .96      .86      .66      .74      .78     1.20      .92      .36      .36      .36
                        .18      .16      .12      .12      .12      .06      .10      .18      .06      .00
                        .06      .06      .06      .14      .18      .00      .02      .06      .06      .06
```

24 JD INDEX STORM NO. 3

STRM	1.38	PRECIPITATION DEPTH
TRDA	9.99	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

25 JD INDEX STORM NO. 4

STRM	1.38	PRECIPITATION DEPTH
TRDA	10.01	TRANSPOSITION DRAINAGE AREA

26 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 5

STRM	1.26	PRECIPITATION DEPTH
TRDA	20.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 6

STRM	1.18	PRECIPITATION DEPTH
TRDA	30.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 7

STRM	1.09	PRECIPITATION DEPTH
TRDA	50.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

```
37 JD          INDEX STORM NO. 8
                     STRM          .96  PRECIPITATION DEPTH
                     TRDA       100.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
```

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	426.	3.75	70.	28.	28.	.90		
+	HYDROGRAPH AT	BW1	5241.	6.00	2989.	1289.	1289.	60.50		
+	HYDROGRAPH AT	BW2	2759.	4.35	1102.	445.	445.	20.80		
+	2 COMBINED AT	BW1&2	6018.	5.65	3425.	1462.	1462.	81.30		
+	2 COMBINED AT	BW APX	6014.	5.65	3441.	1469.	1469.	82.20		
+	HYDROGRAPH AT	MM1B	580.	3.95	120.	48.	48.	2.10		
+	HYDROGRAPH AT	MM2	477.	3.95	98.	39.	39.	1.40		
+	HYDROGRAPH AT	HP1A	423.	3.90	91.	37.	37.	.80		
+	ROUTED TO	RTCPA	401.	4.35	91.	37.	37.	.80		
+	HYDROGRAPH AT	HP1B	309.	4.00	66.	27.	27.	1.00		
+	HYDROGRAPH AT	HP2	365.	4.00	78.	32.	32.	1.20		
+	4 COMBINED AT	CPA1	1229.	4.05	298.	120.	120.	4.40		
+	HYDROGRAPH AT	HP3	624.	4.05	148.	59.	59.	1.70		
+	2 COMBINED AT	CPA2	1757.	4.05	423.	170.	170.	6.10		
+	HYDROGRAPH AT	HP4	984.	4.00	214.	86.	86.	3.30		
+	HYDROGRAPH AT	HP5	526.	3.75	85.	34.	34.	1.20		
+	HYDROGRAPH AT	HP6	711.	4.00	160.	64.	64.	2.20		
+	ROUTED TO	RTCPD	689.	4.30	160.	64.	64.	2.20		
+	HYDROGRAPH AT	HPFA	110.	3.80	19.	8.	8.	.30		
+	3 COMBINED AT	CPD	884.	4.15	246.	99.	99.	3.70		
+	ROUTED TO	RTCPE	868.	4.50	246.	99.	99.	3.70		
+	HYDROGRAPH AT	HPFB	476.	3.90	94.	38.	38.	1.60		
+	3 COMBINED AT	CPE	1819.	4.10	502.	202.	202.	8.60		
+	2 COMBINED AT	CPF	2396.	4.05	820.	330.	330.	14.70		
+	HYDROGRAPH AT	SC1	3498.	6.00	1988.	855.	855.	39.40		
+	HYDROGRAPH AT	SC2	427.	3.95	89.	36.	36.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMSC.OUT

(100-YEAR MODEL)

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****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*            SEPTEMBER 1990            *                    *   HYDROLOGIC ENGINEERING CENTER      *
*             VERSION 4.0              *                    *        609 SECOND STREET             *
*                                      *                    *     DAVIS, CALIFORNIA 95616          *
*  RUN DATE  01/29/1993  TIME  22:03:06 *                   *          (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          ID    FLOOD ASSESSMENT FOR RWMS JOB #:51056           FILE: RWMSC.DAT
   2          ID    100-YEAR 6-HOUR STORM 2.43 INCHES
   3          ID    POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
   4          ID    ADJUSTED RAINFALL PER CORRECTION FACTOR IN TABLE 501 OF
   5          ID    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
   6          ID    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN CCRFCD, 1990
   7          ID    CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
   8          ID    LAG TIMES DETERMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
   9          ID    DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
  10          ID    THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
              *DIAGRAM
  11          IT       3        0        0      300
  12          IO       5
  13          IN       5
  14          JD    2.43      .01
              * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
  15          PC       0        2      5.7      7.0      8.7     10.8     12.4     13.0     13.0     13.0
  16          PC    13.0     13.0     13.0     13.3     14.0     14.2     14.8     15.8     17.2     18.1
  17          PC    19.0     19.7     19.9     20.0     20.1     20.4     21.4     22.9     24.1     24.9
  18          PC    25.1     25.6     27.0     27.8     28.1     28.3     29.5     32.2     35.2     40.9
  19          PC    49.9     59.0     71.0     74.4     78.1     81.2     81.9     83.5     85.1     85.6
  20          PC    86.0     86.8     87.6     88.8     91.0     92.6     93.7     95.0     97.0     97.6
  21          PC    98.2     98.5     98.7     98.9     99.0     99.3     99.3     99.4     99.5     99.8
  22          PC    99.8     99.9    100.0
  23          JD    2.36        1
  24          JD    2.09     9.99
              * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
  25          JD    2.09    10.01
  26          PC       0      2.0      5.9      8.0     11.0     14.4     15.0     16.0     16.8     17.1
  27          PC    18.0     18.2     18.7     19.0     19.7     20.2     21.0     22.0     23.0     24.1
  28          PC    25.0     25.9     26.5     28.0     29.0     30.0     30.5     30.9     31.0     31.7
  29          PC    32.1     32.7     33.3     34.6     36.1     38.1     40.8     43.0     47.7     51.4
  30          PC    56.1     63.0     71.0     72.0     73.1     75.2     77.9     79.0     79.5     80.4
  31          PC    81.0     82.0     82.6     84.0     85.9     88.9     91.0     93.8     96.6     97.0
  32          PC    97.4     97.9     98.1     98.3     98.5     98.9     99.0     99.2     99.3     99.6
  33          PC    99.7     99.9    100.0
  34          JD    1.92       20
  35          JD    1.80       30
  36          JD    1.65       50
  37          JD    1.46      100

  38          KK     MM1A
  39          KM    Basin runoff calculation for Mass. Mountains 1A
  40          BA      .9
  41          LS                 80
  42          UD     .31

  43          KK     BW1
  44          KM     Basin runoff calculation for Barren Wash 1
  45          BA    60.5
  46          LS                 83
  47          UD     2.1
```

```
48        KK     BW2
49        KM      Basin runoff calculation for Barren Wash 2
50        BA     20.8
51        LS                80
52        UD       .9

53        KK   BW1&2
54        KM   Combined BW1 and BW2
55        HC       2

56        KK  BW APX
57        KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
58        HC       2

59        KK    MM1B
60        KM    Basin runoff calulation for Mass. Mountains 1B
          *   Flow was not combined with BW APX because flow from this watershed
          *   will not directly impact RWMS wereas a channel migration at the apex
          *   could impact the RWMS
61        BA     2.1
62        LS                77
63        UD      .48

64        KK     MM2
65        KM    Basin runoff calculation for Mass. Mountains 2
66        BA     1.4
67        LS                79
68        UD      .47

69        KK    HP1A
70        KM    Basin runoff calculation for Half Pint Range 1A
71        BA      .8
72        LS                85
73        UD      .48

74        KK   RTCPA
75        KM   Route Flow from HP1A to CPA
76        RM       9      .43       .2

77        KK    HP1B
78        KM    Basin runoff calculation for Half Pint Range 1B
79        BA     1.0
80        LS                78
81        UD      .51

82        KK     HP2
83        KM    Basin runoff calculation for Half Pint Range 2
84        BA    1.2
85        LS                78
86        UD      .51

87        KK    CPA1
88        KM    Combine MM2, routed HP1A, HP1B, HP2
89        HC       4

90        KK     HP3
91        KM     (CPB) Basin runoff calculation for Half Pint Range 3
92        BA     1.7
93        LS                82
94        UD      .59

95        KK    CPA2
96        KM    Combine HP3 with flow from CPA1
97        HC       2

98        KK     HP4
99        KM     (CPC) Basin runoff calculation for Half Pint Range 4
100       BA     3.3
101       LS                79
102       UD     .52

103       KK     HP5
104       KM     Basin runoff calculation for Half Pint Range 5
105       BA     1.2
106       LS                79
107       UD      .3

108       KK     HP6
109       KM     Basin runoff calculation for Half Pint Range 6
110       BA     2.2
111       LS                80
112       UD     .55

113       KK   RTCPD
114       KM    Route HP6 to CPD
115       RM       5      .27       .2
```

```
116    KK    HPFA
117    KM     Basin runoff calculation for Half Pint Range FA
118    BA      .3
119    LS              77
120    UD     .33

121    KK     CPD
122    KM     Combine HP5, routed HP6, and HPFA
123    HC       3

124    KK   RTCPE
125    KM     Route flow from CPD to CPE
126    RM      8     .39      .2

127    KK     HPFB
128    KM     Basin runoff calculation for Half Pint Range FB
129    BA     1.6
130    LS              77
131    UD     .44

132    KK     CPE
133    KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
134    HC       3

135    KK     CPF
136    KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
137    HC       2

138    KK     SC1
139    KM     Basin runoff calculation for Scarp Canyon 1
       * Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
140    BA    39.4
141    LS              82
142    UD     2.1

143    KK     SC2
144    KM     Basin runoff calculation for Scarp Canyon 2
145    BA     1.5
146    LS              77
147    UD     .48
148    ZZ
```

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

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

  38     MM1A
            .
  43        .         BW1
            .           .
  48        .           .         BW2
            .           .           .
  53        .       BW1&2............
            .           .
  56   BW APX............
            .
  59        .        MM1B
            .           .
  64        .           .         MM2
            .           .           .
  69        .           .           .        HP1A
            .           .           .           V
            .           .           .           V
  74        .           .           .       RTCPA
            .           .           .           .
  77        .           .           .           .        HP1B
            .           .           .           .           .
  82        .           .           .           .           .         HP2
            .           .           .           .           .           .
  87        .           .        CPA1....................................
            .           .           .
  90        .           .           .         HP3
            .           .           .           .
  95        .           .        CPA2............
            .           .           .
  98        .           .           .         HP4
            .           .           .           .
 103        .           .           .           .         HP5
            .           .           .           .           .
 108        .           .           .           .           .         HP6
            .           .           .           .           .           V
            .           .           .           .           .           V
 113        .           .           .           .           .       RTCPD
            .           .           .           .           .           .
 116        .           .           .           .           .           .        HPFA
            .           .           .           .           .           .           .
 121        .           .           .           .         CPD........................
            .           .           .           .           V
            .           .           .           .           V
 124        .           .           .           .       RTCPE
            .           .           .           .           .
 127        .           .           .           .           .        HPFB
            .           .           .           .           .           .
 132        .           .           .         CPE........................
            .           .           .           .
 135        .           .         CPF............
            .           .           .
 138        .           .           .         SC1
            .           .           .           .
 143        .           .           .           .         SC2

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
******************************************
*                                        *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *
*          SEPTEMBER 1990                *
*           VERSION 4.0                  *
*                                        *
*  RUN DATE  01/29/1993  TIME  22:03:06  *
*                                        *
******************************************
```

```
******************************************
*                                        *
*    U.S. ARMY CORPS OF ENGINEERS        *
*    HYDROLOGIC ENGINEERING CENTER       *
*         609 SECOND STREET              *
*      DAVIS, CALIFORNIA 95616           *
*          (916) 756-1104                *
*                                        *
******************************************
```

```
FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMSC.DAT
100-YEAR 6-HOUR STORM 2.43 INCHES
POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
ADJUSTED RAINFALL PER CORRECTION FACTOR IN TABLE 501 OF
CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN CCRFCD, 1990
CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
LAG TIMES DETERMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

    IT        HYDROGRAPH TIME DATA
                     NMIN           3  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1    0  STARTING DATE
                    ITIME        0000  STARTING TIME
                       NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1    0  ENDING DATE
                   NDTIME        1457  ENDING TIME
                    ICENT          19  CENTURY MARK

          COMPUTATION INTERVAL     .05 HOURS
               TOTAL TIME BASE   14.95 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

 14 JD         INDEX STORM NO. 1
                    STRM      2.43  PRECIPITATION DEPTH
                    TRDA       .01  TRANSPOSITION DRAINAGE AREA

 15 PI         PRECIPITATION PATTERN
               1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
               1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
               2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                .06       .06       .06       .14       .18       .00       .02       .06       .06       .06

 23 JD         INDEX STORM NO. 2
                    STRM      2.36  PRECIPITATION DEPTH
                    TRDA      1.00  TRANSPOSITION DRAINAGE AREA

  0 PI         PRECIPITATION PATTERN
               1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
               1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
               2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                .06       .06       .06       .14       .18       .00       .02       .06       .06       .06
```

24 JD INDEX STORM NO. 3

STRM 2.09 PRECIPITATION DEPTH

TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

25 JD INDEX STORM NO. 4

STRM 2.09 PRECIPITATION DEPTH

TRDA 10.01 TRANSPOSITION DRAINAGE AREA

26 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 5

STRM 1.92 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 6

STRM 1.80 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 7

STRM 1.65 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

37 JD INDEX STORM NO. 8

STRM	1.46	PRECIPITATION DEPTH
TRDA	100.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	467.	3.75	77.	31.	31.	.90		
+	HYDROGRAPH AT	BW1	4883.	6.15	2699.	1141.	1141.	60.50		
+	HYDROGRAPH AT	BW2	2778.	4.40	1133.	456.	456.	20.80		
+	2 COMBINED AT	BW1&2	5498.	5.75	3049.	1282.	1282.	81.30		
+	2 COMBINED AT	BW APX	5488.	5.75	3060.	1287.	1287.	82.20		
+	HYDROGRAPH AT	MM1B	644.	4.00	136.	55.	55.	2.10		
+	HYDROGRAPH AT	MM2	526.	3.95	108.	44.	44.	1.40		
+	HYDROGRAPH AT	HP1A	444.	3.95	92.	37.	37.	.80		
+	ROUTED TO	RTCPA	420.	4.40	92.	37.	37.	.80		
+	HYDROGRAPH AT	HP1B	346.	4.00	75.	30.	30.	1.00		
+	HYDROGRAPH AT	HP2	407.	4.00	89.	36.	36.	1.20		
+	4 COMBINED AT	CPA1	1297.	4.05	317.	127.	127.	4.40		
+	HYDROGRAPH AT	HP3	661.	4.05	156.	63.	63.	1.70		
+	2 COMBINED AT	CPA2	1827.	4.10	442.	177.	177.	6.10		
+	HYDROGRAPH AT	HP4	1060.	4.00	233.	94.	94.	3.30		
+	HYDROGRAPH AT	HP5	582.	3.75	94.	38.	38.	1.20		
+	HYDROGRAPH AT	HP6	766.	4.05	174.	70.	70.	2.20		
+	ROUTED TO	RTCPD	741.	4.30	174.	70.	70.	2.20		
+	HYDROGRAPH AT	HPFA	125.	3.80	21.	9.	9.	.30		
+	3 COMBINED AT	CPD	945.	4.15	266.	107.	107.	3.70		
+	ROUTED TO	RTCPE	927.	4.55	266.	107.	107.	3.70		
+	HYDROGRAPH AT	HPFB	533.	3.95	107.	43.	43.	1.60		
+	3 COMBINED AT	CPE	1898.	4.10	537.	215.	215.	8.60		
+	2 COMBINED AT	CPF	2462.	4.05	854.	343.	343.	14.70		
+	HYDROGRAPH AT	SC1	3438.	6.15	1900.	804.	804.	39.40		
+	HYDROGRAPH AT	SC2	478.	4.00	101.	41.	41.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS10.OUT

(10-YEAR MODEL)

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE   (HEC-1)   *
*           SEPTEMBER 1990              *
*             VERSION 4.0               *
*                                       *
* RUN DATE  01/29/1993  TIME  22:05:10  *
*                                       *
*****************************************
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```
*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*         609 SECOND STREET             *
*      DAVIS, CALIFORNIA 95616          *
*          (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      ID     FLOOD ASSESSMENT FOR RWMS JOB #:51056            FILE: RWMS10.DAT
 2      ID     10-YEAR 6-HOUR STORM 1.1 INCHES
 3      ID     POINT RAINFALL VALUE FROM NOAA ATLASS 2 VOL VII
 4      ID     DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
 5      ID     CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
 6      ID     CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
 7      ID     LAG TIMES DETEMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
 8      ID     DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
 9      ID     THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
        *DIAGRAM
10      IT       3       0       0     300
11      IO       5
12      IN       5
13      JD     1.1     .01
        * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
14      PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
15      PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
16      PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
17      PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
18      PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
19      PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
20      PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
21      PC    99.8    99.9   100.0
22      JD    1.07       1
23      JD     .95    9.99
        * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
24      JD     .95   10.01
25      PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
26      PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
27      PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
28      PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
29      PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
30      PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
31      PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
32      PC    99.7    99.9   100.0
33      JD     .87      20
34      JD     .81      30
35      JD     .75      50
36      JD     .66     100

37      KK    MM1A
38      KM   Basin runoff calculation for Mass. Mountains 1A
39      BA      .9
40      LS              80
41      UD     .31

42      KK     BW1
43      KM    Basin runoff calculation for Barren Wash 1
44      BA    60.5
45      LS              83
46      UD     2.1
```

```
KK    BW2
KM     Basin runoff calculation for Barren Wash 2
BA    20.8
LS              80
UD     .9

KK   BW1&2
KM   Combined BW1 and BW2
HC      2

KK  BW APX
KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
HC      2

KK    MM1B
KM     Basin runoff calulation for Mass. Mountains 1B
*   Flow was not combined with BW APX because flow from this watershed
*   will not directly impact RWMS wereas a channel migration at the apex
*   could impact the RWMS
BA     2.1
LS              77
UD     .48

KK    MM2
KM    Basin runoff calculation for Mass. Mountains 2
BA     1.4
LS              79
UD     .47

KK    HP1A
KM    Basin runoff calculation for Half Pint Range 1A
BA      .8
LS              85
UD     .48

KK   RTCPA
KM   Route Flow from HP1A to CPA
RM      9     .43      .2

KK    HP1B
KM    Basin runoff calculation for Half Pint Range 1B
BA     1.0
LS              78
UD     .51

KK    HP2
KM    Basin runoff calculation for Half Pint Range 2
BA    1.2
LS              78
UD     .51

KK    CPA1
KM    Combine MM2, routed HP1A, HP1B, HP2
HC      4

KK     HP3
KM     (CPB) Basin runoff calculation for Half Pint Range 3
BA     1.7
LS              82
UD     .59

KK    CPA2
KM    Combine HP3 with flow from CPA1
HC      2

KK     HP4
KM     (CPC) Basin runoff calculation for Half Pint Range 4
BA     3.3
LS              79
UD     .52

KK     HP5
KM     Basin runoff calculation for Half Pint Range 5
BA     1.2
LS              79
UD      .3

KK     HP6
KM     Basin runoff calculation for Half Pint Range 6
BA     2.2
LS              80
UD     .55

KK   RTCPD
KM    Route HP6 to CPD
RM      5     .27      .2
```

```
115   KK    HPFA
116   KM     Basin runoff calculation for Half Pint Range FA
117   BA     .3
118   LS             77
119   UD     .33

120   KK     CPD
121   KM     Combine HP5, routed HP6, and HPFA
122   HC      3

123   KK    RTCPE
124   KM     Route flow from CPD to CPE
125   RM      8     .39      .2

126   KK    HPFB
127   KM     Basin runoff calculation for Half Pint Range FB
128   BA     1.6
129   LS             77
130   UD     .44

131   KK     CPE
132   KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
133   HC      3

134   KK     CPF
135   KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
136   HC      2

137   KK     SC1
138   KM     Basin runoff calculation for Scarp Canyon 1
      * Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
139   BA    39.4
140   LS             82
141   UD     2.1

142   KK     SC2
143   KM     Basin runoff calculation for Scarp Canyon 2
144   BA     1.5
145   LS             77
146   UD     .48
147   ZZ
```

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

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

  37       MM1A
              .
              .
  42          .       BW1
              .         .
              .         .
  47          .         .       BW2
              .         .         .
              .         .         .
  52          .     BW1&2..........
              .         .
              .         .
  55     BW APX..........
              .
              .
  58          .      MM1B
              .         .
              .         .
  63          .         .       MM2
              .         .         .
              .         .         .
  68          .         .         .      HP1A
              .         .         .         V
              .         .         .         V
  73          .         .         .     RTCPA
              .         .         .         .
              .         .         .         .
  76          .         .         .         .      HP1B
              .         .         .         .         .
              .         .         .         .         .
  81          .         .         .         .         .       HP2
              .         .         .         .         .         .
              .         .         .         .         .         .
  86          .         .     CPA1..............................
              .         .         .
              .         .         .
  89          .         .         .       HP3
              .         .         .         .
              .         .         .         .
  94          .         .     CPA2..........
              .         .         .
              .         .         .
  97          .         .         .       HP4
              .         .         .         .
              .         .         .         .
 102          .         .         .         .       HP5
              .         .         .         .         .
              .         .         .         .         .
 107          .         .         .         .         .       HP6
              .         .         .         .         .         V
              .         .         .         .         .         V
 112          .         .         .         .         .     RTCPD
              .         .         .         .         .         .
              .         .         .         .         .         .
 115          .         .         .         .         .         .      HPFA
              .         .         .         .         .         .         .
              .         .         .         .         .         .         .
 120          .         .         .         .       CPD....................
              .         .         .         .         V
              .         .         .         .         V
 123          .         .         .         .     RTCPE
              .         .         .         .         .
              .         .         .         .         .
 126          .         .         .         .         .      HPFB
              .         .         .         .         .         .
              .         .         .         .         .         .
 131          .         .         .       CPE....................
              .         .         .         .
              .         .         .         .
 134          .         .       CPF..........
              .         .         .
              .         .         .
 137          .         .         .       SC1
              .         .         .         .
              .         .         .         .
 142          .         .         .         .       SC2

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           SEPTEMBER 1990              *
*            VERSION 4.0                *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:05:10 *
*                                       *
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*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*        609 SECOND STREET              *
*     DAVIS, CALIFORNIA 95616           *
*         (916) 756-1104                *
*                                       *
*****************************************
```

```
FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMS10.DAT
10-YEAR 6-HOUR STORM 1.1 INCHES
POINT RAINFALL VALUE FROM NOAA ATLASS 2 VOL VII
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
LAG TIMES DETEMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

  IT           HYDROGRAPH TIME DATA
                     NMIN          3  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1    0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     1    0  ENDING DATE
                   NDTIME       1457  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL     .05 HOURS
                     TOTAL TIME BASE   14.95 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

13 JD          INDEX STORM NO. 1
                     STRM       1.10  PRECIPITATION DEPTH
                     TRDA        .01  TRANSPOSITION DRAINAGE AREA

14 PI            PRECIPITATION PATTERN
```

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

```
22 JD          INDEX STORM NO. 2
                     STRM       1.07  PRECIPITATION DEPTH
                     TRDA       1.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
```

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

23 JD INDEX STORM NO. 3

STRM .95 PRECIPITATION DEPTH

TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

24 JD INDEX STORM NO. 4

STRM .95 PRECIPITATION DEPTH

TRDA 10.01 TRANSPOSITION DRAINAGE AREA

25 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

33 JD INDEX STORM NO. 5

STRM .87 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 6

STRM .81 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 7

STRM .75 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

```
36 JD          INDEX STORM NO. 8
                   STRM        .66  PRECIPITATION DEPTH
                   TRDA     100.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
```

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+					6-HOUR	24-HOUR	72-HOUR			
+	HYDROGRAPH AT	MM1A	50.	3.90	10.	4.	4.	.90		
+	HYDROGRAPH AT	BW1	511.	6.55	265.	111.	111.	60.50		
+	HYDROGRAPH AT	BW2	328.	5.50	104.	42.	42.	20.80		
+	2 COMBINED AT	BW1&2	510.	6.35	268.	112.	112.	81.30		
+	2 COMBINED AT	BW APX	452.	6.40	237.	99.	99.	82.20		
+	HYDROGRAPH AT	MM1B	43.	5.10	13.	5.	5.	2.10		
+	HYDROGRAPH AT	MM2	48.	4.10	13.	5.	5.	1.40		
+	HYDROGRAPH AT	HP1A	81.	4.00	18.	7.	7.	.80		
+	ROUTED TO	RTCPA	77.	4.45	18.	7.	7.	.80		
+	HYDROGRAPH AT	HP1B	28.	4.20	8.	3.	3.	1.00		
+	HYDROGRAPH AT	HP2	33.	4.20	10.	4.	4.	1.20		
+	4 COMBINED AT	CPA1	130.	4.35	39.	16.	16.	4.40		
+	HYDROGRAPH AT	HP3	87.	4.20	24.	10.	10.	1.70		
+	2 COMBINED AT	CPA2	187.	4.30	56.	22.	22.	6.10		
+	HYDROGRAPH AT	HP4	88.	4.20	26.	10.	10.	3.30		
+	HYDROGRAPH AT	HP5	54.	3.90	11.	5.	5.	1.20		
+	HYDROGRAPH AT	HP6	77.	4.20	22.	9.	9.	2.20		
+	ROUTED TO	RTCPD	75.	4.45	22.	9.	9.	2.20		
+	HYDROGRAPH AT	HPFA	9.	3.95	2.	1.	1.	.30		
+	3 COMBINED AT	CPD	90.	4.70	31.	12.	12.	3.70		
+	ROUTED TO	RTCPE	90.	5.05	31.	12.	12.	3.70		
+	HYDROGRAPH AT	HPFB	35.	5.05	10.	4.	4.	1.60		
+	3 COMBINED AT	CPE	168.	5.10	53.	21.	21.	8.60		
+	2 COMBINED AT	CPF	301.	5.20	84.	34.	34.	14.70		
+	HYDROGRAPH AT	SC1	356.	6.55	184.	78.	78.	39.40		
+	HYDROGRAPH AT	SC2	32.	5.10	10.	4.	4.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS10C.OUT

(10-YEAR MODEL)

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           SEPTEMBER 1990              *
*             VERSION 4.0               *
*                                       *
* RUN DATE  01/29/1993  TIME  22:06:45  *
*                                       *
*****************************************
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*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*        609 SECOND STREET              *
*     DAVIS, CALIFORNIA 95616           *
*         (916) 756-1104                *
*                                       *
*****************************************
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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

```
ID     FLOOD ASSESSMENT FOR RWMS JOB #:51056           FILE: RWMS10C.DAT
ID     10-YEAR 6-HOUR STORM 1.1 INCHES
ID     POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
ID     ADJUSTED RAINFALL PER CORRECTION FACTOR IN CLARK COUNTY MANUAL TABLE 501
ID     DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
ID     CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
ID     CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
ID     LAG TIMES DETEMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
ID     DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
ID     THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
*DIAGRAM
IT        3       0       0     300
IO        5
IN        5
JD     1.36     .01
* RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
PC        0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
PC     13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
PC     19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
PC     25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
PC     49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
PC     86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
PC     98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
PC     99.8    99.9   100.0
JD     1.32       1
JD     1.17    9.99
* CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
JD     1.17   10.01
PC        0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
PC     18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
PC     25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
PC     32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
PC     56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
PC     81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
PC     97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
PC     99.7    99.9   100.0
JD     1.07      20
JD     1.01      30
JD      .92      50
JD      .82     100

KK     MM1A
KM     Basin runoff calculation for Mass. Mountains 1A
BA       .9
LS               80
UD      .31

KK      BW1
KM      Basin runoff calculation for Barren Wash 1
BA     60.5
LS               83
UD      2.1
```

```
KK   BW2
KM    Basin runoff calculation for Barren Wash 2
BA   20.8
LS              80
UD     .9

KK  BW1&2
KM  Combined BW1 and BW2
HC      2

KK  BW APX
KM  Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
HC      2

KK   MM1B
KM    Basin runoff calulation for Mass. Mountains 1B
*   Flow was not combined with BW APX because flow from this watershed
*   will not directly impact RWMS wereas a channel migration at the apex
*   could impact the RWMS
BA     2.1
LS              77
UD     .48

KK   MM2
KM    Basin runoff calculation for Mass. Mountains 2
BA     1.4
LS              79
UD     .47

KK   HP1A
KM    Basin runoff calculation for Half Pint Range 1A
BA     .8
LS              85
UD     .48

KK  RTCPA
KM  Route Flow from HP1A to CPA
RM      9     .43     .2

KK   HP1B
KM    Basin runoff calculation for Half Pint Range 1B
BA     1.0
LS              78
UD     .51

KK    HP2
KM    Basin runoff calculation for Half Pint Range 2
BA    1.2
LS              78
UD     .51

KK    CPA1
KM    Combine MM2, routed HP1A, HP1B, HP2
HC      4

KK    HP3
KM    (CPB) Basin runoff calculation for Half Pint Range 3
BA    1.7
LS              82
UD     .59

KK    CPA2
KM    Combine HP3 with flow from CPA1
HC      2

KK    HP4
KM    (CPC) Basin runoff calculation for Half Pint Range 4
BA    3.3
LS              79
UD     .52

KK    HP5
KM    Basin runoff calculation for Half Pint Range 5
BA    1.2
LS              79
UD     .3

KK    HP6
KM    Basin runoff calculation for Half Pint Range 6
BA    2.2
LS              80
UD     .55

KK  RTCPD
KM   Route HP6 to CPD
RM      5     .27     .2
```

```
KK    HPFA
KM     Basin runoff calculation for Half Pint Range FA
BA     .3
LS            77
UD     .33

KK     CPD
KM     Combine HP5, routed HP6, and HPFA
HC       3

KK   RTCPE
KM     Route flow from CPD to CPE
RM       8      .39       .2

KK    HPFB
KM     Basin runoff calculation for Half Pint Range FB
BA     1.6
LS            77
UD     .44

KK     CPE
KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
HC       3

KK     CPF
KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
HC       2

KK     SC1
KM     Basin runoff calculation for Scarp Canyon 1
* Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
BA    39.4
LS            82
UD     2.1

KK     SC2
KM     Basin runoff calculation for Scarp Canyon 2
BA     1.5
LS            77
UD     .48
ZZ
```

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           SEPTEMBER 1990              *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:06:45 *
*                                       *
*****************************************
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*****************************************
*                                       *
*     U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMS10C.DAT
10-YEAR 6-HOUR STORM 1.1 INCHES
POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
ADJUSTED RAINFALL PER CORRECTION FACTOR IN CLARK COUNTY MANUAL TABLE 501
DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
LAG TIMES DETEMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

  IT           HYDROGRAPH TIME DATA
                     NMIN           3  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1    0  STARTING DATE
                    ITIME        0000  STARTING TIME
                       NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1    0  ENDING DATE
                   NDTIME        1457  ENDING TIME
                    ICENT          19  CENTURY MARK

               COMPUTATION INTERVAL    .05 HOURS
                    TOTAL TIME BASE  14.95 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

14 JD          INDEX STORM NO. 1
                     STRM        1.36  PRECIPITATION DEPTH
                     TRDA         .01  TRANSPOSITION DRAINAGE AREA

15 PI            PRECIPITATION PATTERN
```

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

```
23 JD          INDEX STORM NO. 2
                     STRM        1.32  PRECIPITATION DEPTH
                     TRDA        1.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
```

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

24 JD INDEX STORM NO. 3

STRM	1.17	PRECIPITATION DEPTH
TRDA	9.99	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

25 JD INDEX STORM NO. 4

STRM	1.17	PRECIPITATION DEPTH
TRDA	10.01	TRANSPOSITION DRAINAGE AREA

26 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 5

STRM	1.07	PRECIPITATION DEPTH
TRDA	20.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 6

STRM	1.01	PRECIPITATION DEPTH
TRDA	30.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 7

STRM	.92	PRECIPITATION DEPTH
TRDA	50.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

37 JD INDEX STORM NO. 8

STRM .82 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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

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

   38            MM1A
                    .
   43               .         BW1
                    .           .
   48               .           .         BW2
                    .           .           .
   53               .       BW1&2............
                    .           .
   56          BW APX............
                    .
   59               .        MM1B
                    .           .
   64               .           .         MM2
                    .           .           .
   69               .           .           .        HP1A
                    .           .           .           V
                    .           .           .           V
   74               .           .           .       RTCPA
                    .           .           .           .
   77               .           .           .           .        HP1B
                    .           .           .           .           .
   82               .           .           .           .           .         HP2
                    .           .           .           .           .           .
   87               .           .        CPA1....................................
                    .           .           .
   90               .           .           .         HP3
                    .           .           .           .
   95               .           .        CPA2............
                    .           .           .
   98               .           .           .         HP4
                    .           .           .           .
  103               .           .           .           .         HP5
                    .           .           .           .           .
  108               .           .           .           .           .         HP6
                    .           .           .           .           .           V
                    .           .           .           .           .           V
  113               .           .           .           .           .       RTCPD
                    .           .           .           .           .           .
  116               .           .           .           .           .           .        HPFA
                    .           .           .           .           .           .           .
  121               .           .           .           .         CPD........................
                    .           .           .           .           V
                    .           .           .           .           V
  124               .           .           .           .       RTCPE
                    .           .           .           .           .
  127               .           .           .           .           .        HPFB
                    .           .           .           .           .           .
  132               .           .           .         CPE........................
                    .           .           .           .
  135               .           .         CPF............
                    .           .           .
  138               .           .           .         SC1
                    .           .           .           .
  143               .           .           .           .         SC2

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

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	MM1A	108.	3.85	20.	8.	8.	.90		
+	HYDROGRAPH AT	BW1	1083.	6.40	574.	242.	242.	60.50		
+	HYDROGRAPH AT	BW2	653.	5.45	232.	93.	93.	20.80		
+	2 COMBINED AT	BW1&2	1083.	6.10	581.	244.	244.	81.30		
+	2 COMBINED AT	BW APX	1078.	6.10	581.	244.	244.	82.20		
+	HYDROGRAPH AT	MM1B	110.	4.10	28.	11.	11.	2.10		
+	HYDROGRAPH AT	MM2	110.	4.05	26.	10.	10.	1.40		
+	HYDROGRAPH AT	HP1A	139.	4.00	30.	12.	12.	.80		
+	ROUTED TO	RTCPA	132.	4.40	30.	12.	12.	.80		
+	HYDROGRAPH AT	HP1B	68.	4.10	17.	7.	7.	1.00		
+	HYDROGRAPH AT	HP2	79.	4.10	20.	8.	8.	1.20		
+	4 COMBINED AT	CPA1	278.	4.25	76.	31.	31.	4.40		
+	HYDROGRAPH AT	HP3	170.	4.15	43.	17.	17.	1.70		
+	2 COMBINED AT	CPA2	399.	4.20	108.	43.	43.	6.10		
+	HYDROGRAPH AT	HP4	210.	4.10	54.	21.	21.	3.30		
+	HYDROGRAPH AT	HP5	123.	3.85	23.	9.	9.	1.20		
+	HYDROGRAPH AT	HP6	168.	4.10	43.	17.	17.	2.20		
+	ROUTED TO	RTCPD	164.	4.40	43.	17.	17.	2.20		
+	HYDROGRAPH AT	HPFA	23.	3.90	5.	2.	2.	.30		
+	3 COMBINED AT	CPD	199.	4.30	62.	25.	25.	3.70		
+	ROUTED TO	RTCPE	196.	4.70	62.	25.	25.	3.70		
+	HYDROGRAPH AT	HPFB	93.	4.05	23.	9.	9.	1.60		
+	3 COMBINED AT	CPE	335.	4.25	116.	46.	46.	8.60		
+	2 COMBINED AT	CPF	576.	5.20	182.	73.	73.	14.70		
+	HYDROGRAPH AT	SC1	769.	6.40	408.	172.	172.	39.40		
+	HYDROGRAPH AT	SC2	84.	4.10	21.	9.	9.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS2.OUT

(2-YEAR MODEL)

```
*****************************************                    *****************************************
*                                       *                    *                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                    *  U.S. ARMY CORPS OF ENGINEERS         *
*           SEPTEMBER 1990              *                    *  HYDROLOGIC ENGINEERING CENTER        *
*             VERSION 4.0               *                    *        609 SECOND STREET              *
*                                       *                    *     DAVIS, CALIFORNIA 95616           *
* RUN DATE  01/29/1993  TIME  22:08:57  *                    *          (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        ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMS2.DAT
   2        ID    2-YEAR 6-HOUR STORM 0.7 INCHES
   3        ID   POINT RAINFALL FROM NOAA ATLAS 2 VOL VII (NO ADJUSTMENT NECESSARY)
   4        ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
   5        ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCFRCD, 1990)
   6        ID   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCFRCD, 1990
   7        ID   LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCFRCD, 1990
   8        ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
   9        ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
            *DIAGRAM
  10        IT       3       0       0     300
  11        IO       5
  12        IN       5
  13        JD     0.7     .01
            * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
  14        PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
  15        PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
  16        PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
  17        PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
  18        PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
  19        PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
  20        PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
  21        PC    99.8    99.9   100.0
  22        JD     .68       1
  23        JD     .60    9.99
            * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
  24        JD     .60   10.01
  25        PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
  26        PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
  27        PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
  28        PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
  29        PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
  30        PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
  31        PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
  32        PC    99.7    99.9   100.0
  33        JD     .55      20
  34        JD     .52      30
  35        JD     .48      50
  36        JD     .42     100

  37        KK    MM1A
  38        KM   Basin runoff calculation for Mass. Mountains 1A
  39        BA      .9
  40        LS              80
  41        UD     .31

  42        KK     BW1
  43        KM    Basin runoff calculation for Barren Wash 1
  44        BA    60.5
  45        LS              83
  46        UD     2.1
```

```
47    KK     BW2
48    KM     Basin runoff calculation for Barren Wash 2
49    BA    20.8
50    LS              80
51    UD      .9

52    KK    BW1&2
53    KM    Combined BW1 and BW2
54    HC      2

55    KK   BW APX
56    KM    Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
57    HC      2

58    KK     MM1B
59    KM     Basin runoff calulation for Mass. Mountains 1B
      *    Flow was not combined with BW APX because flow from this watershed
      *    will not directly impact RWMS wereas a channel migration at the apex
      *    could impact the RWMS
60    BA      2.1
61    LS              77
62    UD      .48

63    KK      MM2
64    KM     Basin runoff calculation for Mass. Mountains 2
65    BA      1.4
66    LS              79
67    UD      .47

68    KK     HP1A
69    KM     Basin runoff calculation for Half Pint Range 1A
70    BA       .8
71    LS              85
72    UD      .48

73    KK     RTCPA
74    KM     Route Flow from HP1A to CPA
75    RM      9     .43      .2

76    KK     HP1B
77    KM     Basin runoff calculation for Half Pint Range 1B
78    BA      1.0
79    LS              78
80    UD      .51

81    KK      HP2
82    KM     Basin runoff calculation for Half Pint Range 2
83    BA     1.2
84    LS              78
85    UD      .51

86    KK     CPA1
87    KM     Combine MM2, routed HP1A, HP1B, HP2
88    HC      4

89    KK      HP3
90    KM     (CPB) Basin runoff calculation for Half Pint Range 3
91    BA      1.7
92    LS              82
93    UD      .59

94    KK     CPA2
95    KM     Combine HP3 with flow from CPA1
96    HC      2

97    KK      HP4
98    KM      (CPC) Basin runoff calculation for Half Pint Range 4
99    BA      3.3
100   LS              79
101   UD      .52

102   KK      HP5
103   KM      Basin runoff calculation for Half Pint Range 5
104   BA      1.2
105   LS              79
106   UD       .3

107   KK      HP6
108   KM      Basin runoff calculation for Half Pint Range 6
109   BA      2.2
110   LS              80
111   UD      .55

112   KK     RTCPD
113   KM      Route HP6 to CPD
114   RM       5     .27      .2
```

```
115    KK    HPFA
116    KM     Basin runoff calculation for Half Pint Range FA
117    BA      .3
118    LS               77
119    UD     .33

120    KK     CPD
121    KM     Combine HP5, routed HP6, and HPFA
122    HC       3

123    KK    RTCPE
124    KM     Route flow from CPD to CPE
125    RM       8      .39      .2

126    KK     HPFB
127    KM     Basin runoff calculation for Half Pint Range FB
128    BA     1.6
129    LS               77
130    UD     .44

131    KK     CPE
132    KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
133    HC       3

134    KK     CPF
135    KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
136    HC       2

137    KK     SC1
138    KM     Basin runoff calculation for Scarp Canyon 1
       * Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
139    BA    39.4
140    LS               82
141    UD      2.1

142    KK     SC2
143    KM     Basin runoff calculation for Scarp Canyon 2
144    BA     1.5
145    LS               77
146    UD     .48
147    ZZ
```

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

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

 37      MM1A
            .
 42         .       BW1
            .         .
 47         .         .       BW2
            .         .         .
 52         .    BW1&2..........
            .         .
 55    BW APX..........
            .
 58         .      MM1B
            .         .
 63         .         .       MM2
            .         .         .
 68         .         .         .    HP1A
            .         .         .       V
            .         .         .       V
            .         .         .   RTCPA
 73         .         .         .       .
            .         .         .       .
 76         .         .         .       .      HP1B
            .         .         .       .         .
 81         .         .         .       .         .       HP2
            .         .         .       .         .         .
 86         .         .      CPA1..............................
            .         .         .
 89         .         .         .       HP3
            .         .         .         .
 94         .         .      CPA2..........
            .         .         .
 97         .         .         .       HP4
            .         .         .         .
102         .         .         .         .       HP5
            .         .         .         .         .
107         .         .         .         .         .       HP6
            .         .         .         .         .         V
            .         .         .         .         .         V
            .         .         .         .         .     RTCPD
112         .         .         .         .         .         .
115         .         .         .         .         .         .      HPFA
            .         .         .         .         .         .         .
            .         .         .         .       CPD....................
120         .         .         .         .         V
            .         .         .         .         V
            .         .         .         .     RTCPE
123         .         .         .         .         .
126         .         .         .         .         .      HPFB
            .         .         .         .         .         .
            .         .         .       CPE....................
131         .         .         .         .
134         .         .       CPF..........
            .         .         .
137         .         .         .       SC1
            .         .         .         .       SC2
142         .         .         .         .

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*          SEPTEMBER 1990               *
*            VERSION 4.0                *
*                                       *
* RUN DATE  01/29/1993  TIME  22:08:57  *
*                                       *
*****************************************
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```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
                    FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMS2.DAT
                     2-YEAR 6-HOUR STORM 0.7 INCHES
                    POINT RAINFALL FROM NOAA ATLAS 2 VOL VII (NO ADJUSTMENT NECESSARY)
                    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCFRCD, 1990)
                    CURVE NUMBERS DETERMINED USING TABLE 602 IN CCFRCD, 1990
                    LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCFRCD, 1990
                    DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                    THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

   IT           HYDROGRAPH TIME DATA
                      NMIN          3  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1   0  ENDING DATE
                    NDTIME       1457  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .05 HOURS
                      TOTAL TIME BASE   14.95 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

 13 JD           INDEX STORM NO. 1
                      STRM        .70  PRECIPITATION DEPTH
                      TRDA        .01  TRANSPOSITION DRAINAGE AREA
```

14 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

```
 22 JD           INDEX STORM NO. 2
                      STRM        .68  PRECIPITATION DEPTH
                      TRDA       1.00  TRANSPOSITION DRAINAGE AREA
```

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

23 JD INDEX STORM NO. 3

STRM .60 PRECIPITATION DEPTH

TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

24 JD INDEX STORM NO. 4

STRM .60 PRECIPITATION DEPTH

TRDA 10.01 TRANSPOSITION DRAINAGE AREA

25 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

33 JD INDEX STORM NO. 5

STRM .55 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 6

STRM .52 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 7

STRM .48 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 8

STRM .42 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	6.	5.00	1.	0.	0.	.90		
+ HYDROGRAPH AT	BW1	22.	7.10	11.	4.	4.	60.50		
+ HYDROGRAPH AT	BW2	7.	6.00	2.	1.	1.	20.80		
+ 2 COMBINED AT	BW1&2	22.	7.10	11.	4.	4.	81.30		
+ 2 COMBINED AT	BW APX	9.	7.10	4.	2.	2.	82.20		
+ HYDROGRAPH AT	MM1B	2.	5.30	0.	0.	0.	2.10		
+ HYDROGRAPH AT	MM2	5.	5.15	1.	0.	0.	1.40		
+ HYDROGRAPH AT	HP1A	16.	4.15	4.	2.	2.	.80		
+ ROUTED TO	RTCPA	15.	4.55	4.	2.	2.	.80		
+ HYDROGRAPH AT	HP1B	3.	5.25	0.	0.	0.	1.00		
+ HYDROGRAPH AT	HP2	3.	5.25	1.	0.	0.	1.20		
+ 4 COMBINED AT	CPA1	15.	5.40	4.	2.	2.	4.40		
+ HYDROGRAPH AT	HP3	14.	5.20	4.	2.	2.	1.70		
+ 2 COMBINED AT	CPA2	23.	5.30	6.	3.	3.	6.10		
+ HYDROGRAPH AT	HP4	8.	5.25	2.	1.	1.	3.30		
+ HYDROGRAPH AT	HP5	6.	5.00	1.	0.	0.	1.20		
+ HYDROGRAPH AT	HP6	10.	5.25	2.	1.	1.	2.20		
+ ROUTED TO	RTCPD	10.	5.50	2.	1.	1.	2.20		
+ HYDROGRAPH AT	HPFA	1.	5.10	0.	0.	0.	.30		
+ 3 COMBINED AT	CPD	10.	5.40	2.	1.	1.	3.70		
+ ROUTED TO	RTCPE	9.	5.75	2.	1.	1.	3.70		
+ HYDROGRAPH AT	HPFB	2.	5.25	0.	0.	0.	1.60		
+ 3 COMBINED AT	CPE	9.	5.55	2.	1.	1.	8.60		
+ 2 COMBINED AT	CPF	25.	5.50	6.	3.	3.	14.70		
+ HYDROGRAPH AT	SC1	15.	7.10	7.	3.	3.	39.40		
+ HYDROGRAPH AT	SC2	2.	5.30	0.	0.	0.	1.50		

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

FEMA FAN MODEL OUTPUT

BARREN WASH ALLUVIAL FAN

(Model Sets 1, 2, 3 & 4)

Barren Wash Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	511
100	1848	1845

MEAN = 1.042752
STANDARD DEVIATION = 1.533850
SKEW = -1.2

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 511
50-YEAR DISCHARGE = 1440
100-YEAR DISCHARGE = 1845
500-YEAR DISCHARGE = 2633

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.6502+0.5415 LOG(Q)

MEAN OF Z = 2.214841
STANDARD DEVIATION = 0.830596
SKEW = -1.200000
TRANSFORMATION CONSTANT = 4.989660

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$44.6869\ Q^{0.5415}$	WIDTH (FT)
0.5	0.3	49	0.39939	0.77515	5458
1.5	1.0	756	0.06472	0.22080	1555

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$44.6869\ Q^{0.5415}$	WIDTH (FT)
3.5	0.4	68	0.35475	0.72986	5139
4.5	0.6	238	0.18938	0.50031	3523
5.5	0.9	649	0.07853	0.25818	1818
6.5	1.3	1496	0.01847	0.07781	548

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	44.6869 Q 0.5415	WIDTH (FT)
0.5	0.4	429	0.12044	0.35977	9627

..OCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	44.6869 Q 0.5415	WIDTH (FT)
3.5	0.5	1046	0.03859	0.14838	3970

Barren Wash Alluvial Fan: Model Set 2

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	508
100	3513	3523

MEAN = 1.220155
STANDARD DEVIATION = 1.237478
SKEW = -0.6

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 508
50-YEAR DISCHARGE = 2234
100-YEAR DISCHARGE = 3523
500-YEAR DISCHARGE = 8018

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.3608+0.7454 LOG(Q)

MEAN OF Z = 2.270321
STANDARD DEVIATION = 0.922428
SKEW = -0.600000
TRANSFORMATION CONSTANT = 5.221557

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$22.9512\ Q^{0.7454}$	WIDTH (FT)
0.5	0.3	49	0.38603	0.75342	5552
1.5	1.0	756	0.07282	0.27335	2014
2.5	1.7	2712	0.01575	0.08826	650

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$22.9512\ Q^{0.7454}$	WIDTH (FT)
3.5	0.4	68	0.33839	0.70932	5227
4.5	0.6	238	0.17753	0.49364	3637
5.5	0.9	649	0.08326	0.30011	2211
6.5	1.3	1496	0.03427	0.16404	1209
7.5	1.7	3059	0.01310	0.07724	566

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	22.9512 $Q^{0.7454}$	WIDTH (FT)
0.5	0.4	429	0.11715	0.37930	10621

OCITY FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	22.9512 $Q^{0.7454}$	WIDTH (FT)
3.5	0.5	1046	0.05069	0.21668	6067
4.5	0.8	2981	0.01367	0.07961	2218

Barren Wash Alluvial Fan: Model Set 3

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	511
100	6018	6011

MEAN = 1.323916
STANDARD DEVIATION = 1.089877
SKEW = -0.1

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 511
50-YEAR DISCHARGE = 3187
100-YEAR DISCHARGE = 6011
500-YEAR DISCHARGE = 21319

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.1038+0.9523 LOG(Q)

MEAN OF Z = 2.364550
STANDARD DEVIATION = 1.037845
SKEW = -0.100000
TRANSFORMATION CONSTANT = 5.498632

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$12.7010\ Q^{0.9523}$	WIDTH (FT)
0.5	0.3	49	0.37636	0.74376	5771
1.5	1.0	756	0.07741	0.31531	2447
2.5	1.7	2712	0.02368	0.15673	1203

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$12.7010\ Q^{0.9523}$	WIDTH (FT)
3.5	0.4	68	0.32668	0.70074	5438
4.5	0.6	238	0.17183	0.50209	3896
5.5	0.9	649	0.08625	0.33928	2633
6.5	1.3	1496	0.04176	0.22110	1712
7.5	1.7	3059	0.02093	0.14484	1104
8.5	2.2	5719	0.01078	0.08963	639

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$12.7010\ Q^{0.9523}$	WIDTH (FT)
0.5	0.4	429	0.11639	0.40412	11916

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$12.7010\ Q^{0.9523}$	WIDTH (FT)
3.5	0.5	1046	0.05870	0.26939	7936
4.5	0.8	2981	0.02152	0.14740	4278

Barren Wash Alluvial Fan: Model Set 4

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	1083	1100
100	5498	5436

MEAN = 0.967763
STANDARD DEVIATION = 1.909410
SKEW = -1.2

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 1100
50-YEAR DISCHARGE = 3994
100-YEAR DISCHARGE = 5436
500-YEAR DISCHARGE = 8466

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=2.1296+0.4869 LOG(Q)

MEAN OF Z = 2.600766
STANDARD DEVIATION = 0.929608
SKEW = -1.200000
TRANSFORMATION CONSTANT = 6.163823

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4869 134.7735 Q	WIDTH (FT)
0.5	0.3	49	0.41930	0.84140	7319
1.5	1.0	756	0.13521	0.45395	3949
2.5	1.7	2712	0.03806	0.17863	1554

LOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4869 134.7735 Q	WIDTH (FT)
3.5	0.4	68	0.38395	0.81578	7096
4.5	0.6	238	0.24947	0.66394	5775
5.5	0.9	649	0.14958	0.48573	4225
6.5	1.3	1496	0.07778	0.30563	2659
7.5	1.7	3059	0.03212	0.15540	1352

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4869 134.7735 Q	WIDTH (FT)
0.5	0.4	429	0.18835	0.56624	18717

LOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4869 134.7735 Q	WIDTH (FT)
3.5	0.5	1046	0.10475	0.38461	12713
4.5	0.8	2981	0.03340	0.16040	5302

FEMA FAN MODEL OUTPUT

SCARP CANYON ALLUVIAL FAN

(Model Sets 1, 2, 3 & 4)

Scarp Canyon Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	356	351
100	1251	1265

MEAN = 0.878659
STANDARD DEVIATION = 1.533991
SKEW = -1.2

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 351
50-YEAR DISCHARGE = 987
100-YEAR DISCHARGE = 1265
500-YEAR DISCHARGE = 1805

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.5751+0.5415 LOG(Q)

MEAN OF Z = 2.050915
STANDARD DEVIATION = 0.830638
SKEW = -1.200000
TRANSFORMATION CONSTANT = 4.290921

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$37.5951\ Q^{0.5415}$	WIDTH (FT)
0.5	0.3	49	0.34883	0.72387	4383
1.5	1.0	756	0.03535	0.13698	829

VELOCITY T/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$37.5951\ Q^{0.5415}$	WIDTH (FT)
3.5	0.4	68	0.30420	0.67202	4069
4.5	0.6	238	0.14528	0.41207	2495
5.5	0.9	649	0.04559	0.17003	1030

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$37.5951\ Q^{0.5415}$	WIDTH (FT)
0.5	0.4	443	0.07886	0.25909	5962

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$37.5951\ Q^{0.5415}$	WIDTH (FT)
3.5	0.4	805	0.03152	0.12353	2842

Scarp Canyon Alluvial Fan: Model Set 2

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	356	351
100	2178	2198

MEAN = 1.030262
STANDARD DEVIATION = 1.279943
SKEW = -0.7

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 351
50-YEAR DISCHARGE = 1443
100-YEAR DISCHARGE = 2198
500-YEAR DISCHARGE = 4604

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.3680+0.7081 LOG(Q)

MEAN OF Z = 2.097573
STANDARD DEVIATION = 0.906384
SKEW = -0.700000
TRANSFORMATION CONSTANT = 4.459600

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$23.3345\ Q^{0.7081}$	WIDTH (FT)
0.5	0.3	49	0.33492	0.70714	4450
1.5	1.0	756	0.04683	0.19857	1250

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$23.3345\ Q^{0.7081}$	WIDTH (FT)
3.5	0.4	68	0.28883	0.65373	4114
4.5	0.6	238	0.14038	0.42021	2645
5.5	0.9	649	0.05653	0.22635	1425
6.5	1.3	1496	0.01914	0.09895	623

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$23.3345\,Q^{0.7081}$	WIDTH (FT)
0.5	0.4	443	0.08348	0.29635	7087

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$23.3345\,Q^{0.7081}$	WIDTH (FT)
3.5	0.4	805	0.04358	0.18942	4530

Scarp Canyon Alluvial Fan: Model Set 3

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	356	357
100	3498	3491

MEAN = 1.117872
STANDARD DEVIATION = 1.152607
SKEW = -0.3

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 357
50-YEAR DISCHARGE = 1976
100-YEAR DISCHARGE = 3491
500-YEAR DISCHARGE = 10458

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.2079+0.8628 LOG(Q)

MEAN OF Z = 2.172367
STANDARD DEVIATION = 0.994433
SKEW = -0.300000
TRANSFORMATION CONSTANT = 4.652288

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$16.1400\,Q^{0.8628}$	WIDTH (FT)
0.5	0.3	49	0.32531	0.70098	4602
1.5	1.0	756	0.05446	0.24845	1631
2.5	1.7	2712	0.01444	0.09633	625

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$16.1400\,Q^{0.8628}$	WIDTH (FT)
3.5	0.4	68	0.27964	0.64926	4263
4.5	0.6	238	0.13909	0.43758	2873
5.5	0.9	649	0.06377	0.27117	1780
6.5	1.3	1496	0.02760	0.16044	1051
7.5	1.7	3059	0.01232	0.08785	565

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$16.1400\ Q^{0.8628}$	WIDTH (FT)
0.5	0.4	443	0.08692	0.33143	8269

ELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$16.1400\ Q^{0.8628}$	WIDTH (FT)
3.5	0.4	805	0.05067	0.23920	5968
4.5	0.6	2293	0.01738	0.11285	2774

Scarp Canyon Alluvial Fan: Model Set 4

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	769	779
100	3438	3406

MEAN = 0.751408
STANDARD DEVIATION = 2.011177
SKEW = -1.3

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 779
50-YEAR DISCHARGE = 2597
100-YEAR DISCHARGE = 3406
500-YEAR DISCHARGE = 4925

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=2.0997+0.4540 LOG(Q)

MEAN OF Z = 2.440823
STANDARD DEVIATION = 0.913058
SKEW = -1.300000
TRANSFORMATION CONSTANT = 5.305945

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4540 125.8027 Q	WIDTH (FT)
0.5	0.3	49	0.38263	0.81739	6120
1.5	1.0	756	0.10286	0.37538	2811
2.5	1.7	2712	0.01841	0.09197	689

LOCITY rT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4540 125.8027 Q	WIDTH (FT)
3.5	0.4	68	0.34751	0.78692	5892
4.5	0.6	238	0.21491	0.61188	4582
5.5	0.9	649	0.11751	0.41056	3074
6.5	1.3	1496	0.05029	0.21689	1624
7.5	1.7	3059	0.01396	0.07173	537

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4540 125.8027 Q	WIDTH (FT)
0.5	0.4	443	0.15397	0.49326	14035

:LOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4540 125.8027 Q	WIDTH (FT)
3.5	0.4	805	0.09752	0.36091	10269
4.5	0.6	2293	0.02578	0.12522	3563

FEMA FAN MODEL OUTPUT

HALFPINT ALLUVIAL FAN

(Model Sets 1, 2, 3 & 4)

Halfpint Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	170
100	603	598

MEAN = 0.759609
STANDARD DEVIATION = 1.328618
SKEW = -1.1

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 170
50-YEAR DISCHARGE = 464
100-YEAR DISCHARGE = 598
500-YEAR DISCHARGE = 876

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.2765+0.5980 LOG(Q)

MEAN OF Z = 1.730742
STANDARD DEVIATION = 0.794495
SKEW = -1.100000
TRANSFORMATION CONSTANT = 3.392134

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$18.9020\ Q^{0.5980}$	WIDTH (FT)
0.5	0.3	49	0.26742	0.59475	2847

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$18.9020\ Q^{0.5980}$	WIDTH (FT)
3.5	0.4	68	0.21876	0.52204	2499
4.5	0.6	238	0.06832	0.21587	1033

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$18.9020\ Q^{0.5980}$	WIDTH (FT)
0.5	0.3	449	0.02168	0.08480	1543

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$18.9020\ Q^{0.5980}$	WIDTH (FT)
3.5	0.4	566	0.01212	0.04847	882

Halfpint Alluvial Fan: Model Set 2

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	169
100	1180	1176

MEAN = 0.928731
STANDARD DEVIATION = 1.055311
SKEW = -0.4

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 169
50-YEAR DISCHARGE = 731
100-YEAR DISCHARGE = 1176
500-YEAR DISCHARGE = 2890

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.0090+0.8374 LOG(Q)

MEAN OF Z = 1.786716
STANDARD DEVIATION = 0.883714
SKEW = -0.400000
TRANSFORMATION CONSTANT = 3.569505

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q 0.8374	WIDTH (FT)
0.5	0.3	49	0.24808	0.57142	2878
1.5	1.0	756	0.01928	0.09924	500

VELOCITY T/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q 0.8374	WIDTH (FT)
3.5	0.4	68	0.20017	0.50667	2552
4.5	0.6	238	0.07596	0.26560	1338
5.5	0.9	649	0.02353	0.11884	599

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q^0.8374	WIDTH (FT)
0.5	0.3	449	0.03741	0.16695	3196

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q^0.8374	WIDTH (FT)
3.5	0.4	566	0.02835	0.13656	2614

Halfpint Alluvial Fan: Model Set 3

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	168
100	1819	1821

MEAN = 1.016033
STANDARD DEVIATION = 0.935309
SKEW = 0.1

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 168
50-YEAR DISCHARGE = 970
100-YEAR DISCHARGE = 1821
500-YEAR DISCHARGE = 6634

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=0.7953+1.0450 LOG(Q)

MEAN OF Z = 1.857036
STANDARD DEVIATION = 0.977359
SKEW = 0.100000
TRANSFORMATION CONSTANT = 3.728261

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$6.2420\ Q^{1.0450}$	WIDTH (FT)
0.5	0.3	49	0.23709	0.56316	2963
1.5	1.0	756	0.02605	0.15414	802

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$6.2420\ Q^{1.0450}$	WIDTH (FT)
3.5	0.4	68	0.19242	0.50416	2653
4.5	0.6	238	0.07866	0.29407	1546
5.5	0.9	649	0.03085	0.16909	883
6.5	1.3	1496	0.01313	0.09258	462

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: $6.2420\ Q^{1.0450}$	WIDTH (FT)
0.5	0.3	449	0.04315	0.20703	4126

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: $6.2420\ Q^{1.0450}$	WIDTH (FT)
3.5	0.4	566	0.03509	0.18232	3625
4.5	0.5	1614	0.01192	0.08813	1651

Halfpint Alluvial Fan: Model Set 4

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	335	343
100	1898	1867

MEAN = 0.734788
STANDARD DEVIATION = 1.596884
SKEW = -1.0

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 343
50-YEAR DISCHARGE = 1310
100-YEAR DISCHARGE = 1867
500-YEAR DISCHARGE = 3269

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.6637+0.5765 LOG(Q)

MEAN OF Z = 2.087308
STANDARD DEVIATION = 0.920624
SKEW = -1.000000
TRANSFORMATION CONSTANT = 4.101043

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$46.0992\ Q^{0.5765}$	WIDTH (FT)
0.5	0.3	49	0.31010	0.71462	4136
1.5	1.0	756	0.04476	0.19714	1141

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$46.0992\ Q^{0.5765}$	WIDTH (FT)
3.5	0.4	68	0.27085	0.66516	3850
4.5	0.6	238	0.13611	0.43540	2520
5.5	0.9	649	0.05423	0.22757	1317
6.5	1.3	1496	0.01626	0.08582	497

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$46.0992\,Q^{0.5765}$	WIDTH (FT)
0.5	0.3	449	0.08068	0.30203	6642

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$46.0992\,Q^{0.5765}$	WIDTH (FT)
3.5	0.4	566	0.06397	0.25496	5607
4.5	0.5	1614	0.01411	0.07631	1678

```
*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    29JAN93    TIME   15:20:50   *
*********************************************
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*****************************************
*  U.S. ARMY CORPS OF ENGINEERS         *
*  HYDROLOGIC ENGINEERING CENTER        *
*  609 SECOND STREET, SUITE D           *
*  DAVIS, CALIFORNIA 95616-4687         *
*         (916) 756-1104                *
*****************************************
```

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X     X  XXXXXXX   XXXXX             XXXXX
X     X  X        X     X           X     X
X     X  X        X                       X
XXXXXXX  XXXX     X          XXXXX   XXXXX
X     X  X        X                 X
X     X  X        X     X           X
X     X  XXXXXXX   XXXXX            XXXXXXX
```

T1 HEC-2 RUN TO DETERMINE 100-YEAR FLOOD HAZARD LIMITS AND DEPTHS
T2 SOUTHWEST CORNER OF RWMS ASSUMING NO BERM
T3 FLOW CONDITION OF "NATURAL CONDITIONS" FILE: SWCRWMS.DAT
SUBCRITICAL FLOW
CROSS SECTIONS DEVELOPED FROM 1"=400', 5' C.I. TOPOGRAPHIC MAP OF THE RWMS.
THE 100-YEAR DISCHARGE AT CROSS SECTION 1 FROM HEC-1 MODEL RWMSW.OUT (CPF)
IS 2396 CFS. THE REMAINING CROSS SECTIONS (2-7) USED THE 100-YEAR DISCHARGE
OF 1230 CFS FROM HEC-1 MODEL RWMSW.OUT (CPA1).

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	2	0	0	-1	0	0	0	3166	0

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	1	0	-1	0	0	-1	0	0	0	0

NC	0.040	0.040	.035	.1	.3	0	0	0		
QT	1	2396								
X1	1.0	6	0	670	0	0	0			
GR	3175	0	3165	300	3167	340	3165	360	3170	390
GR	3175	670								
QT	1	1229								
X1	2.0	19	445	661	1240	1240	1240			
GR	3180	0	3177.5	420	3177.5	445	3177	446	3176.5	460
GR	3176	461	3176	470	3175.5	471	3175.5	490	3176	491
GR	3176	555	3175	556	3175	590	3176.5	591	3176.5	610
GR	3176	611	3176	660	3178	661	3180	930		
X1	3.0	9	765	821	560	560	560			
GR	3185	0	3181	740	3181	765	3180	766	3180	775
GR	3181	776	3181	820	3182	821	3185	1100		
X1	4.0	3	0	1060	800	800	800			
GR	3190	0	3185	660	3190	1060				
X1	5.0	3	0	1440	1840	1840	1840			
GR	3215	0	3210	770	3215	1440				
X1	6.0	3	0	1130	820	820	820			
GR	3220	0	3215	440	3220	1130				
X1	7	3	0	1150	780	780	780			
GR	3230	0	3225	590	3230	1150				

```
   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

*PROF 1
0

CCHV=     .100 CEHV=      .300
*SECNO 1.000
3720 CRITICAL DEPTH ASSUMED
    1.000      3.18    3168.18    3168.18    3166.00    3169.09       .91        .00        .00    3175.00
   2396.0        .0     2396.0         .0         .0      312.8        .0         .0         .0    3175.00
      .00       .00       7.66        .00       .000       .035      .000       .000    3165.00     204.61
  .015002        0.         0.         0.          0         22         0        .00     174.47     379.08

*SECNO 2.000

3301 HV CHANGED MORE THAN HVINS

    2.000      2.68    3177.68        .00        .00    3177.84       .16       8.67        .08    3177.50
   1229.0       3.6     1225.4         .0        7.0      383.9        .0       10.0        6.3    3178.00
      .11       .52       3.19        .00       .040       .035      .000       .000    3175.00     390.55
  .002669      1240.      1240.      1240.         6          0         0        .00     270.29     660.84

*SECNO 3.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
    3.000      2.30    3182.30    3182.30        .00    3182.70       .40       2.92        .07    3181.00
   1229.0     691.4      532.6        5.1      187.7       82.1       4.1       14.3       10.3    3182.00
      .14      3.68       6.49       1.25       .040       .035      .040       .000    3180.00     500.26
  .014448       560.       560.       560.        20         12         0        .00     348.26     848.52

*SECNO 4.000

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.19

    4.000      2.17    3187.17        .00        .00    3187.26       .09       4.54        .03    3190.00
   1229.0        .0     1229.0         .0         .0      499.9        .0       21.4       17.7    3190.00
      .23       .00       2.46        .00       .000       .035      .000       .000    3185.00     373.34
  .003005       800.       800.       800.         5          0         0        .00     460.39     833.73

*SECNO 5.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
    5.000      1.34    3211.34    3211.34        .00    3211.69       .35      11.64        .08    3215.00
   1229.0        .0     1229.0         .0         .0      260.3        .0       37.4       35.6    3215.00
      .34       .00       4.72        .00       .000       .035      .000       .000    3210.00     562.95
  .021001      1840.      1840.      1840.        20         14         0        .00     387.21     950.16

*SECNO 6.000

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.55

    6.000      2.09    3217.09        .00        .00    3217.18       .10       5.47        .03    3220.00
   1229.0        .0     1229.0         .0         .0      494.3        .0       44.6       43.7    3220.00
      .43       .00       2.49        .00       .000       .035      .000       .000    3215.00     255.94
  .003231       820.       820.       820.         8          0         0        .00     472.69     728.63

*SECNO 7.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
    7.000      1.47    3226.47    3226.47        .00    3226.85       .38       5.16        .09    3230.00
   1229.0        .0     1229.0         .0         .0      248.4        .0       51.2       51.0    3230.00
      .47       .00       4.95        .00       .000       .035      .000       .000    3225.00     416.57
  .020478       780.       780.       780.        20         19         0        .00     338.04     754.61


NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST
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CONDITION OF "NATURAL C

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	1.000	.00	.00	.00	3165.00	2396.00	3168.18	3168.18	3169.09	150.02	7.66	312.77	195.62
	2.000	1240.00	.00	.00	3175.00	1229.00	3177.68	.00	3177.84	26.69	3.19	390.85	237.88
*	3.000	560.00	.00	.00	3180.00	1229.00	3182.30	3182.30	3182.70	144.48	6.49	273.88	102.25
*	4.000	800.00	.00	.00	3185.00	1229.00	3187.17	.00	3187.26	30.05	2.46	499.89	224.21
*	5.000	1840.00	.00	.00	3210.00	1229.00	3211.34	3211.34	3211.69	210.01	4.72	260.30	84.81
*	6.000	820.00	.00	.00	3215.00	1229.00	3217.09	.00	3217.18	32.31	2.49	494.33	216.23
*	7.000	780.00	.00	.00	3225.00	1229.00	3226.47	3226.47	3226.85	204.78	4.95	248.41	85.88
*	1.000	2396.00	3168.18	.00	.00	2.18	174.47	.00					
	2.000	1229.00	3177.68	.00	9.50	.00	270.29	1240.00					
*	3.000	1229.00	3182.30	.00	4.62	.00	348.26	560.00					
*	4.000	1229.00	3187.17	.00	4.87	.00	460.39	800.00					
*	5.000	1229.00	3211.34	.00	24.17	.00	387.21	1840.00					
*	6.000	1229.00	3217.09	.00	5.74	.00	472.69	820.00					
*	7.000	1229.00	3226.47	.00	9.38	.00	338.04	780.00					

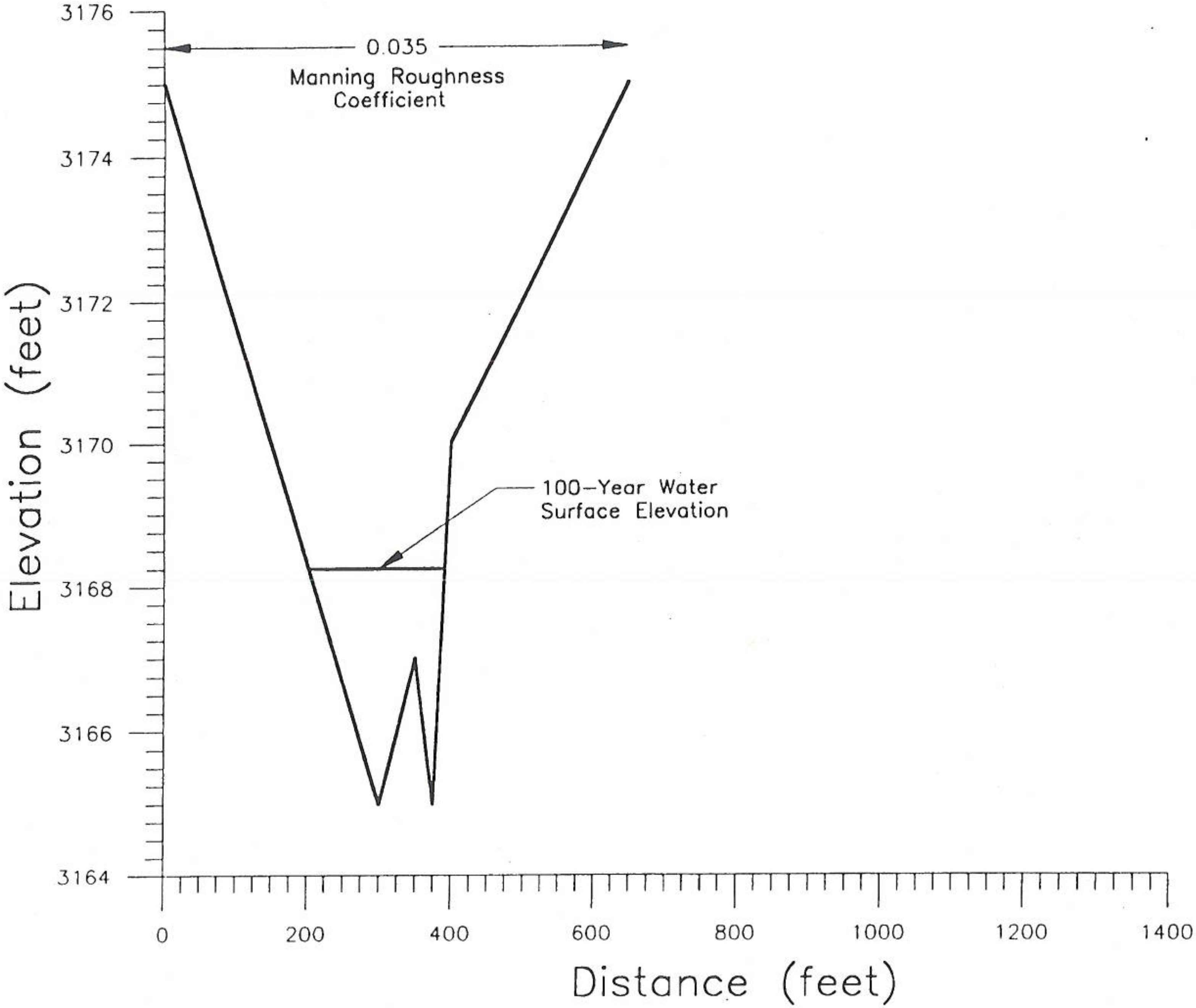
SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=     1.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

    ION SECNO=     3.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     3.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     3.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=     4.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     5.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     5.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     5.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=     6.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     7.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     7.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     7.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
```

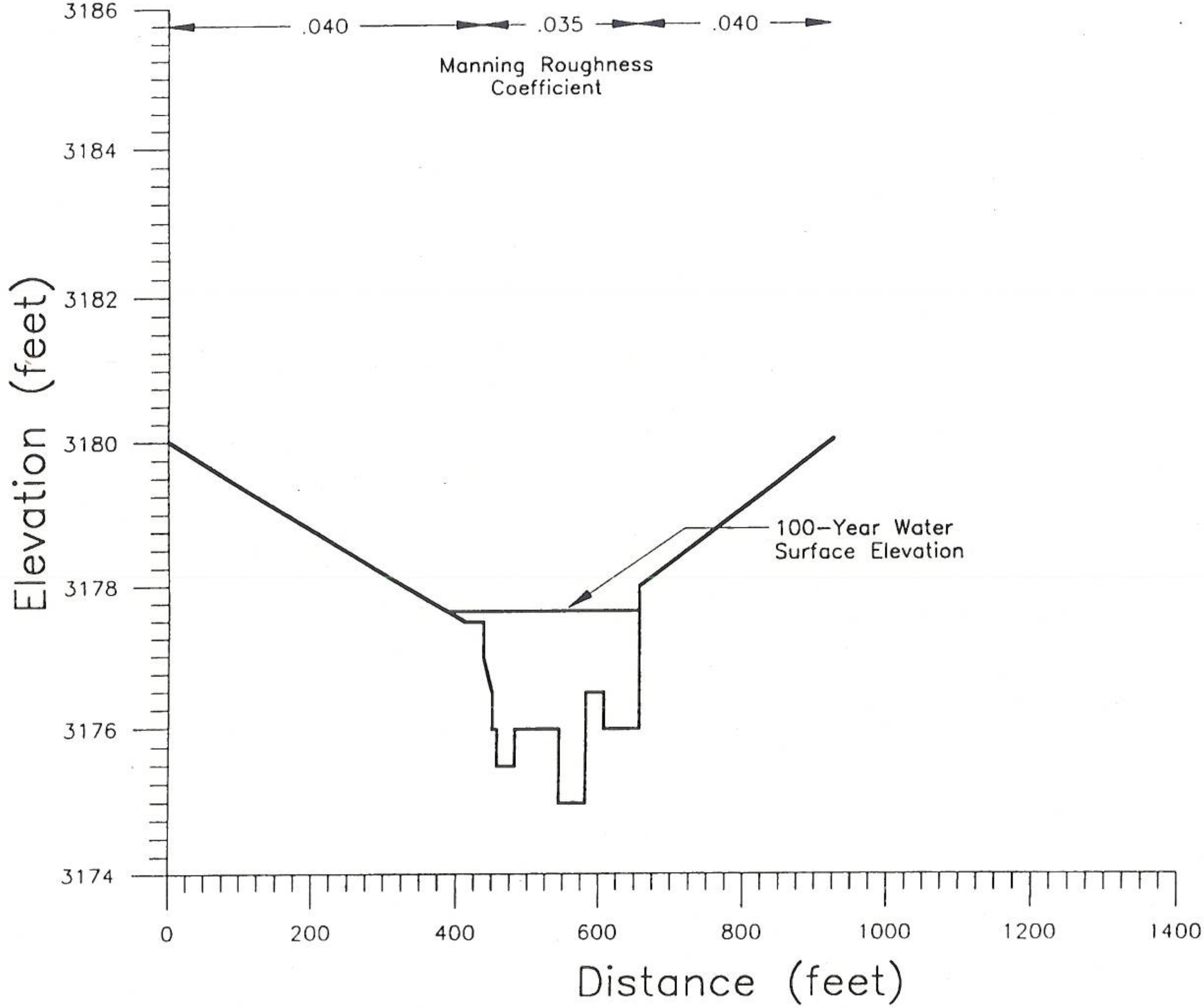
HEC-2 MODEL OUTPUT

CROSS SECTIONS

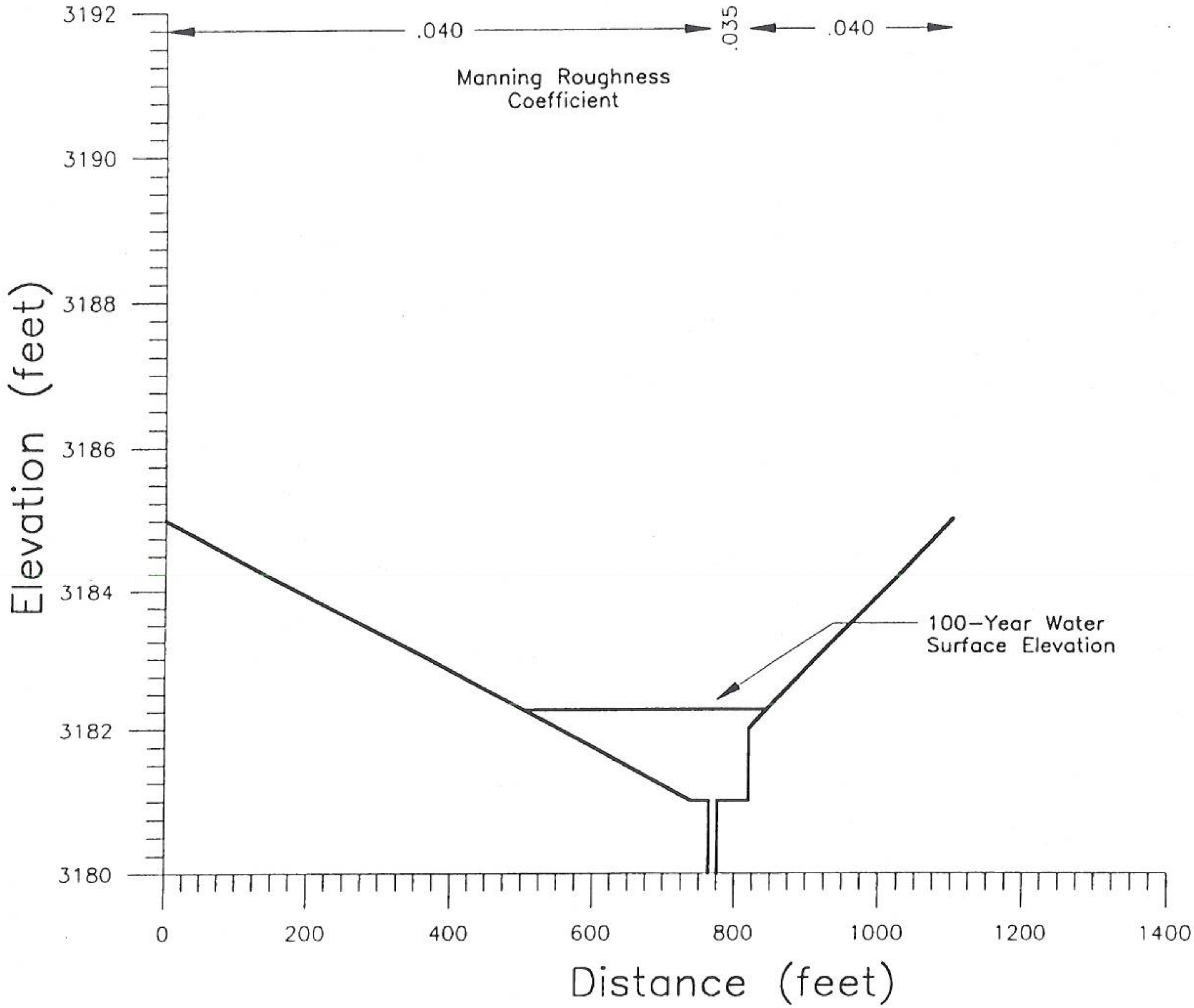
Cross-Section 1.000



Cross-Section 2.000



Cross-Section 3.000



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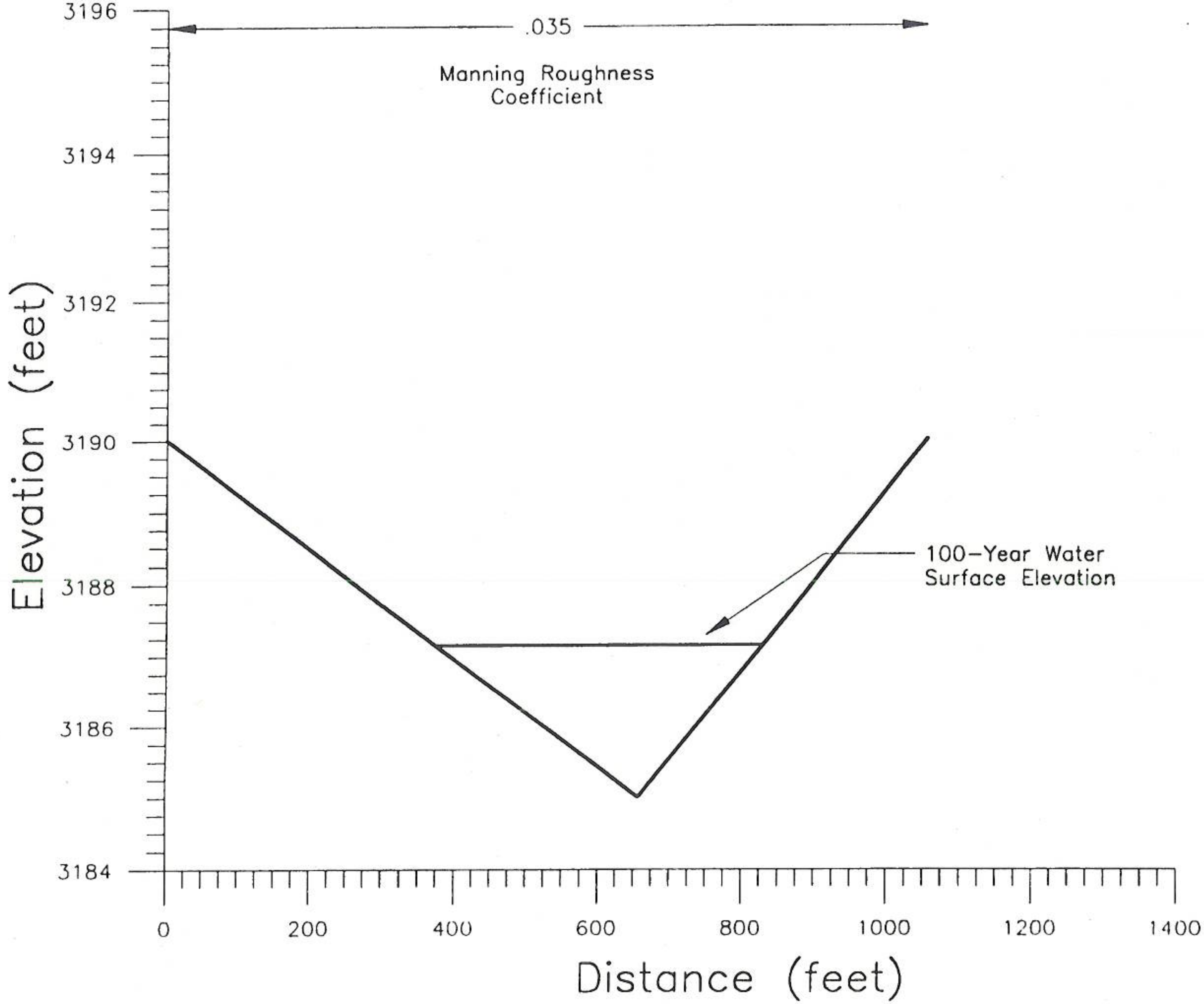
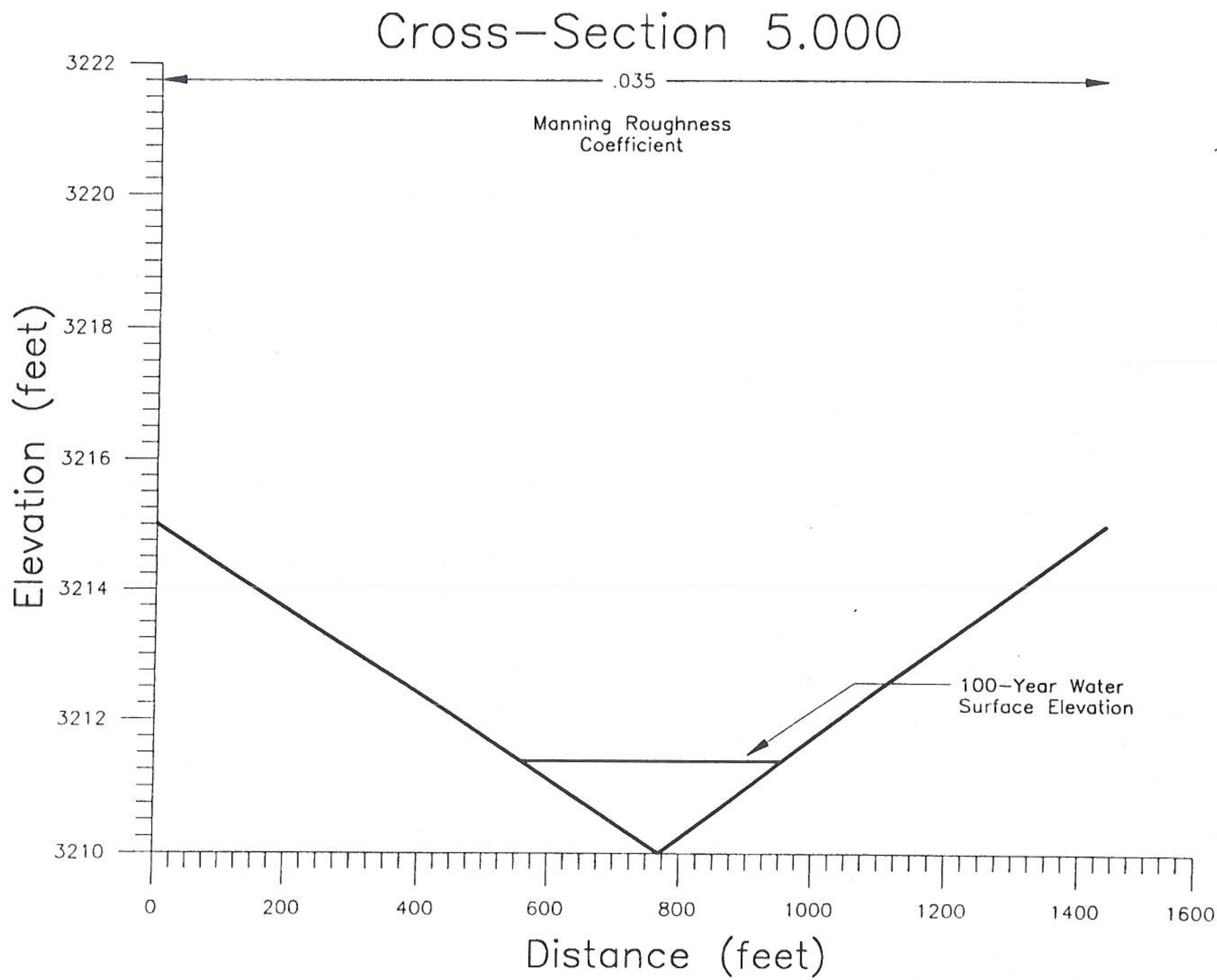
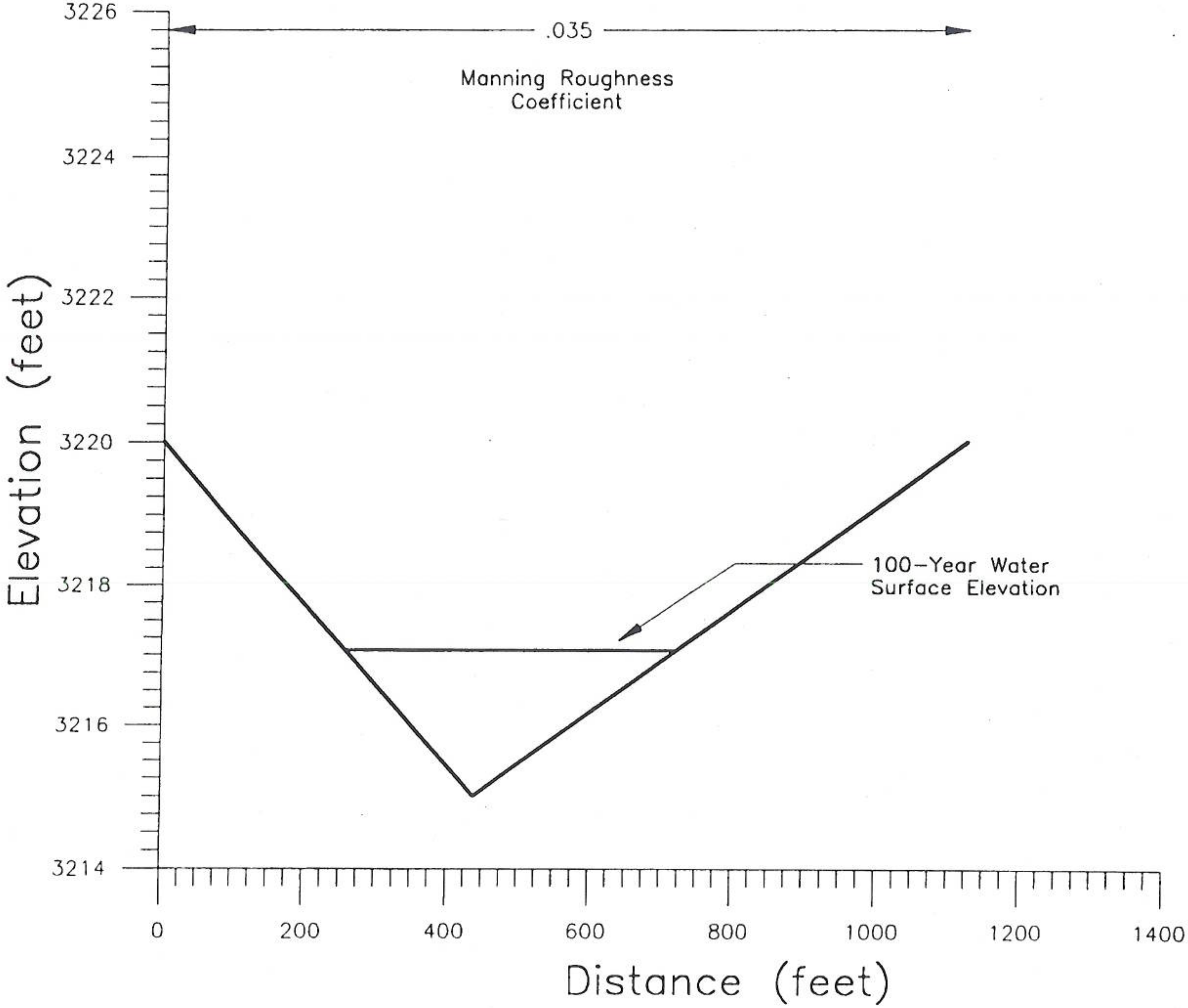


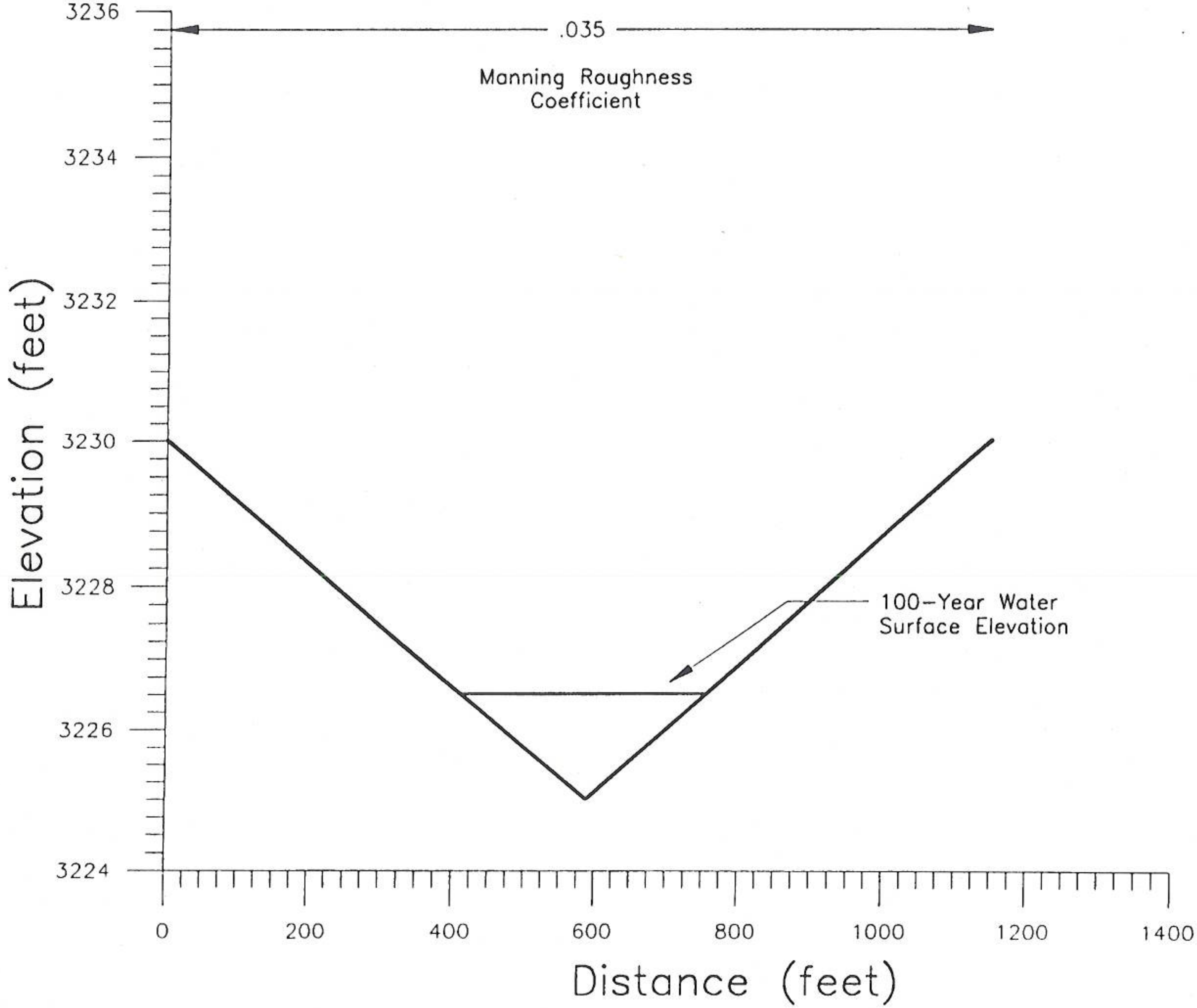


Cross-Section 5.000
.035
Manning Roughness
Coefficient
100-Year Water
Surface Elevation
Elevation (feet)
3222
3220
3218
3216
3214
3212
3210
Distance (feet)
0
200
400
600
800
1000
1200
1400
1600

Cross-Section 6.000



Cross-Section 7.000



SHEETFLOW CALCULATIONS FOR THE NORTH SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION (ft)	REACH LENGTH (ft)	MANNING COEFFICIENT	SLOPE (ft/ft)	WIDTH (ft)	DISCHARGE (ft^3/sec)
90	3500	0.035	0.026	2500	624

Q = DISCHARGE (ft^3/sec)
V = VELOCITY (ft/sec)
A = AREA (ft^2) (For a rectangular channel, area = depth * width)
R = HYDRAULIC RADIUS (ft) (For a shallow channel, assume R = depth)
S = SLOPE (ft/ft)
n = MANNING COEFFICIENT
W = WIDTH (ft)
d = DEPTH (ft)

EQUATIONS:

$$Q = VA$$

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

CALCULATIONS:

$$Q = \frac{1.49}{n} d^{2/3} S^{1/2} dW$$

$$Q = \frac{1.49}{n} d^{5/3} S^{1/2} W$$

$$d = \frac{Qn}{(1.49 S^{1/2} W)^{3/5}}$$

DEPTH CALCULATION:

FLOW DEPTH = 0.11 ft

SHEETFLOW CALCULATIONS FOR THE EAST SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION (ft)	REACH LENGTH (ft)	MANNING COEFFICIENT	SLOPE (ft/ft)	WIDTH (ft)	DISCHARGE (ft^3/sec)
75	4250	0.035	0.018	2460	1100

Q = DISCHARGE (ft^3/sec)
V = VELOCITY (ft/sec)
A = AREA (ft^2) (For a rectangular channel, area = depth * width)
R = HYDRAULIC RADIUS (ft) (For a shallow channel, assume R = depth)
S = SLOPE (ft/ft)
n = MANNING COEFFICIENT
W = WIDTH (ft)
d = DEPTH (ft)

EQUATIONS:

$$Q = VA$$

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

CALCULATIONS:

$$Q = \frac{1.49}{n} d^{2/3} S^{1/2} dW$$

$$Q = \frac{1.49}{n} d^{5/3} S^{1/2} W$$

$$d = \frac{Qn}{(1.49 S^{1/2} W)^{3/5}}$$

DEPTH CALCULATION:

FLOW DEPTH = 0.22 ft

SHEETFLOW CALCULATIONS FOR THE WEST SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION (ft)	REACH LENGTH (ft)	MANNING COEFFICIENT	SLOPE (ft/ft)	WIDTH (ft)	DISCHARGE (ft^3/sec)
100	3500	0.035	0.029	2780	450

Q=DISCHARGE (ft^3/sec)
V=VELOCITY (ft/sec)
A=AREA (ft^2) (For a rectangular channel, area = depth * width)
R=HYDRAULIC RADIUS (ft) (For a shallow channel, assume R=depth)
S=SLOPE (ft/ft)
n=MANNING COEFFICIENT
W=WIDTH (ft)
d=DEPTH (ft)

EQUATIONS:

$$Q=VA$$

$$V=\frac{1.49}{n}R^{2/3}S^{1/2}$$

$$Q=\frac{1.49}{n}R^{2/3}S^{1/2}A$$

CALCULATIONS:

$$Q=\frac{1.49}{n}d^{2/3}S^{1/2}dW$$

$$Q=\frac{1.49}{n}d^{5/3}S^{1/2}W$$

$$d=\frac{Qn}{(1.49S^{1/2}W)^{3/5}}$$

DEPTH CALCULATION:

FLOW DEPTH = 0.10 ft

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B.12 Training [40 CFR 270.14(b)(12)]

This section identifies the training requirements applicable to personnel assigned to perform duties at the MWSU.

B.12.a Radioactive Waste Management Program Training

Training requirements are established using the contractor's Training Program Manual. The manual uses a systematic approach that ensures personnel assigned to waste handling operations are trained and qualified to safely and effectively perform their assigned work. Qualified training personnel work with the Operations Manager and subject matter experts, who are knowledgeable of hazardous and radioactive waste management and emergency procedures, to develop job descriptions for each functional title. Based on job descriptions, qualification programs are developed for each position to identify critical task assignments, entry-level qualifications, and additional training needs. Qualification cards are prepared for all personnel to document completion of the assigned training program for their functional title. Annual reviews of training programs and qualification statuses for personnel are performed to ensure personnel training qualifications are current. Personnel qualification cards are maintained by the contractor's Training Division. Personnel training records are accessible at the RWMC via the contractor's training database. The Operations Manager also maintains a List of Qualified Individuals at the RWMC to ensure personnel training and qualifications are current.

B.12.b RWMC Personnel [40 CFR 264.16(d)]

Table 10 includes functional titles and required training for personnel assigned to perform work at the MWSU. Current functional titles and job descriptions are maintained in the Radioactive Waste Operations Training Records.

B.12.c Visitors

Visitors are not permitted within the boundaries of the RWMC without an escort. Training requirements for visitors are reviewed on a case-by-case basis by the RWMC Facility Manager. The training required for a visitor depends upon the task the visitor is performing, the operations occurring at the RWMC at the time of visitation, and whether exposure to wastes or hazardous constituents could occur. Visitors include inspectors, auditors, vendors, consultants, subcontractors, and TSDF contractors. Other visitors can include personnel not assigned to perform normal day-to-day operations at the RWMC. Visitors receive a facility briefing that, at a minimum, includes the following:

1. Elements of the contingency plan and emergency procedures (e.g., alarms, evacuation routes, emergency equipment)
2. Hazard communication
3. Hazard awareness and PPE requirements

Personnel not assigned to the RWMC who are performing work within the RWMC boundaries must receive approval from the RWMC Facility Manager or designee. These personnel receive a detailed facility briefing specific to the task to be performed including additional hazard communication when required. Visitors must sign in and out each day they are visiting.

Table 10. MWSU Training Matrix

Functional Title	Outline of Required Training
Operations Manager	Hazard Communication Hazardous Waste Site General Worker Basic RCRA and Hazardous Waste Manifest Hazardous Waste Site General Worker Refresher Radiological Worker II RCRA Refresher General Employee Training Employee Emergency Action Training for Radioactive Waste Operations (RWO) Hazardous Materials Handling and Spill Response
Facility Manager	Hazard Communication Hazardous Waste Site General Worker Basic RCRA and Hazardous Waste Manifest Hazardous Waste Site General Worker Refresher Radiological Worker II RCRA Refresher General Employee Training Employee Emergency Action Training for RWO Hazardous Materials Handling and Spill Response
LLW Operations Supervisor	Hazard Communication Hazardous Waste Site General Worker/Supervisor (8 hr) Basic RCRA and Hazardous Waste Manifest Hazardous Waste Site General Worker Refresher Radiological Worker II RCRA Refresher General Employee Training Employee Emergency Action Training for RWO Hazardous Materials Handling and Spill Response
Waste Specialist	Hazard Communication Hazardous Waste Site General Worker Basic RCRA and Hazardous Waste Manifest Hazardous Waste Site General Worker Refresher Radiological Worker II RCRA Refresher General Employee Training Employee Emergency Action Training for RWO Hazardous Materials Handling and Spill Response
Radiological Control Technician	Hazard Communication Hazardous Waste Site General Worker Basic RCRA and Hazardous Waste Manifest Hazardous Waste Site General Worker Refresher

Functional Title	Outline of Required Training
	Radiological Control Technician Training RCRA Refresher General Employee Training Employee Emergency Action Training for RWO Hazardous Materials Handling and Spill Response
Craft	Hazard Communication Hazardous Waste Site General Worker Hazardous Waste Site General Worker Refresher RCRA for Crafts Radiological Worker II RCRA Refresher General Employee Training Employee Emergency Action Training for RWO Hazardous Materials Handling and Spill Response
RTR Operator	Hazard Communication Hazardous Waste Site General Worker Hazardous Waste Site General Worker Refresher RCRA Refresher Radiological Worker II General Employee Training Employee Emergency Action Training for RWO Hazardous Materials Handling and Spill Response

B.12.d Implementation and Documentation of the Training Program

New employees must meet the training requirements within 6 months of employment and before working at the MWSU. The contractor's Training Division and the Operations Manager perform the following activities:

1. Maintain, update, and revise the training program as necessary
2. Review regulations and operations/safety procedures to determine the adequate amount of training for each employee
3. Ensure that personnel conducting or administering training have proper credentials and certifications
4. Verify that the training program is documented and maintained in the MWSU personnel training records
5. Verify that former employee records are maintained for a minimum of 3 years from the date the employee is reassigned or terminated
6. Verify that employees are notified when specific training is required or due and that the training is received and successfully completed
7. Verify that employees have successfully completed the required training before working in an unsupervised capacity

B.12.e Course Descriptions

1. Hazard Communication (**29 CFR 1910.1200**) – This course provides awareness of the hazard communication standard and its basic requirements. Course elements include hazards in the workplace, employee right-to-know, methods and observations, and safe work practices. (Frequency – one time)
2. Hazardous Waste Site General Worker/Annual Refresher (**29 CFR 1910.120** and **40 CFR 264.16**) – Workers at a hazardous waste or LLMW TSDF are required to have a minimum of 40 hours of training with an 8-hour annual refresher. The training includes regulations, PPE, toxicology, basic chemistry, decontamination techniques, monitoring instruments, risk assessment/hazard evaluation, sampling methods and techniques, and emergency management. (Frequency – one-time 40-hour training and annual 8-hour refresher)
3. Hazardous Waste Site Supervisor (**29 CFR 1910.120**) – This course provides a review of the supervisor's responsibilities concerning the health and safety program, associated employee training programs, the PPE Program, the spill containment program, health hazard monitoring procedure and techniques, and the legal aspects of supervising when conducting hazardous waste operations. (Frequency – one time)
4. Basic RCRA and Hazardous Waste Manifest/Annual Refresher (**40 CFR 260–268**) – This course discusses RCRA regulations, how they apply to LLMW handling and disposal, types of waste, how to identify hazardous waste, emergency response, and the LDRs for hazardous waste. Hazardous waste manifest requirements are also covered. (Frequency – annual refresher)
5. Radiological Worker II (**10 CFR 835.901**) – This course provides knowledge necessary to work safely in areas controlled for radiological purposes. The course covers identification of controlled areas, proper work practices, contamination control, practical factors demonstration, and handling radioactive material. (Frequency – refresher every 2 years)
6. RCRA Refresher (**40 CFR 264.16**) – This course provides RCRA information for waste management activities (identification of hazardous waste and LLMW, LDRs, uniform hazardous waste manifest, and emergency response actions. (Frequency – annual)
7. General Employee Training (**29 CFR 1910.120** and **40 CFR 264.16**) – This course provides information on RWO facilities related to waste characterization, handling classified waste, transuranic waste activities, LLMW disposal, general work hazards, and response to emergency/off-normal events. (Frequency – one time)
8. Radiological Control Technician (RCT) Qualification Program (**10 CFR 835.103**) – This qualification program requires RCTs to complete both national and site-specific written and oral examinations of radiological control procedures, work practices, and instrumentation. Job performance is also tested using field situations. Continuing education to maintain qualification is provided through in-house training on specific and general radiation control topics at regular intervals. (Frequency – continuing)
9. Employee Emergency Action Training for RWO (**40 CFR 264.16, 29 CFR 1910.38,** and **29 CFR 1910.120**) – This course provides employees assigned to the facility with emergency response training. The course provides information on alarm recognition and proper response, making notifications, sheltering, evacuation route maps, identification of location of fire alarms, first aid kits, and spill response kits.

10. Hazardous Materials Handling and Spill Response (**49 CFR 172.704**) – This course provides measures to protect employees from the hazards associated with hazardous materials to which they may be exposed in the work place, including specific measures the hazmat employer has implemented to protect employees from exposure and methods and procedures for avoiding accidents, such as the proper procedures for handling packages containing hazardous materials. (Frequency – every 3 years)

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B.13 Closure and Post-Closure Care Plan [40 CFR 270.14(b)(13)]

This information represents the Closure and Post-Closure Care Plan for the MWSU. A description of the waste managed at this unit is found in Section B.2 and the facility operating record. Closure activities are subject to the requirements of **40 CFR 264.112**. This document presents an interim closure and post-closure care plan for the MWSU. New information, technologies, or changes in performance monitoring may warrant an amendment to the closure and post-closure care plan. A copy of this plan is maintained in the MWSU Operating Record.

B.13.a Description of Closure [40 CFR 264.112(b)(4)]

Closure of the MWSU is proposed as a clean closure; therefore, a written post-closure care plan is not required.

B.13.b Closure Performance Standard [40 CFR 264.111]

As defined in **40 CFR 264.111** and **NAC 444.8632**, the standard for closure for the MWSU will:

1. Use engineering and administrative controls during closure to minimize or eliminate, to the extent necessary, the release of hazardous substances from the unit
2. Minimize the need for maintenance
3. Protect human health and the environment during closure and after closure activities

LLMW and residues remaining in MWSU facilities will be removed and disposed according to regulatory requirements at the time of closure. Hazardous wastes and residues will be removed from the site. Container systems and closure equipment will be decontaminated before removal from the unit.

Spills or releases of LLMW noted in the operating record that have not been remediated will be remediated before closure. Cleanup of releases of LLMW to the ground will involve the removal of soil. The excavated area will be surveyed for isotopes identified in the generator characterization data. If radionuclide levels are less than or equal to the limits specified in Table 2-2 or Table 4-2 of the *NNSS Radiological Control Manual*, the release will be considered remediated. Table 2-2 limits are applicable for an area cleanup, and Table 4-2 limits are applicable to material/equipment cleanup.

B.13.c Coordination with Other Regulatory Standards

Disposal of LLW (including the LLW component of LLMW) at the RWMC is subject to requirements and performance objectives of DOE O 435.1, “Radioactive Waste Management,” and the associated manual (DOE M 435.1-1) and guidance (DOE G 435.1-1). DOE O 435.1 requires that a Disposal Authorization Statement be obtained for new or existing disposal facilities. A Disposal Authorization Statement for the RWMC was issued by DOE Headquarters in December 2000 and specifies that the disposal program shall be conducted according to the site Performance Assessment.

B.13.d Financial Requirements [40 CFR 264.140(c)]

Federal and state governments are exempt from the requirements of **40 CFR 264, Subpart H**.

B.13.e Facility Location and Description at Closure [40 CFR 264.112(b)(1)]

The MWSU is located in the southeast corner of the RWMC in a remote area of the southern NNSS. Figures and text describing the unit are found in Section B.1 and Exhibit 1 of this permit application. Facilities that comprise the MWSU will be clean-closed and reused as necessary.

B.13.e.1 Maximum Waste Inventory

The maximum amount of LLMW stored at the MWSU at any one time is estimated to not exceed 18,429 m^3 (650,000 ft^3) (Section B.1.e). The lifetime of the unit is not known at this time.

B.13.e.2 Removal or Decontamination

Equipment or facilities contaminated with LLMW constituents from storage operations will be decontaminated by appropriate methods. The contaminated media will be disposed. If the contaminated media requires treatment, it will be treated to meet applicable LDRs and disposed at a permitted facility.

B.13.f Closure Schedule [40 CFR 264]

Table 11 depicts a closure activity schedule for the unit.

Table 11. MWSU Closure Activity Schedule

Closure Activity	Duration
Notify NDEP of closure	Within 45 days before commencement of closure activities and within 30 days of receipt of the last shipment of LLMW
Conduct closure of the unit	Initiated 45 days after notification of closure and completed within 180 days of receiving the final volume of LLMW
Submit certification of closure to NDEP	Within 60 days after completion of closure activities

B.13.g Amendment to Closure Plan [40 CFR 264.112(c)]

Any amendments to the closure plan will be submitted to NDEP for approval as a permit modification at least 60 days before a proposed change in facility design or operation or no later than 60 days after an unexpected event that affects the closure plan. However, if an unexpected event occurs during the partial or final closure period, NNSA/NFO will request a permit modification no later than 30 days after the unexpected event. The approved closure plan will become a condition of the permit. If contamination is detected, this closure plan will be amended to provide specific decontamination and removal procedures applicable to the type and extent of contamination.

B.13.h Post-Closure Care [40 CFR 264.117]

The MWSU will be clean-closed; therefore, post-closure care is not required.

B.14 Post-Closure Notices [40 CFR 270.14(b)(14)]

Closed hazardous waste disposal units on the NNSS are noted in NDEP Permit NEV HW0101, Section 9.

Closure of legacy hazardous waste management sites on the NNSS is carried out through the *Federal Facility Agreement and Consent Order* (FFACO). The FFACO is an agreement between the State of Nevada, DoD, DOE Legacy Management, and NNSA/NFO. The process requires that use restrictions (URs) be instituted at sites where contamination above regulatory limits is being closed in place. Two types of URs are established in the FFACO, administrative and standard. Administrative URs differ from standard URs in that they do not require onsite postings or other physical barriers. Administrative URs apply to remote locations and occasional-use areas where future land use scenarios are used to calculate final action levels.

Each UR site is identified and documented on a UR form with an enclosed map. The completed form and map are the official records documenting the sites where contamination remains in place after closure. The DOE and DoD will maintain UR records as long as the land is under their jurisdiction. The information on the form and the maps are filed in the FFACO database, the DOE Corrective Action Unit/Corrective Action Site files, and in the U.S. Air Force Geographical Information System.

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B.15 Closure Cost Estimate [40 CFR 270.14(b)(15)]

The federal government is exempt from the financial requirements according to **40 CFR 264.140(c)**.

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B.16 Post-Closure Cost Estimate [40 CFR 270.14(b)(16)]

The federal government is exempt from the financial requirements according to **40 CFR 264.140(c)**.

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B.17 Liability Requirements [40 CFR 270.14(b)(17)]

The federal government is exempt from the financial requirements according to **40 CFR 264.140(c)**.

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B.19 Topographic Map

Figure 5, with 1.5-m (5-ft) contour intervals and a scale of 2.5 cm (1 in.) equal to 61 m (200 ft), illustrates the MWSU facilities and extends a distance of 305 m (1,000 ft) outside the MWSU boundaries. This figure shows access roads, gates, existing facilities, wells, drainage, and flood control structures. The center of the RWMC is located at N 768,650.25 ft and E 706,476.40 ft (based on Nevada State Plane Grid – Central Zone, North American Datum, 1983).

B.19.a Land Use

Several Public Land Orders (PLOs) withdrew land from the public domain to establish the NNSS. PLO 805, issued in 1952, withdrew the land where the MWSU is located. Since then, the NNSS has been used for national defense, energy-related testing and research, and waste management activities. In 2009, NNSA/NFO sought to expand the RWMC to build a new LLMW disposal cell. The BLM reviewed the land use in Area 5 and determined that land originally withdrawn was unsuitable for return to the public domain. On October 30, 2009, the General Services Administration transferred custody and accountability of portions of Area 5 to DOE to expand the RWMC.

The NNSS is not open to public entry for any purpose (e.g., agriculture, mining, homestead, or recreation). Due to the nature of land use at the NNSS since 1952, there are no plans to return this area to public use. Areas in and adjacent to Area 5 were used for atmospheric and underground nuclear weapons testing. Current land uses in Area 5 include LLW disposal, LLMW disposal, controlled hazardous material spill testing, and hazardous waste storage. An NNSS land use map is provided as Figure 3.

B.19.b Wind Rose

Wind speed and direction are provided in Figure 11. Winds in this area are generally from the southwest, with wind velocities varying from 0 to 20 m (0 to 66 ft) per second. However, there is a diurnal reversal effect such that winds are predominantly southerly during the day and northerly at night. In a similar manner, there is a seasonal reversal such that winds are predominantly southerly during the summer and northerly during the winter.

B.19.c Well Locations

Figure 5 is a topographic map with 1.5-m (5-ft) contours showing the MWSU facilities and the surrounding area, including nearby well locations.

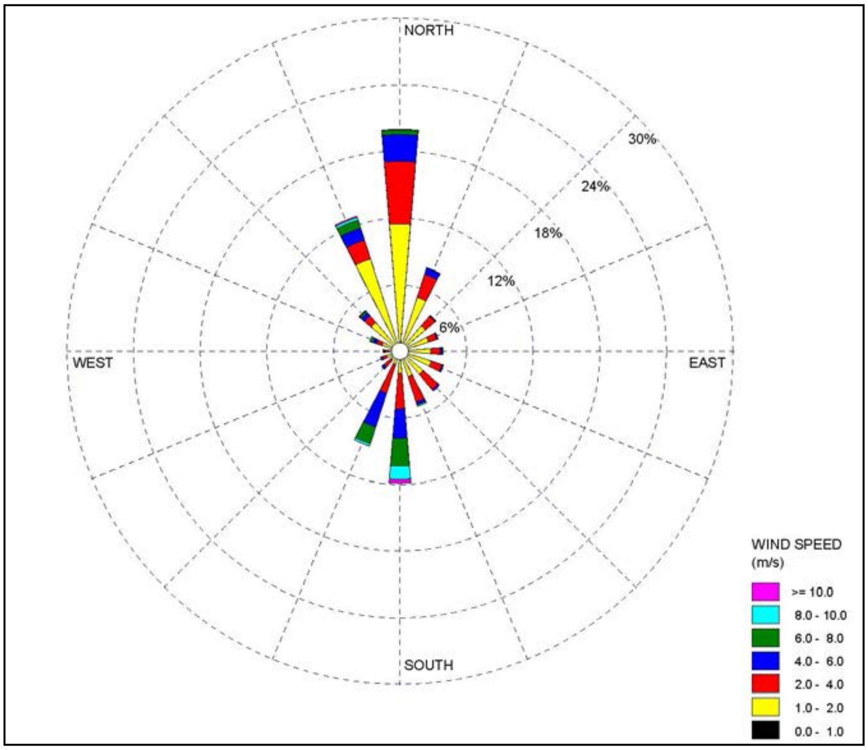

Figure 11. Wind Rose Diagram for the RWMC Meteorology Station

B.19.d Utility Characteristics

Utilities at the RWMC are shown in Figures 12 through 14.

(1) Potable Water, Wastewater, and Fire Protection

The potable and fire protection water system for the MWSU is served by Public Water System Permit NY-0360-12NTNC. Domestic wastewater from RWMC office buildings and the VERB is discharged to a permitted septic system (NY-1038) located south of the RWMC.

Fire alarm pull boxes are located in Buildings 5-6, 5-7, and 5-31. Personnel working at the MWSU have access to hand-held radio, telephone, and cell phone communications. Emergency response is discussed in Section B.7.

(2) Power System

Offsite electrical power is supplied to the NNSS and transmitted through a loop. The voltage is transformed down to a distribution voltage and then to a working voltage. The Frenchman Flat Substation provides power to the RWMC through an overhead line. A diesel generator provides emergency power to the VERB.

(3) Storm Water Drainage

The storm drainage system designed to protect the MWSU from run-on and runoff is depicted in Figure 6.

Figure 12. Water and Sewer Plan

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Figure 13. Electrical and Communications Plan – South

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Figure 14. Electrical and Communications Plan – North

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B.20 Additional Information [40 CFR 270.14(b)(20)]

B.20.a Operations

B.20.a.1 Operating Record [40 CFR 264.73]

NNSA/NFO maintains a written operating record. Because the MWSU is located in a remote area, portions of the operating record are maintained at the RWMC, Mercury, or North Las Vegas Facility for convenience. The operating record includes the following information:

1. Description and quantity of each hazardous waste received/stored, the date the waste was placed in storage, and the date the waste was removed from storage
2. Location and quantity of each hazardous waste stored at the MWSU, cross-referenced to specific manifest document numbers
3. Records and results of waste analyses and waste determinations
4. Summary reports and details of incidents that require implementation of the contingency plan
5. Records and results of inspections for the last 3 years
6. Monitoring, testing, analytical data, and corrective actions resulting from a release from the MWSU
7. Record of written notice from NNSA/NFO to generators indicating that NNSA/NFO has the necessary permits for and will accept the waste the generator is shipping

B.20.a.2 Generator Process

The following steps outline the procedure for offsite generators shipping LLMW to the NNSS:

1. Waste generators and the waste profile are approved according to the current revision of the NNSSWAC and the WAP before waste is shipped. An initial waste verification rate per waste stream is developed and approved by NNSA/NFO.
2. An EPA Uniform Hazardous Waste Manifest (**40 CFR 264.71**), appropriate LDR certification or notification (**40 CFR 268.7**), and “Package Shipment and Disposal Request” form are required for each waste shipment. Waste is transported according to federal, DOE, and State requirements. Applicable State requirements include those of the State in which the shipment originates, State(s) the waste is transported through, and the State of Nevada. The package number and waste stream number are entered on the “Package Shipment and Disposal Request” form.
3. The NNSS receives and verifies waste containers Monday through Thursday, unless otherwise coordinated in advance.
4. The transporter provides the necessary paperwork for initial review at Gate 100, the entrance to the NNSS. If the transporter does not have an NNSS badge, a temporary badge is issued after checking the driver’s identification. A map to the RWMC is available at the gate.
5. The transporter delivers the waste shipment to the RWMC for processing and off-loading.

The following steps outline the procedure for onsite generators transferring LLMW to the MWSU for storage:

1. Generators complete waste stream characterization outlined in Section B.3.b.1.
2. The transporter delivers the waste shipment to the RWMC for processing and off-loading.

B.20.a.3 Waste Receipt, Survey, and Shipping Records

When a shipment arrives at the RWMC, the driver parks and signs in at Building 5-7, completes a route survey, and submits applicable shipping documents. RWMC personnel perform a completeness review of the generator's shipping documents, which may include the following:

1. Uniform Hazardous Waste Manifest or Onsite Waste Transportation Manifest
2. LDR documents

For flatbed trailers, the vehicle and load are surveyed for radiological contamination and transport integrity before entering the controlled area. For closed transport vehicles (vans), the vehicle is surveyed for radiological contamination and van integrity.

Upon approval from RWMC personnel, the transporter is escorted into the controlled area by proceeding through the gate adjacent to Building 5-31, the CAAB, for shipments going to the TPCB or TP. Shipments destined for storage at other MWSU facilities are directed as shown in Figure 8.

RWMC personnel perform pre-entry radiation surveys of the exterior of the waste transport vehicle and a radiation survey as the closed transport vehicle door is opened. Radiation surveys are conducted on all packages off-loaded at the designated MWSU facilities.

At Building 5-6, containers are unloaded for RTR verification, if required. The RTR system can process three 55-gallon drums or one typical waste box at a time. Only the specified quantity of waste requiring RTR is removed from the transport vehicle. After RTR is completed, accepted containers are transported to the appropriate MWSU facility. Containers are not loaded back onto the transport vehicle but are transported by other means, such as a forklift.

Containers, markings, and labels are inspected and compared with associated manifests. Paperwork review and inspection requirements are documented on a shipment checklist. Waste manifests, LDR documents, and certifications are inspected by qualified personnel. Specific details on containers are recorded on a container checklist that is filed with the associated shipping paperwork. When unloading is complete and all containers have been accepted, RWMC personnel commence placing the waste containers in the storage configuration.

Radiological surveys of the truck bed and tires are performed before releasing the waste transport vehicles from the RWMC.

B.20.a.4 Discrepancies

If a discrepancy is detected at any time during the paperwork or inspection process, the discrepancy is categorized dependent upon the level of severity of the condition. Waste containers remain on the transport vehicle until the noncompliant condition is resolved.

Offsite shipments destined for disposal in the MWDU may be screened by RTR. If one of the containers in the original sample set fails RTR, a second sample set of equal quantity is selected from the shipment. A second failure in either the first or the second sample set constitutes failure of the shipment. If the second sample set passes inspection, the single failed container is considered an anomaly, and the remainder of the shipment passes verification. Failed containers and shipments are dispositioned via the Radioactive Waste Acceptance Program.

If a discrepancy requires several days to resolve, the containers are placed in the verification hold area on the TP. Wastes in this area must meet the requirements in **40 CFR 264.170** through **178**, inclusive.

If the discrepancy cannot be resolved, all waste packages associated with the noncompliant shipment are returned to a generator-specified facility, and required discrepancy notifications are made. Manifesting of partial or full loads that are rejected by NNSA/NFO is carried out as required in **40 CFR 264.72**.

B.20.a.5 Condition of Containers [40 CFR 264.171]

Shipments received for storage arrive in DOT-compliant containers. If a container is not in good condition when it arrives, the waste container is repackaged into a larger container before storage. This includes containers that exhibit severe rust, structural defects, and/or if a container begins to leak.

B.20.a.6 Compatibility of Waste Containers [40 CFR 264.172 and 264.177]

Containers must be made of or lined with materials that will not react with and are compatible with the hazardous waste to be stored. Incompatible wastes or wastes in combination with incompatible materials are not placed in the same container.

B.20.a.7 Management of Containers [40 CFR 264.173]

Containers from offsite generators remain closed during storage. If repackaging is necessary, the damaged container is not opened, and contents are not removed. The entire container and contents are repackaged in a larger container. If a waste box or freight container is leaking, the container is wrapped or diapered rather than repackaged in a larger container. Containers are managed and handled by trained personnel using proper equipment to eliminate the potential for rupture or leakage.

B.20.a.8 Inspections [40 CFR 264.174]

MWSU inspection procedures and schedules are described in Section B.5.

B.20.a.9 Containment [40 CFR 264.175]

Offsite-generated wastes accepted for storage at the MWSU do not contain free liquids. Onsite-generated wastes accepted for storage at the MWSU may contain free liquids. Wastes that contain free liquids are stored on spill pallets. MWSU facilities that can be impacted by precipitation include the TP and DHP.

The TP is bermed. Whenever waste boxes or drums are stored on the TP, metal pallets are used to prevent contact with accumulated precipitation.

The DHP is a sloped pad with berms. Whenever waste boxes or drums are stored on the DHP, pallets are used to prevent contact with accumulated precipitation. The pad is not drained; therefore, any accumulation of precipitation is removed using brooms and squeegees.

B.20.a.10 Special Requirements for Ignitable Wastes [40 CFR 264.177]

Special requirements for ignitable wastes are not applicable to the MWSU. The MWSU is located at least 15 m (50 ft) from the nearest NNSS boundary.

B.20.a.11 Closure [40 CFR 264.178]

The MWSU will be clean-closed. All hazardous waste and hazardous waste residues will be removed. Any equipment, materials, or soils contaminated by spills or releases of hazardous waste will be decontaminated or removed and disposed according to the regulations in effect at the time of closure (Section B.13.b).

B.20.a.12 Air Emission Standards [40 CFR 264.179]

Non-radioactive classified hazardous waste received and stored at the MWSU is stored in DOT-approved containers that are in good condition. The containers will remain closed excepted when adding or removing waste in accordance with **40 CFR 264.1086**.

B.20.b Other Federal Laws [40 CFR 270.3]

Other federal laws that apply to operations and discharges from the MWSU include the following:

1. *National Historic Preservation Act* – Within the boundaries of the RWMC, waste disposal activities do not create adverse effects to properties listed or eligible for listing on the National Register of Historic Places.
2. *Endangered Species Act* – Waste disposal activities at the RWMC are not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect critical habitats.
3. *Clean Air Act* – Fugitive dust emissions from activities at the RWMC are regulated by Air Quality Permit AP9711-2557 (NNSS Class II Air Quality Operating Permit) issued by the State of Nevada.
4. *Clean Air Act* (National Emissions Standards for Hazardous Air Pollutants) – Air monitoring for radionuclide emissions is conducted from two monitoring stations at the RWMC. Results confirm that emissions are below reporting limits for radionuclide emissions.

B.20.c Exposure Information Report [40 CFR 270.10(j)]

According to **40 CFR 270.10(j)**, an exposure information report for this operational unit is not required.

C.1 MWSU Groundwater Protection [40 CFR 270.14(c)]

Additional information regarding protection of groundwater, including a groundwater monitoring plan, is required for regulated units under **40 CFR 270.14(c)**. A regulated unit is a surface impoundment, waste pile, land treatment unit, or landfill (**40 CFR 264.90 [a][2]**). The MWSU is a storage facility, not a regulated unit; therefore, a groundwater monitoring plan is not required.

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D.1 Characterize Solid Waste Management Units [40 CFR 270.14(d)]

Closed solid waste management units on the NNSS are noted in NDEP Permit NEV HW0101, Section 9. Post-closure requirements are described in the Permit Application for Permit NEV HW0101. Closure Reports for each unit are maintained in NNSA/NFO contractor files; copies are provided to NDEP. Reports contain characterization parameters, location maps, and a description of each facility, time of operation, wastes managed, and the sampling and analysis results of characterization.

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